

## The Distribution of *Pleurospermum austriacum* (L.) HOFFM. in Czechoslovakia

Rozšíření druhu *Pleurospermum austriacum* (L.) HOFFM. v Československu

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**Abstract** — The genus *Pleurospermum* s. str. has 3 species: *P. camtschaticum* HOFFM. (Far East, Japan, ?China), *P. uralense* HOFFM. (E. Russia to China and Japan) and *P. austriacum* (L.) HOFFM. The distribution of the last mentioned species in Czechoslovakia is given in map No. 1, the general distribution in map No. 2. In Czechoslovakia it grows within different plant communities from alpine meadows to hornbeam groves. It prefers limestone or other rocks rich in nutrients. *P. austriacum* thrives in regions with a July temperature lower than 19° C or in regions with 40 summer days or less per year. Subfossil and fossil finds show that *Pleurospermum* had in Czechoslovakia a considerably wider distribution than today during not only Early Postglacial, but also in Late Glacial (W), and even in M/R, R, and R/W. The authors presume that the ancestral form of *Pleurospermum* was distributed in southern Siberia in the early Ice Age. During the Mindel Glaciation it penetrated to Central Europe; the European population was isolated in M/R or latest in R/W from the Siberian one and since then two separate species developed, viz *P. austriacum* and *P. uralense*. If this hypothesis is correct, *P. austriacum* as a separate species cannot have a longer existence than 200,000—300,000 years.

The genus *Pleurospermum* HOFFM. sensu lato includes, according to DRUDE in ENGLER et PRANTL (1898 : 171), about 25 species. This is, in our opinion, a too broad generic concept; we think it better to exclude *Hymenolaena* D. C., *Eleutherospermum* C. KOCH, *Aulacospermum* LEDB., *Pterocyclus* KLTZCH and *Hymenidium* LINDL. as separate genera closely allied, but sufficiently different from *Pleurospermum* HOFFM. sensu stricto. In this narrower sense the genus includes 3 species of a montane-continental character; its area extends in the temperate zone of Eurasia. The original "linnéon", *Ligusticum austriacum* L. Sp. pl. (1753) 250, was divided later on in *Pleurospermum austriacum* (L.) HOFFM., Gen. Umbell. 1814 (central and southern Europe), *P. uralense* HOFFM. (the easternmost part of the European Russia, Siberia, Mongolia, Japan and China), and *P. camtschaticum* HOFFM. (Far East, Japan, China?).

In this paper we have tried to give the distribution of *P. austriacum* in Czechoslovakia as well as in Europe, and to find a probable explanation of the areogenesis, taxonomical differentiation and speciation in the genus *Pleurospermum* s. str.

### Taxonomy

*Pleurospermum austriacum* is a well defined and not very much variable species. According to BAKSAY (1958) it has  $2n = 22$ . There is, as far as we know, only one infraspecific taxon worth of mentioning: *P. austriacum* var. *pubescens* BORB. in Akad. Közl. 15 : 305, 1878, valued by BORZA, Consp. Fl. Rom. 2 : 198, 1947—49 as a form only. This taxon has hairy nerves on the leaf underside. It was described in Rumania, but occurs also in this country, e. g. on Rokoš in Slovakia.

As the species can be easily recognized and there is a very little probability of a confusion with another species (in herbaria only in two cases we have found plants of *Laserpitium archangelica* WULF. identified as *Pleurospermum*), we could use also information from the literature for our map.

#### The distribution in Czechoslovakia

The distribution of *Pleurospermum austriacum* in Czechoslovakia may be seen from the Map. 1. To draw this map we have revised material from the following herbaria: PR, PRC, BRNM, BRNU, BRA, BRAC, SLO. There, in literary sources as well as in DOMINS MS. and in our own notes we have found about 300 data bearing its distribution, represented in our map by 230 dots. Enumeration of the localities is given in the Czech text.

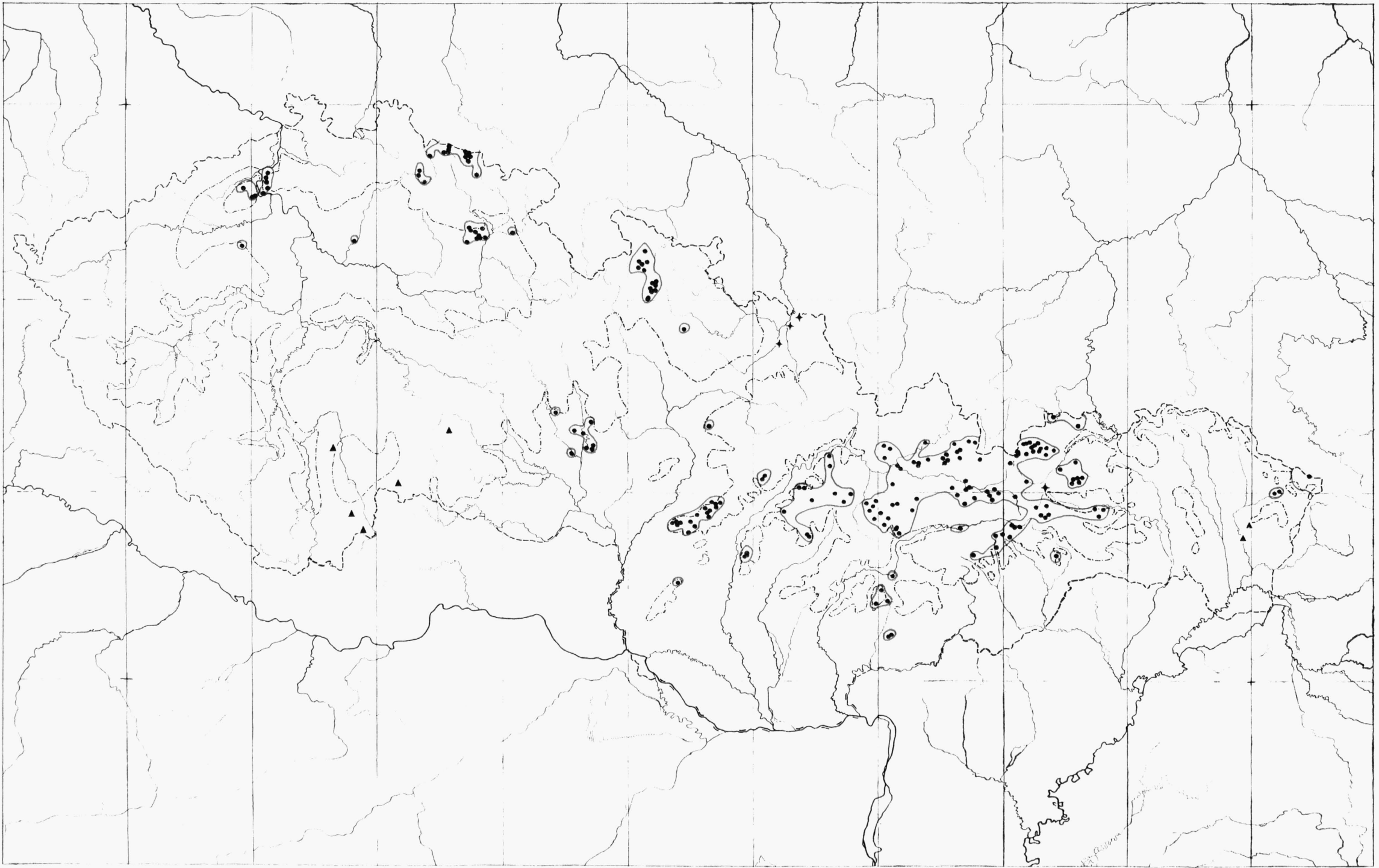
About 18% of the known localities in Czechoslovakia are in the Sudetic subregion, approximately 14% belong to the Subpannonicum, one locality is situated on the periphery of Matricum, and the rest, about 68 % of localities, belong to the Carpathian region. It is lacking in regions poor in nutrients (Hercynicum) or in regions with a too hot summer (Eupannonicum). Its area seems to be mainly dependent on the edaphic and climatic conditions. There are, however, several areas with rich limestone soils and a climate which seems to be favourable for *Pleurospermum austriacum* — but this species is absent. Such district is e. g. the Bohemian Karst (Český kras). If *Pleurospermum* can exist in the neighbourhood of Brno, we cannot see why it could not exist in Český kras or on eruptive rocks of the NW Bohemia. It is thus probable that also historic factors take part in the formation of its area.

#### General distribution

The present area of *Pleurospermum austriacum* extends from the western Ukraine (rare to scattered in the Chmelnik and Tarnopol districts, relatively common in the Carpathians of the Transcarpathian Ukraine), to the Southern Carpathians and the Balkans and further through the Dalmatian mountains to the Southern Alps; it likewise occurs in the Western Carpathians and NW Alps, in the High Sudetic mountains, in the Thüringer Wald, Frankenwald and other German mountains as well as in the Baltic region.

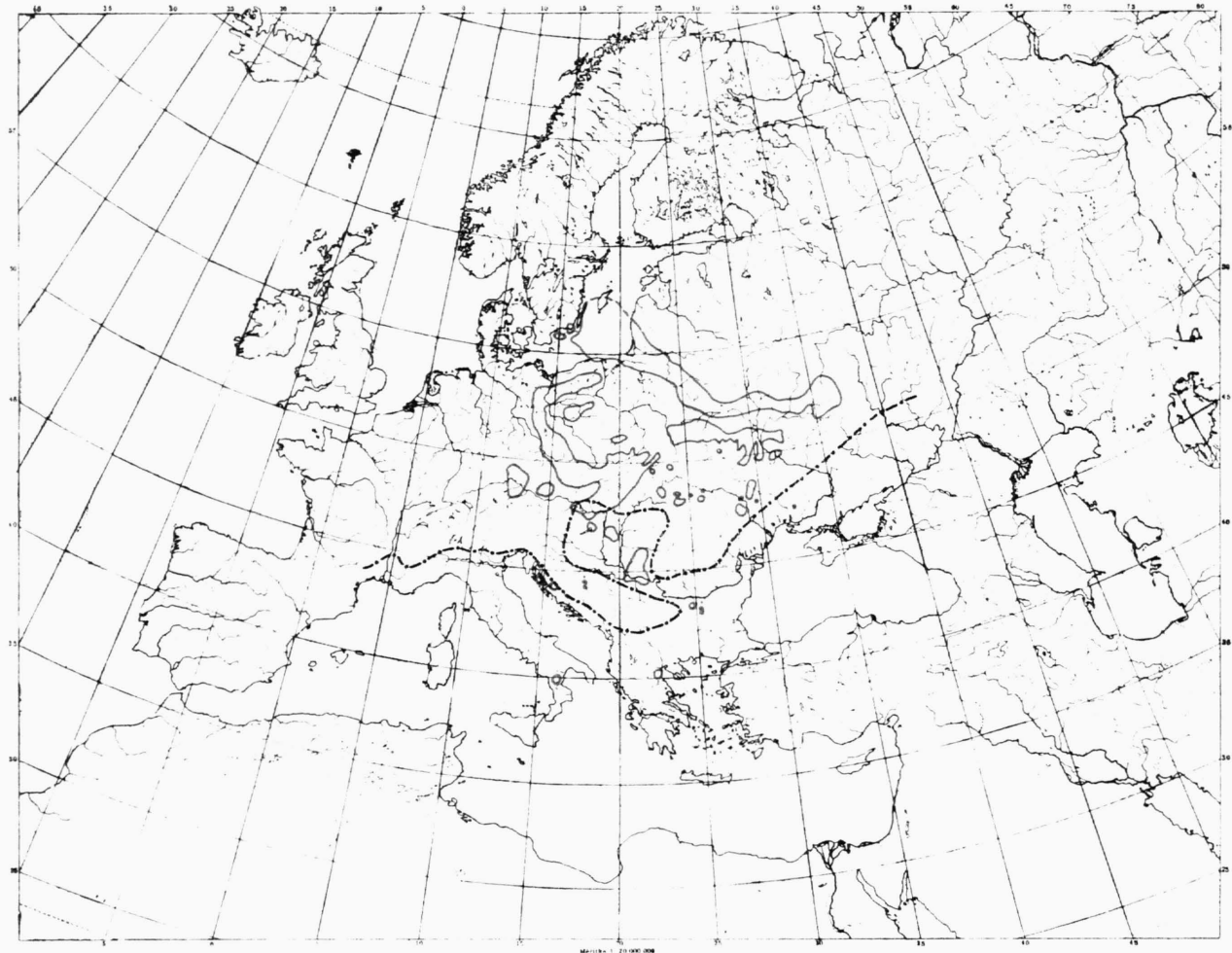
In Rumania it grows practically everywhere in the montane and subalpine belts of the Carpathians and the Muntii Apușeni, in Bulgaria in the Vitoša mountain group, in the Western and Central Balcan ridge. The southern limit of its distribution in the Balcanis is difficult to draw — we have no concrete data from Macedony and Albania, where we can expect its southernmost localities. In the mountains of Yougoslavia it is scattered, mainly in the subalpine belt; there are, however, some exceptions, like the locality in the valley of the Gostović river at 360 m alt. We can follow its distribution from the mountain plateaus of the SE Serbia through Montenegro, Hercegovina, Croatia and Slovenia to the Italian and the Austrian Alps. In the Alps it grows in the southern as well as in the northern part, where it descends along some of the rivers down to the Danube. The main distribution in the northern promontories of the Alps runs along the right bank tributaries of the Danube, especially along the Iller, the Werlach, the Lech, the Ammer and the Isar; to the West and East its occurrence is more scattered. In the East it ends in the promontories of the Alps in Hungary — Sopron and Kőszegi hegység.

Besides the Alps, its distribution in Germany is confined to the Jura of



Map. 1. — Distribution of *Pleurospermum austriacum* in Czechoslovakia: - - - - - line connecting places with 40 summer days per year, red line: recent area, dots: recent localities, triangles: pollen finds from the Younger Dryas and Praeboreal deposits, asterisks: pollen finds from R, M/R and R/W deposits.





Map. 2. — Distribution of *Pleurospermum austriacum* (total); red line — area of the species, -.-.- line connecting places with a mean day temperature 20° C or more for 2 months.

Baden and Schwab, the Frankenwald and Thüringerwald; an isolated locality is at Leach in the Rhine valley. In Czechoslovakia, as we have seen, it grows in Northern Bohemia, in some places in Moravia and on the whole Carpathian ridge. In Hungary, apart from the above named localities, there are isolated occurrences in the Bükk and Mátra mountains.

To the North from the Carpathian ridge, *Pleurospermum austriacum* descends along the Visla river to the environments of Lublin, Luków, Nowogródek; isolated localities are at Kampinos near Warszawa and at Zakroczyn. The lowest localities are found on the Low Visla as relics from the colder postglacial period. In the birch and the pine woods there grow, together with *Pleurospermum*, also *Bupleurum longifolium*, *Pulsatilla vernalis*, *Ajuga pyramidalis* etc. (SZAFFER 1959/2 : 46). A similar character manifests the occurrence in the Soviet Baltic republic (in SE direction as far as Minsk). The northernmost locality of *Pleurospermum austriacum* can be found in Sweden SW from Nyköping. Somewhat doubtful is a second locality, viz. at Listarums in Skane (leg. C. KURCK 1897). The plant, deposited in Herb. Lund under the name of *Livisticum officinale*, is, according to WEIMARCK (1963: 486), really *Pleurospermum austriacum*. WEIMARCK tried to find this species at Listarums in 1961–62, but without success.

A similar form of the area as *Pleurospermum austriacum* and a similar taxonomical differentiation may be found also in several other species of different genera, with a main distribution in the montane and subalpine belts (cf. e.g. MEUSEL 1943, 305). It is not without interest that this group of species has, in several cases, also similar ecological requirements and some of them occur in the same localities as *Pleurospermum*. To such belong, e.g. the following species (first the European taxon, the next one has its main distribution in Siberia, in some cases there is a further differentiation in Eastern Asia): *Aconitum anthora* L. — *A. Komarovii* STEINB.; *Aruncus vulgaris* RAF. — *A. asiaticus* A. POJARK. and *A. kantschaticus* RYDB.; *Bupleurum longifolium* L. — *B. aurum* FISCH.; *Cimicifuga europaei* N. SCHIPCZ. — *C. foetida* L.; *Larix decidua* L. — complex of Asiatic species; *Finns cembra* L. — *P. sibirica* RUPR.; *Thalictrum aquilegifolium* L. — *T. contortum* L. etc.

Such a coincidence in the area and differentiation cannot be accidental; a most probable explanation is, in our opinion, a common history of these species.

### Phytocoenological behaviour

*Pleurospermum austriacum* can thrive in fairly different plant communities. Together with many other species of a similar florogenesis, it forms a part of communities that are relatively stabilised from the floristic point of view. A striking floristic abundance of those communities speaks for their considerable age.

In our Sudetic mountains it grows above the timberline mainly in communities of the alliance *Calamagrostidion arundinaceae* (LUQUET 1926) JENÍK 1961. JENÍK (l. c.) found *Pleurospermum* in the ass. *Bupleuro-Calamagrostetum arundinaceae* (ZLATNÍK 1928) JENÍK in 5 from 10 relevés in the Krkonoše and Jeseníky mountains.

Example: *Bupleuro-Calamagrostetum arundinaceae* (ZLAT.) JENÍK, Krkonoše: Velká Kotelná jáma, a scree below the western gully, humose, fine, blackbrown soil on coarse granitic blocks, 1180 m alt., aspect SE, 25° slope, 10 m<sup>2</sup>. Tc (herb. layer) 95%, d(moss layer) +. 27. 7. 1965 (HADAČ et al.) (Abund. and dominance in DOMIN et HADAČ scale.) *Calamagrostis arundinacea* 7, *Pimpinella major* 5, *Gentiana asclepiadea*, 4, *Luzula nemorosa* 4, *Pleurospermum austriacum* 4, *Myosotis palustris nemorosa*, 3, *Ranunculus nemorosus* 3, *Rumex arifolius* 3, *Achillea sudetica* 2, *Anemone narcissiflora* 2, *Delphinium elatum* 2, *Geranium sylvaticum* 2, *Potentilla aurea* 2, *Primula*

*elatio* 2, *Senecio nemorensis* 2, *Viola biflora* 2, *Alchemilla glabra* 1, *Allium sibiricum* 1, *Anthoxanthum odoratum* 1, *Angelica montana* 1, *Bartsia alpina* 1, *Bistorta major* 1, *Bupleurum longifolium* 1, *Carex pallescens* 1, *Epilobium alpestre* 1, *Festuca rubra* 1, *Galium sudeticum* 1, *Geum rivale* 1, *Heracleum sphondylium* 1, *Knaulia arvensis* 1, *Lilium martagon* 1, *Melampyrum sibiricum* subsp. *carpaticum* Soč 1, *Mercurialis perennis* 1, *Potentilla erecta* 1, *Scrophularia nodosa* 1, *Silene vulgaris* 1, *Thalictrum aquilegifolium* 1, *Thesium alpinum* 1, *Cirsium erisithales* +, *Mnium affine* 4, *Rhodobryum roseum* 1.

In the alpine belt of the Carpathians *P. austriacum* grows in a corresponding alliance of *Seslerion tatrae* PAWL. 1935. It belongs to the characteristic species of the ordre *Seslerietalia tatrae* HADAČ 1962 together with *Astrantia major*, *Delphinium elatum*, *Bupleurum longifolium*, *Pimpinella major* var. *carpatica* HČ and *Crepis succisifolia*. It is scattered in the *Festucetum carpaticae* SILL. 1933 in the Nízké and Belanské Tatry, in *Helianthemum-Calamagrostetum arundinaceae* HČ 1964MS and *Aconito-Digitaletum* HČ, i.e. in the Belanské Tatry mountains.

Example: *Festucetum carpaticae*, Belanské Tatry, Dolina Siedmich prameňov, a moist serec below a steep rock wall, moist black-greybrown soil containing some stones; in 70 cm depth the soil passes into a consolidated limestone serec; 1501 m alt., aspect S, 47°, 10 m<sup>2</sup>, Te 100%, d 30%, 31. 7. 1956 (HADAČ et al.):

*Festuca carpatica* 8, *Aconitum variegatum* 5, *Astrantia major* 5, *Crepis succisifolia* 4, *Digitalis grandiflora* 4, *Pimpinella major* v. *carpatica* 4, *Campanula trachelium* 3, *Carex tatarorum* 3, *Leontodon hispidus* 3, *Phleum hirsutum* 3, *Sesleria tatrae* 3, *Heracleum sphondylium* 2, *Hieracium muro-ri* 2, *Hypericum maculatum* 2, *Libanotis montana* 2, *Potentilla aurea* 2, *Primula elatio*\* *carpatica* 2, *Stachys alpina* 2, *Trifolium pratense*\* *Kotulae* 2, *Anthoranthum odoratum* 1, *Bellidiastrum Micheli*, 1, *Bupleurum longifolium* 1, *Calamintha clinopodium* 1, *Campanula speciosa* 1, *Carlina acaulis* 1, *Carduus glaucus* 1, *Centaurea scabiosa*\* *alpestris* 1, *Chrysanthemum subcorimbosum* 1, *Cirsium erisithales* 1, *Cortusa Mathioli* 1, *Delphinium elatum* 1, *Helianthemum grandiflorum* 1, *Hieracium prenanthoides* 1, *Lilium martagon* 1, *Linum catarrhulare* 1, *Lotus corniculatus* 1, *Mercurialis perennis* 1, *Phyteuma orbiculare* 1, *Pleurospermum austriacum* 1, *Polygala brychiptera* 1, *Prunella vulgaris* 1, *Ranunculus Hornschüchii* 1, *Senecio capitatus* 1, *Soldanella carpatica* 1, *Trifolium badium* 1, *Tussilago farfara* 1, *Veronica chamaedrys* 1, *Rhytidadelphus triquetrus* 5, *Mnium hornum* 4, *M. punctatum* 4, *Calliergonella cuspidata* 1, *Eurhynchium praelongum* 1, *Hylorhynchium splendens* 1, *Chrysohypnum protensum* +, *Tortella tortuosa* +.

*Pleurospermum austriacum* was also found in the alliance of *Calamagrostidion variae* SILL. 1933, especially in the ass. *Calamagrostetum variae carpaticum* SILLINGER 1933. This author found *Pleurospermum* in 3 from 13 relevés of this community in the Nízké Tatry, HADAČ (MS.) noted it in 2 from 5 relevés of the same association in Belanské Tatry.

In the belt of montane and submontane woods, *P. austriacum* grows mainly in flowery beech woods, fir-beech woods and fir woods, rarely in spruce forests (ordre *Athyrio-Piceetalia* HČ 1962) primarily in communities with humose soils and a rich herbaceous vegetation, mainly on slopes, e.g. in the *Fagetum adenostylosum* in the Malá Fatra mountains (SILLINGER apud DOMIN MS), in mixed spruce forests on limestone in the Nízké Tatry (SILL. 1933), in a *Carpino-Fagetum* in the Bílé Karpaty (2 from 10 relevés, SILL. 1929 : 22) etc. At this altitude *Pleurospermum* also occurs in secondary communities like *Coryletum*; the following example shows that such a community includes both species from the alliance *Abietion* BRÉZ. et HČ. and from oakwoods.

Example: Levočské pohorí, (Levoča mountain group) a slope above the Vápnistý potok (brook), 645 m alt., aspect SW, 30°, 200 m<sup>2</sup>, T a + b 75°, c 70°, 17. 6. 1964, (SLAVIK et HADAČ):

*Corylus avellana* 8, *Betula pendula* 3, *Picea abies* 3, *Cornus sanguinea* 2, *Tilia cordata* 2, *Daphne mezereum* 1, *Prunus avium* 1, *Quercus petraea* +, *Q. robur* +, *Carex pilosa* 7, *Aegopodium podagraria* 4, *Poa nemoralis* 4, *Luzula nemorosa* 3, *Symphytum tuberosum* 3, *Anemone nemorosa* 2, *Asarum*

*europaeum* 2, *Digitalis grandiflora* 2, *Euphorbia amygdaloides* 2, *Lathyrus vernus* 2, *Pimpinella major* 2, *Pleurospermum austriacum* 2, *Pulmonaria obscura* 2, *Stellaria holostea* 2, *Actaea spicata* 1, *Angelica montana* 1, *Betonica officinalis* 1, *Brachypodium sylvaticum* 1, *Bupleurum longifolium* 1, *Campanula trachelium* 1, *Crepis succisifolia* 1, *Dactylis polygama* 1, *Dentaria bulbifera* 1, *Doronicum austriacum* 1, *Fragaria vesca* 1, *Glechoma hirsuta* 1, *Hypericum hirsutum* 1, *Lathyrus niger* 1, *Luzula pilosa* 1, *Majanthemum bifolium* 1, *Melitis melissophyllum* 1, *Milium effusum* 1, *Paris quadrifolia* 1, *Phyteuma spicatum* 1, *Polygonatum multiflorum* 1, *Prenanthes purpurea* 1, *Ranunculus lanuginosus* 1, *Salvia glutinosa* 1, *Senecio Fuchsii* 1, *Vicia dumetorum* 1, *V. silvatica* 1, *Viola silvatica* 1.

*Pleurospermum* may be found even in scree communities of the alliance *Tilio-Acerion* KLIKA 1955 on humose, stony soils.

As an example of such a community may serve the following relevé from the Levoča mountains: Ex.: a scree SE from the top of the Brezová hill, 790 m alt., aspect SW, 100 m<sup>2</sup>, 16. 6. 1964 (SLAVÍK at HADAČ):

*Acer pseudoplatanus* 8, *Tilia cordata* 5, *Betula pendula* 4, *Quercus petraea* 4, *Corylus avellana* 6, *Lonicera xylosteum* 4, *Cornus sanguinea* 1, *Euonymus europaea* 1, *Ribes alpinum* 1, *Poa nemoralis* 5, *Ranunculus lanuginosus* 5, *Aegopodium podagraria* 4, *Campanula trachelium* 3, *Milium effusum* 3, *Phyteuma spicatum* 3, *Stellaria holostea* 3, *Symphytum tuberosum* 3, *Veronica chamaedrys* 3, *Anemone nemorosa* 2, *Chrysanthemum subcorymbosum* 2, *Doronicum austriacum* 2, *Glechoma hirsuta* 2, *Melica nutans* 2, *Pleurospermum austriacum* 2, *Primula elatior* 2, *Pulmonaria obscura* 2, *Senecio Fuchsii* 2, *Actaea spicata* 1, *Cardamine impatiens* 1, *Crepis succisifolia* 1, *Cystopteris fragilis* 1, *Dactylis polygama* 1, *Digitalis grandiflora* 1, *Dryopteris filix-mas* 1, *Epilobium montanum* 1, *Galium verum* 1, *Geranium phaeum* 1, *G. Robertianum* 1, *Geum urbanum* 1, *Hypericum hirsutum* 1, *Lathyrus vernus* 1, *Lilium martagon* 1, *Majanthemum bifolium* 1, *Melandrium rubrum* 1, *Melitis melissophyllum* 1, *Mycelis muralis* 1, *Myosotis silvatica* 1, *Ranunculus auricomus* 1, *Vicia sepium* 1, *V. silvatica* 1, *Thalictrum aquilegifolium* 1.

Sometimes such communities occur in climatic inversions at very low altitudes; *Pleurospermum* can exist even there, as may be seen from the next example:

Ex a m p l e: a scree below rocks on the left bank of the Jizera river opposite to the hospital in the town of Semily, stony soil, aspect NNW, slope 40–45°, 250 m<sup>2</sup>, 350 m alt., Ta 95%, b 60%, c 90%, 30. 6. 1965 (SLAVÍK) (dominance and abundance in Braun-Blanquet scale):

*Acer pseudoplatanus* 3, *Picea abies* 3, *Ulmus scabra* 3, *Corylus avellana* 3, *Lonicera nigra* 2, *Sambucus racemosa* 2, *Ribes alpinum* 1, *Daphne mezereum* +, *Fraxinus excelsior* +, *Lonicera xylosteum* +, *Rosa pendulina* +, *Rubus idaeus* +, *Dryopteris filix-mas* 4, *Geranium robertianum* 3, *Actaea spicata* 2, *Mercurialis perennis* 2, *Petasites albus* 2, *Senecio Fuchsii* 2, *Impatiens noli-tangere* 1, *Polystichum lobatum* 2, *Asarum europaeum* 1, *Athyrium filix-femina* 1, *Lamium galeobdolon* 1, *Galium sylvaticum* 1, *Melica nutans* 1, *Mochringia trinervia* 1, *Oxalis acetosella* 1, *Phegopteris dryopteris* 1, *Pleurospermum austriacum* 1, *Polygonatum verticillatum* 1, *Urtica dioica* 1, *Epilobium montanum* 1, *Angelica montana* +, *Cystopteris fragilis* +, *Heracleum sphondylium* +, *Lilium martagon* +, *Milium effusum* +, *Mycelis muralis* +, *Paris quadrifolia* +, *Pulmonaria obscura* +, *Scrophularia nodosa* +.

*Pleurospermum austriacum* can thrive in communities with dominating *Quercus* and *Carpinus* (*Galio-Carpinetum* OBERD. 1957) even at relatively low altitudes. As an example of such a community we bring a relevé from the promontories of the Thüringer Wald in DDR, which is very similar to some communities including *Pleurospermum* in this country:

Ex a m p l e: Espenfelder Gottesholz at Arnstadt, shell-limestone (Muschelkalk), aspect N, 3°, 100 m<sup>2</sup>, 4. 6. 1966 (HADAČ et WEINERT).

*Quercus robur* 7, *Carpinus betulus* 6, *Corylus avellana* 5, *Tilia platyphyllos* 5, *Sorbus aucuparia* 1, *Acer campestre* 1, *Rhamnus cathartica* 1, *Pleurospermum austriacum* 5, *Aegopodium podagraria* 4, *Melampyrum nemorosum* 4, *Phyteuma spicatum* 4, *Viola mirabilis* 4, *Anemone nemorosa* 3, *Asarum europaeum* 3, *Hepatica nobilis* 3, *Mercurialis perennis* 3, *Campanula trachelium* 2, *Carex montana* 2, *Chrysanthemum corymbosum* 2, *Convallaria majalis* 2, *Crepis succisifolia* 2, *Galium sylvaticum* 2, *Laserpitium latifolium* 2, *Lathyrus vernus* 2, *Primula veris* 2, *Sanicula europaea* 2, *Anthriscus nitidus* 1, *Aquilegia vulgaris* 1, *Brachypodium sylvaticum* 1, *Bupleurum longifolium* 1, *Campanula per-*



*sicifolia* 1, *Dactylis polygama* 1, *Daphne mezereum* 1, *Festuca heterophylla* 1, *Fragaria vesca* 1, *Hieracium murorum* 1, *Lathyrus niger* 1, *Lilium martagon* 1, *Listera ovata* 1, *Lonicera xylosteum* 1, *Melica nutans* 1, *Polygonatum officinale* 1, *Ranunculus auricomus* 1, *R. polyanthemus* 1, *Serratula tinctoria* 1, *Vincetoxicum officinale* 1.

From the above relevés it is evident that *P. austriacum* practically never occurs as a dominant species in any community, but nevertheless it plays a significant role in some of them, e.g. in the alliances of *Calamagrostidion arundinaceae*, *Calamagrostidion variae*, *Seslerion tatrae*, *Tilio-Acerion* or *Carpinion*.

Though it can grow at such different altitudes and in rather different plant communities, we can find quite a few species occurring very often associated with it in most places, e.g. *Lilium martagon*, *Bupleurum longifolium*, *Crepis succisifolia*, *Campanula trachelium*, *Mercurialis perennis*, *Pimpinella major* etc. It is probable that some of these species exhibit a similar history as *P. austriacum*.

## Ecology

*Pleurospermum austriacum* flowers usually in July. Its pollination is secured mainly by Hymenoptera; pollination by ants was observed in the Belanské Tatry (HADAČ 1960).

Ripe fruits (cremocarpia) may be observed in August or later. The diaspore production is considerable. We have found in different individuals 500—7.000 fruits; HORN (1946) found the maximal fruit number per indiv. to be 6.000. According to THELLUNG in HEGI (1926) the germinating capacity of the seeds is very low, ca 2%. The winged cremocarpia are mainly transported by wind or running water. The buoyancy of the fruits lasts, according to THELLUNG in HEGI l.c. p. 1902, for about 10 days. Fruits of *Pleurospermum* are relatively heavy 0.0077 g (ŠMARDA et ŠMARDOVÁ 1966); we cannot expect them to be able of a long distance transport.

Most of the localities of *Pleurospermum* in this country are situated on limestone rocks (ca 80% of occurrences), ca 8% was found on sandy marlstones (called locally „opuka“), 8% on eruptive rocks (basalts etc), 3% on dolomits. The localities in granitic districts are probably situated on mylonites. It is thus evidently an eutrophic, subneutro — to basiphilous species. The soil reaction in its rhizosphere in the Belanské Tatry was found to be pH 6.4—7.0 (HADAČ et al. MS).

In mountains, *P. austriacum* is a pronouncedly chionophilous species. It grows only in places with sufficient snow cover in winter and a soil moist in summer, with enough of nutrients. It shows no preference for open or shaded

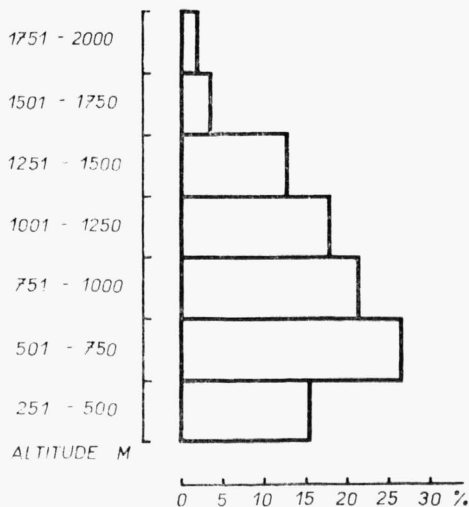


Fig. 1. Vertical distribution of *Pleurospermum austriacum* in Czechoslovakia.

habitats in mountains, whereas at lower altitudes it prefers shaded places, deep gullies or terrains with a climatic inversion.

In this country it has a considerable vertical amplitude (Fig. 1.). The lowest localities are met with in the valley of Jizera at N. Benátky at 190 m alt. (temporary, somewhat doubtful occurrence) and at Semily, 330 m; further in the Labe (Elbe) valley at Jaroměř in NE Bohemia, ca 280 m alt. These

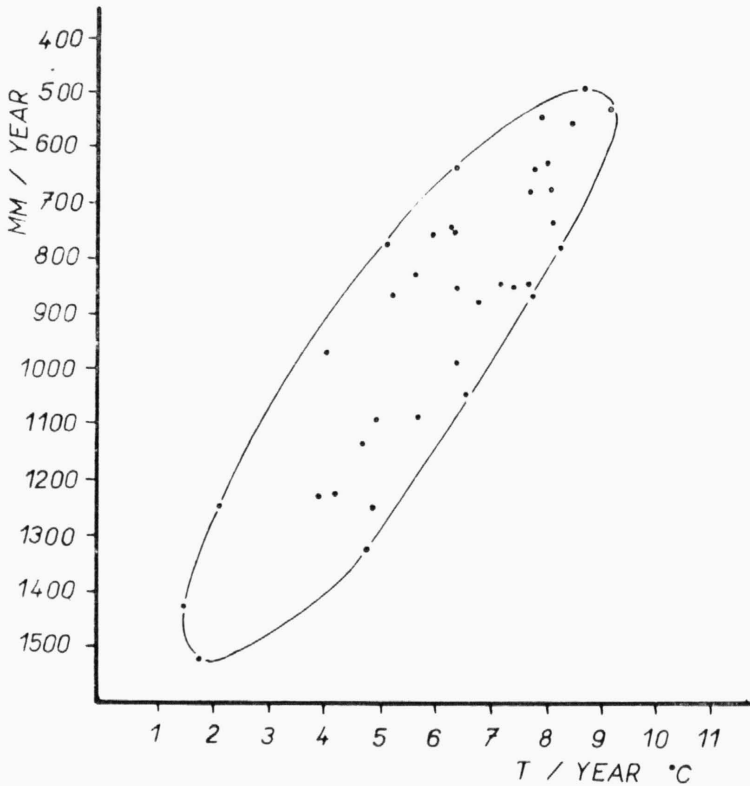


Fig. 2. — Precipitations (mm/year) and the annual mean temperature in localities of *Pleurospermum austriacum* in Czechoslovakia.

occurrences may be classified as dealpine, in the same way as some of the localities in Slovakia (SILLINGER 1929 : 18). The highest occurrence is in the Belanské Tatry at 1760 m alt. Vertical amplitude of *P. austriacum* in this country is thus approximately 1500 m. It attains considerable altitudes also in other European mountains, e.g. in Velebit it grows at 1600 m, in the Eastern Carpathians at 1730 m, in the Bavarian Alps at 1820 m etc.

It is not easy to find any correlation between the distribution of *P. austriacum* in Czechoslovakia and some of the climatic indices. The main difficulty is probably caused by the fact that this species occupies habitats with a microclimate which is very different from that of the next macroclimatic station. In lowlands its microclimate is generally colder (inversion, northern slopes), in mountains, however, considerably warmer than the corresponding macroclimate, since it grows on limestones in places, protected in winter by a deep snow cover. Likewise the precipitation gives only a fragmentary picture of

the amounts of water it has at its disposal, as it usually grows in crevices and gullies with plenty of water running that way during each rainfall (Fig. 2).

RYBNÍČKOVÁ (1961) holds that *P. austriacum* grows in regions where the mean January temperature is lower than  $-2^{\circ}\text{C}$ . This may be true; it is not unthinkable that the germinating capacity of its seeds is dependent on a certain period of temperature below the freezing point. But on the other

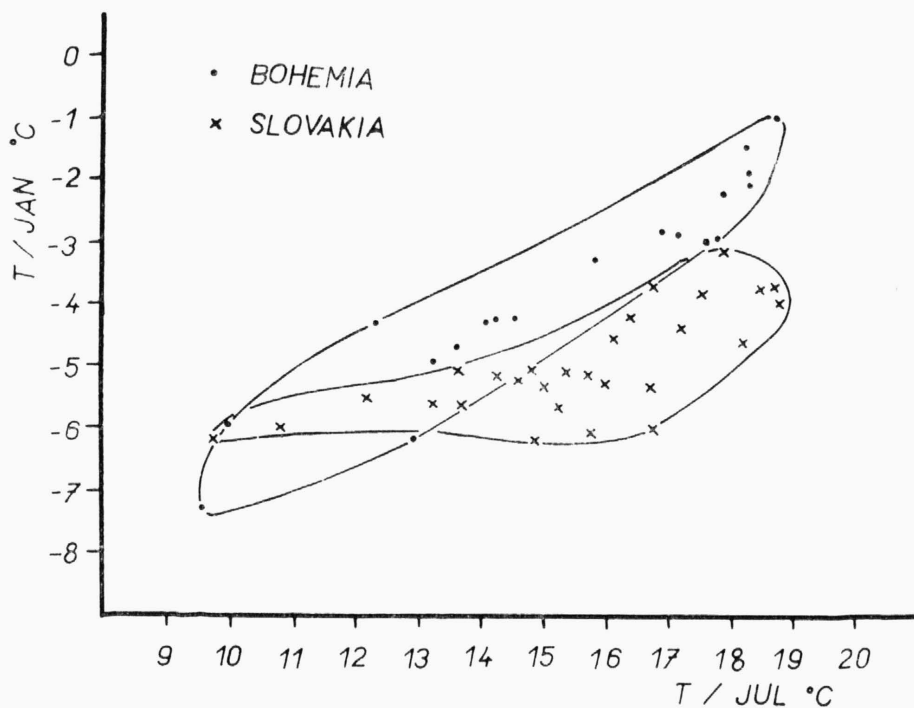


Fig. 3. — Mean January and July temperature in localities of *PleurospERMUM austriacum* in Czechoslovakia.

hand, in regions with the mean January temperature below  $-2^{\circ}\text{C}$  very warm summers are frequent. One could imagine that the limiting factor could be a high summer temperature as well. Fig. 3. shows that the mean July temperature in localities of *PleurospERMUM* in this country never surpass  $19^{\circ}\text{C}$ . By comparing its distribution in Czechoslovakia with climatic maps (Atlas podnebí ČSSR) we find a fairly good correlation with a line limiting regions with 40 and less summer days per year. Some of the localities seem to exceed this line, but these are on the northern slopes or in inversions. The continental character of *P. austriacum* may be seen also in its absence from regions with a more pronounced influence of the subatlantic climate, like Jizerské hory, Orava or the Beskydy.

#### Areogenesis and the History of the Species

The area of *P. austriacum* in Czechoslovakia as well as in other countries is split in island-like arels on the periphery of the Alpine-Carpathian-Balkanico coenoarea. The disjunction of such arels may be explained in two ways. The

disjunctions originated during a recent penetration of the species to districts not yet occupied by this species, or such occurrences are relics from a former compact distribution.

In some cases the first possibility is more probable. Seeds of *Pleurospermum* brought down from mountains to lowlands by water can germinate, and the plants can grow there for some few or for many years. Such a case of a temporary occurrence is known in the neighbourhood of Nové Benátky. But for localities in the surroundings of Brno this explanation is improbable. They are fairly distant from the next occurrences in the Jeseníky and the Bílé Karpaty mountains. A transportation of diaspores at such a distance by wind is not probable and a transportation by means of running water is out of the question. Similar situation arises in the locality in the valley of Kamenice at Jesenný. Wind transport is not probable and spreading by running water likewise, as the Kamenice river and its tributaries originate in the Jizerské hory, where no *Pleurospermum* grows. In the two cases occurrences of *Pleurospermum* must be explained as relics from a more compact distribution.

BRESINSKY (1965 : 36), discussing the distribution of *Pleurospermum austriacum* in the northern Alps, writes: "Manche präalpine Sippe besitzt heute in Mitteleuropa nördlich der Donau und Aare Vorkommen, die den Gedenken an eine eiszeitliche Überdauerung in situ aufkommen lassen . . . Die Auflockerung ihrer Areale in Mitteleuropa im Gegensatz zu den dealpinen, eher glazial als wärmezeitlich bedingt ist." In our opinion the disintegration of its coherent area was caused mainly by the warm interglacial or postglacial periods rather than by the Glacial itself. This supposition is based on finds made by several Czechoslovak palaeobotanists. RYBNÍČKOVÁ (1961) had found pollen of *Pleurospermum* in Loučky and Žižpachy (Blato) in sediments from the Praeboreal period, and Kotoučková (oral information) had found pollen of this species in sediments dated as Younger Dryas period in the depth of 380 cm at Červené blato, and from the depth of 600 cm at Borkovice. It was also found in praeboreal deposits from the moor Velanská cesta near České Velenice — all in Southern Bohemia. *Pleurospermum* does not grow in Southern Bohemia at present; nearest localities are fairly distant — in the Alps or in the neighbourhood of Brno. Similar finds are also known from Slovakia. At the village Vinné in the lowland of the Eastern Slovakia, *Pleurospermum* pollen was found at the depth of 640 and 660 cm in sediments dated approximately to the Younger Dryas period, and *Pleurospermum* grew there until the early Praeboreal (depths 400, 410, 420 and 440 cm). Another profile from Michalovce (E. Slovakia) showed *Pleurospermum* pollen at the depth of 640 cm, corresponding to the late glacial period of Alleröd (KRIPPEL in litt.).

In the Late Glacial and the early Postglacial period *Pleurospermum* was in all probability relatively common in the region between the Alps, the Sudetes and the Carpathians, and, perhaps, also in a part of the Hercynian district. When the subarctic continental climate changed to a warmer and less continental one, *Pleurospermum* was exterminated in many places, where it was unable to find suitable conditions — either because of the rising acidity and depauperation of the soils, or by a too warm climate. From the recent distribution it could be supposed that in the late Ice age or in the Early Postglacial *Pleurospermum* grew also in the Jizerské hory; there in our opinion, it was, exterminated by a warmer and more subatlantic climate.

while plants brought to the lowland by the running water could survive because of local favourable soil conditions.

A similar situation probably existed in the still older history of this species. The common ancestor of *Pleurospermum austriacum* and *P. sibiricum* was probably distributed in S. Siberia already in the early Ice age. During the Mindel glaciation it penetrated to Central Europe. In the following interglacial period Siberian and European populations were separated and they started to develop independently into different species. It is not impossible that the Siberian and Central European populations mixed once more during the Riss glaciation; in this case the starting point of the speciation of the two taxa must be placed to the Riss-Würm interglacial period. If in individual mountain systems, especially in the Alps and the Carpathians, some populations were isolated and started to develop independently for some time, such deviations were incorporated again in the bulk of the type by mixing together during the successive glaciations, when mountain plants descended to the lowlands and formed again a coherent area. This is perhaps the reason why we find in the whole area of the species only few deviations from the type.

This hypothesis is corroborated or at least is not in contradiction with fossil finds of *Pleurospermum* pollen in pleistocene deposits of Central Europe. VODIČKOVÁ (1965) has found pollen of *Pleurospermum* sp. in M/R deposits at Skřečoh and Muglinov, in R 1/2 at Stará Bělá in Silesia, and in R/W sediments in Gánovce in N. Slovakia (Vodičková 1965). In Poland *Pleurospermum* pollen was found in the aurignac interstadial deposits at Brzeziny and Lańcuchów, and in the late Glacial deposits at Podbukowina, Rzesów, Grel and Puscina near Nowy Targ (KOCZWARA 1950).

(In her study VODIČKOVÁ in MACOUN et al. (1965) classifies *Pleurospermum* as a steppe plant. In our opinion it is a mountain plant descending to deciduous woods at lower altitudes. So for instance in the White Carpathians it grows in *Carpinus* woods only, never in steppe communities. Its occurrence in Silesia during the Ice Age may suggest perhaps the vegetation type of steppotundra or tayga rather than steppe.)

If our hypothesis is right, the age of *Pleurospermum austriacum* cannot be higher than 200.000—300.000 years — i. e. the time since the isolation of the populations of C. Europe and Siberia in M/R or R/W. Before this time the Eurosiberian population of *Pleurospermum* formed probably a coherent area not suitable for the forming of two different taxa.

## Souhrn

Rod *Pleurospermum* s. str. má tři druhy, *P. camtschaticum* na Dálném Východě, v Japonsku a snad Číně, *P. uralense* od vých. části Evr. Ruska po Japonsko, a *P. austriacum* ve stř. Evropě (viz mapa). V Československu se vyskytuje hlavně v Karpatech a Sudetech, prakticky chybí v panonské a horecynské oblasti. Vertikální rozpětí jeho rozšíření v Československu je asi 1500 m. Nejčastěji roste na vápencích a na jiných výživných horninách, ve společenstvech horských niv, jedlín, bučin, habřin apod. V horách roste na místech, kde bývá v zimě hluboká sněhová pokrývka. Ve vyšších polohách nejvíce preferenci pro stinná nebo výslunná stanoviště, v nížině však roste jen na stinných místech, v roklích nebo v místech klimatické inverze.

Výskyt tohoto druhu u nás je, jak se zdá, omezen vysokými letními teplotami — chybí tam, kde průměrná červenová teplota je vyšší než 19° nebo tam, kde je více než 40 letních dní do roka (s výjimkou několika lokalit na severních svazích).

Výchozí forma rodu *Pleurospermum* byla pravděpodobně koncem třetihor rozšířena na jižní Sibiři. V době Mindelského zalednění se dostala do Střední Evropy; v následující době meziledové byla evropská populace odtržena od sibiřské. Pokud v Risském zalednění nedošlo k opětovnému spojení obou arel, můžeme začátek M/R zalednění pokládat za začátek samostatného vývoje obou forem, a tak i začátek vzniku druhu *P. austriacum*. Je-li tento předpoklad správný, pak tento druh není starší než 200 000 – 300 000 let.

Mapa rozšíření *P. austriacum* v Československu je založena na datech získaných ze všech hlavních herbářů v Československu (PR, PRC, BRNM, BRNU, BRA, BRAC, SLO), na literárních

údajích, DOMINOVĚ rukopisném materiálu a na vlastních našich poznámkách z terénu (celkem 230 bodů). V následujícím podáváme výčet všech nám známých lokalit:

## Sudeticum

### Jizerské hory

SCHMIDT (1794) uvádí tento druh z Jizerských hor bez bližší lokality. Údaj je však pochybný a žádný spolehlivý z tohoto území neexistuje. V této souvislosti nutno však zmínit nález z údolí Kamenice u Jesenného (SLAVÍK 1966), neboť tato řeka pramení v Jizerských horách.

### Krkonoše

1. Sněžné jámy: obě S. jámy (FUNCK 1820), čedičové droliny v Malé S. jámě (SCHIFFNER PRC, ZLATNÍK 1926), ve třech S. jamách v as. *Ribes petraeum-Pinus* (HUECK 1939), S. jámy (WIMMER 1840, LIMPRICHT 1867, CALLIER 1888, SCHUSTLER 1918a). — 2. Labský důl (FUNCK 1820, FIEK 1881, HUECK 1939), ve výši 1110 m n. m. (JENÍK 1961). — 3. Kotelní jámy (SCHUSTLER PR), v as. *Calamagrostetum arundinaceae delphiniosum* (ZLATNÍK 1926, 1928a) ve výši 1220–1350 m n. m. (JENÍK 1961). — 4. Kotel (KABLÍKOVÁ PR), druhý svah Kotle směrem k Lysé hoře (DOMIN PRC). Velký Kotel (1902 PROSCHWITZER PRC, 1907 STEJSKAL PRC). — 5. Čertova zahrádka (UECHTRITZ apud FIEK 1881, KAVINA 1914e, SCHUSTLER 1918a, PR, ZLATNÍK 1926), Čertova rokle nad loveckou stezkou (ŠOUREK 1948), Malá Čertova rokle, 1150 m n. m. (JENÍK 1961). — 6. Pláň (Równia, Lahnberg) nad M. Rybníkem (GÖPPERT 1864b, WIMMER 1840, KABLÍKOVÁ PR, HUECK 1939). — 7. Nivy v kotlech Obřího dolu (FUNCK 1820, SCHUSTLER 1918a). — 8. Sněžka, přední strana (FUNCK 1820, HAENKE 1791). — 9. Studničná (FUNCK 1820). — 10. Rudník (Kiesberg) (ZLATNÍK 1926, ŠOUREK 1948). — 11. U vodopádů Úpy (1881 HANDSCHKE PRC, CYPER 1882, HUECK 1939). — 12. Ve skalních roklích proti Schlingelově boudě (SCHUSTLER 1918a). — 13. Melzerův důl (FIEK 1881). — 14. Jánské lázně, keřnatá stráň, 600 m n. m., ojedinele (MIKULÁŠ apud DOMIN MS). — 15. Vápencové skalky na levém břehu Jizery proti samotě Zabyly severně od Jablonce n. Jiz. (1966 SLAVÍK).

### Rychlebské hory

1. Při silnici z Vápenné do Lipové u mramorového lomu (FORMÁNEK 1882, OBORNÝ 1885). — 2. U Vápenné pod vrchem „Nesselkoppe“ (dříve „Kopřivová“, dnes pravděpodobně Studničný vrch (HRUBY 1923a). — 3. U Vápenné, ve starém lomu směrem k Polce (SCHUBE 1908b).

### Hrubý Jeseník

1. Šumárník (Šumný), na vrcholové erlánové skalce, 1065 m n. m. (1954 SKYBOVÁ BRNU). — 2. Studénková hole (Studénky) (FORMÁNEK 1882). — 3. Velký a Malý Kotel (LAUS 1911, HRUBY 1914), Velká Kotlina (DOSTÁL PRC, JENÍK 1961). — 4. Praděd (KOLENATI 1860), horní okraj kotle (MAKOWSKY 1864b). — 5. Divoký důl (ZAVŘEL 1955). — 6. Koprník (ZAVŘEL 1955). — 7. Šerák (ZAVŘEL 1955). — 8. Vozka (ZAVŘEL 1955). — 9. Skřítek (ZAVŘEL 1955). — 10. Petrovy kameny (OBORNÝ 1885). — 11. Jelení hřbet (OBORNÝ 1885). — 12. Františkova skála u Fr. myslivny (OBORNÝ 1885). — 13. Vřesová studánka (MAKOWSKY 1864b, OBORNÝ 1885). — 14. Červená Hora (JENÍK 1961).

### Nízký Jeseník

1. Skalní rokle u Valtořic („am Karlsdorfer Hochfalle“) (REISSEK 1841).

## Prae-Sudeticum

### Podkrkonoší

1. Skály a sut pod skalami na levém břehu Jizery proti nemocnici v Semilech (1965 SLAVÍK). — 2. Skály nad Riegrovou stezkou v soutěsce Jizery na pravém břehu nedaleko přehradního zařízení elektrárny u Bítouchova (1961 SLAVÍK, 1966 KUČERA et PLAŠILOVÁ). — 3. Vápencové skály na levém břehu Kamenice pod jezem v Jesenném (1966 SLAVÍK).

## Pannonicum

## Matricum

### Jihoslovenský kras

1. Gerlachovská skála nad Štítníkem, 700 m n. m. (DOSTÁL PRC).

## České středohoří

1. Milešovka: nejvyšší zóna mezi nakupenými znělcovými plotnami v lese podél turistické stezky (1925 DOMIN MS), severní svah (FIRBAS 1928b), Milešovka (HIPPE PRC, 1851 HAMPEL SLO), „Milešovka, 835 m n. m., neobyčejně statné, zvýší až přes 2 m, tvoří celé lesíky pod samým vrcholem, také na severním svahu, často ve spol. *Libanotis* ve stínu i na slunci“ (DOMIN 1904a). — 2. Lovosův (MAAS PR, ČELAKOVSKÝ 1889d, DOMIN 1904a, TESAŘ 1926). — 3. Na Čerčeništi (TESAŘ 1926). — 4. V háji na Špičáku nad Babinou (DOMIN 1904a). — 5. Jihozápadně od Babiny ve smrkovém lese (DOMIN MS), u Babiny (TESAŘ 1926, 1887 HORA PRC), vlhký háj u Babiny (1934 PREISS PRC). — 6. V doubravě SZ od Němčí (DOMIN 1904a). — 7. Pod Hradišťany (DOMIN 1904a). — 8. Radobýl (PREISS PRC). — 9. Háje v blízkosti opukové stráně od Skalického mlýna nad Granátovým potokem u obce Skalice 450 m n. m. (VULTERIN 1938). — 10. Lysá hora u Režného Újezdu (VULTERIN 1938).

## Džbán

1. Na stráni proti Bilichovské myslivně, jen v listech (1884 ČELAKOVSKÝ PR, BÍLEK 1885); nověji potvrzeno MLADÝM (úst. sděl.) a KRÍSOU (PRC).

## Střední Polabí

1. Vzácně na keřnatých stráních u N. Benátek (KALISTA apud SLÁDEČEK 1927—1928 et apud NOVOTNÝ 1966).

## Východní Polabí

1. V lese „Nademlýnem“ u Lužan d. h., ca 290 m n. m. (PROKEŠ apud ROHLENA 1926). — 2. Račický háj, kolem lomu, asi 50 ex., ca 280 m n. m. (PROKEŠ apud ROHLENA 1926). — 3. Les Holá u Sadové, ca 280 m n. m. (KRČAN apud ROHLENA 1928). — 4. „Na kopci“ mezi Žiželevsi a Vřeštovem, ca 300 m n. m. (TRAXLER PRC). — 5. Habřina u Josefova (TRAXLER apud ROHLENA 1936), Habřinská stráž u Smiřic (1935 TRAXLER PRC), ca 280 m n. m. — 6. Sendražický háj, ca 290 m n. m. (PROKEŠ PRC). — 7. Jodlový les u Velichovek, s *Adenophora liliifolia* (1893 KOŠTÁL PR), ca 330 m n. m. — 8. Les Lisice u dv. Černice nedaleko V. Vřeštova, 320 m n. m. (1940 ŠOUREK PRC, 1942 DOSTÁL PRC). — 9. Les Borek u Rodova, ca 280 m n. m. (KRČAN BRAC). — 10. Les Tuří u Slavětína, ca 280 m n. m. (1941 KRČAN PRC).

## Praebohemium

1. Luhy u Lonnice u Tišnova, ca 380 m n. m. (PLUSKAL 1853b). — 2. Pisárky (HOCHSTETTER 1825). — 3. U Šebetova za Pisárkami (ROHRER apud MAKOWSKY 1863b). — 4. Babí lom u Brna, ca 500 m n. m. (VINCENT apud DOMIN MS). — 5. Při vchodu do Kateřinského údolí u Adamova (1862 THEIMER BRNU). — 6. Na Ferdinandsku (MAKOWSKY 1863b). — 7. Koží žleb u Bilové (1902 LAUS BRNM, BRNU).

## Carpatium occidentale

## Praecarpatium moravicum

## Moravský kras

1. Hády: údolí Řičky jižně Ochozu a na svazích Lysé hory; proti V. Hornoku (ŠVESTKA PRC); Hády, 423 m n. m. (HRUBÝ 1923c). — 2. Údolí mezi Lažánkami a Skalickým mlýnem (Bílý BRNU).

## Bílá Karpaty (stepní)

1. Korytná: les Kadločková (STANĚK 1926b, SILLINGER 1929a). — 2. Les Hluboček, městský a panský les, ca 460 m n. m. (1926 STANĚK BRNU). — 3. V lesním žlebu mezi Havříčkem a Cuzeniský (STANĚK 1926b). — 4. Severní svah Lesné (Bílý BRNM), v podhorské bučině, 580 m n. m. (SILLINGER PRC). — 5. Křoví v seči směrem k potoku Kasivci (Bílý BRNM, PODPĚRA BRNU). — 6. Lesní žleb pod Veselkou u Radějova, 300–350 m n. m. (SILLINGER PR, PRC). — 7. Radějov: Mandátický údolí (STANĚK 1926b). — 8. Pavlov v údolí směrem k Žalostivé (PODPĚRA BRNU, POSPÍŠIL BRNM). — 9. Lesní žleb mezi Machovou a Paličkami u Vrbové (WEBER PR, POSPÍŠIL BRNM). — 10. Nivnice: Lipiny (STANĚK 1926b, SILLINGER 1929a). — 11. Pod Studeným vrchem, 646 m n. n. (SILLINGER 1929a). — 12. Kněždub: les při Jarkovci (STANĚK 1926b, SILLINGER 1929a). — 13. Kuželov: Ochoza (STANĚK 1926b, SILLINGER 1929a). — 14. Lesní žleb u Bořic, 300 m n. m., pod Lípinkou (SILLINGER 1929a, WEBER PR, PRC). — 15. Velká, rokle

v Háji (1918 BÉŇA BRNM, BRNU). — 16. Vápenka u Velké (NEVOLE BRNU, STANĚK 1926b, SILLINGER 1929a). — 17. V horách za Butáčkou (VOTRUBA apud DOMIN MS).

## Praecarpaticum slovacum

### Malé Karpaty

1. Veterník (Wetterling), hřeben k Čelu, 650 m n. m. (SILLINGER 1937b).

### Tematínské kopce

1. Rovence, severní svah, 500 m n. m., na dolomitu (SILLINGER PR, PRC). — 2. Bučina pod hradem Tematín (SILLINGER 1930a). — 3. Hřebíček, 620 m n. m., severní a východní svah (POUZAR PR). — 4. Bučina na severním svahu vrchu mezi Kňazným a Sokolem, 641 m n. m. (SILLINGER PR, PRC).

### Strážovská hornatina

1. Vrch Žihlavník, 630 m n. m., bučina v roklině, dolomit (FUTÁK BRAC). — 2. Strážov, vrchol, 1213 m n. m., též 1180 m n. m. (DOMIN PRC, SUZA BRNU, ROHRER PRC). — 3. Malenica (KITABEL 1863c, ut *Ligusticum scoticum*; BÖBELSTEIN PRC). — 4. Ostrý u Beluší, 519 m n. m. (ONDRČKA apud HOLUBY 1888).

### Rokoš

1. Vysoký Rokoš nad obcí Diviaky, 900 m n. m. (KRIST BRNU). — 2. Při Uhrovcí, 1010 m n. m. (DOMIN MS). — 3. Na severním boku Rokoše, 970 m n. m., na dolomitu (DOMIN MS).

### Sulovské skály

1. Bučiny na Roháči (SILLINGER apud DOMIN MS). — 2. Severovýchodní stráň Žibřida pod trianglem, 868 m n. m. (UNZEITIG BRNU).

### Štiavnické pohorie

1. Pustý hrad u Zvolena, 300 m n. m., trachyt (FREYN BRNM). — 2. Na vrchu Hor. Bukovina západně od Žibřitova, 600 m n. m. (CHRTEK 1961). — 3. Les Kerhanka záp. od železniční stanice Babiná, 420 m n. m. (CHRTEK 1961). — 4. Kopec Tri Kamene, 6 km od Dobré Nivy (NEUHÄUSLOVÁ 1966).

### Javorje

1. Čabrad (1876, 1890 KMEŤ BRA). — 2. Údolí Lietavky pod kótou H. Tále (1963 HADAČ et HOUFEK). — 3. Okraj lesa pod horou Slotno vých. od Drienova, 350 m n. m. (CHRTEK et HENDRYCH 1964).

### Slovenské Rudohorie (skupina Galmusu)

1. Tisová dolina, 700 m n. m., vápenc (MARSA BRA). — 2. Poráčský potok, na již. stráni u vodopádu a na sev. stráni pod planinkou (HAJDÚK 1963). — 3. Biela voda, na stráni v úžlabince (HAJDÚK 1963).

### Muráňská plošina

1. Údolí potoka od Červené skaly, 824 m, k JJZ ke kótě 829 m (DOMIN PRC). — 2. Velká Stožka, 1000 m n. m., *Calamagrostetum variae* (SILLINGER apud DOMIN MS). — 3. Pod Čigánkou, 700 m n. m., *Calamagrostetum variae* a bučina s *Cal. varia* (SILLINGER apud DOMIN MS, FUTÁK SLO). — 4. Skály nad údolím Erzavy k SV, 1000 m n. m. (SILLINGER apud DOMIN MS). — 5. Roklina pod Lopušnou u Zlatna, 780–820 m, v as. *Seslerio-Festucetum tatrae*; mezi Červ. Hrádkem a Zlatnou (DOMIN MS). — 6. Vápencové skály nad Hronem mezi Valkovňou a Zlatnem, 750 m n. m. (DOMIN MS). — 7. Strmé skály nad sedlem pod Šajbou, 950–1000 m n. m. (DOMIN MS). — 8. Čeremošná u Tisovce, 600–700 m n. m. (VRANÝ PRC). — 9. Muráňský hrad (1944 FUTÁK SLO).

### Pohornádi

1. V údolí Hornádu u Košických Hamrů (HULJÁK 1926).

### Slovenský ráj

1. Soutěska Tesnina blíže Vernáru, 710 m n. m. (DOMIN 1939a). — 2. Mezi Vernárem a Popovou, též mezi Popovou a Pustým Polem (WETSCHKY 1872). — 3. V údolí Gelnického potoka záp. od zastávky Ladová jaskyňa, 840–900 m n. m. (DOMIN MS). — 4. Haineshöhe a Kriváň u Dobšinské jaskyně (LENGYEL 1927). — 5. Malý Sokol nad Stratenou (LENGYEL 1927). — 6. Lipovec (LEN-



GYEL 1927). — 7. Stratená, v *Calamagrostetum variae*, 750 m n. m. (SILLINGER PR), skály u silnice v údolí Hnilce mezi Dobšinou a Stratenou (1931 HAJNÝ PRC). — 8. Kláštorisko (1944 FUTÁK SLO).

## Eu-Carpaticum

### Malá Fatra

1. Témě Jankové, 1025 m n. m. vápenec (MALOCH PRC). — 2. Klak nad Rajčankou, 1353 m n. m. (BRANCSIK 1880), v *Calamagrostetum variae* 1260—1300 m n. m. (SILLINGER apud DOMIN MS), nad osadou Fačkovo (SUZA BRNU). — 3. V křovinách na hřbetu Studence u Kláštoru pod Znievom (WAGNER 1901a). — 4. Rokele mezi salaší a chatou na F. Kriváni, 1200 m n. m. (DOMIN MS). — 5. Sev. svah Stohu, ca 1200 m n. m., havezová bučina (SILLINGER apud DOMIN MS). — Vrátenská soutěska nad Terchovou, 560 m n. m. (DOMIN MS).

### Velká Fatra

1. Blatnická dolina (TEXTORIS BRA). — 2. Horný Balov: Košiariska pod Ploskou (PETRIKOVICH 1912a). — 3. Čierný Kameň, 1350 m n. m., v kleči (KLIKA 1926f). — 4. Križná, 1400 m n. m. (NÁBĚLEK BRA), rokliny potoků na V. Križné, vápenec (FREYN 1872). — 5. Gaderská dolina, 700—820 m n. m. (PETRIKOVICH 1912a, SILLINGER PR). — 6. Smrekovica, 1380 m n. m. (SCHIDLAY BRAC, SOUČKOVÁ BRNM). — 7. Žernoviská dolina u Štubn. Teplic v *Calamagrostetum variae* (KLIKA 1932a, KOBLÍZEK PR). — 8. Témě vrchu Maliny nad Rakšou, 832 m n. m., vápenec (MALOCH PRC). — 9. Témě Harmaneckého vrchu, 982 m n. m., vápenec (MALOCH PRC). — 10. Klak, vrchol, 1395 m n. m. (FRITZE et ILSE 1870). — 11. Majerova skala (1947 FUTÁK SLO).

### Chočské pohorie a skupina Sivého vrchu

1. V křoví u cesty z Jasenové do Vel. Dubové, 780 m n. m. (FUTÁK BRAC). — 2. Smrčina na záp. svahu pod srázy Sokola, 950 m n. m. (SILLINGER apud DOMIN MS). — 3. Choč (KRZISCH 1860, SZONTAGH 1863). — 4. Ostrá, 1105 m n. m. (ONDRČKA apud HOLUBY 1888). — 5. Prosečno, 1060—1100 m n. m. (SILLINGER apud DOMIN MS). — 6. Biela skala, 1325 m n. m. (PAWLOWSKI 1930). — 7. Pod Mníchem, 1135 m n. m. (PAWLOWSKI 1930). — 8. Pod Sivým vrchem, 1400 m n. m., dolomit ŠVESTKA BRNM). — 9. Kvačany (ŽOFÁK PRC), vápencová soutěska potoka Kvačanky sev. od Kvačan, 675 m n. m. (1966 SLAVÍK). — 10. V háji Kameno Obleko nad Zubercem, 900—1000 m n. m., vápenec (DOSTÁL PRC). — 11. Hájek na břehu Suchého potoka u kóty 599 záp. od Lipt. Matiašovců (1966 SLAVÍK).

### Nízké Tatry

1. Demänovská dolina pod Krakovou hoľou, 1752 m n. m. (ZAHRADNÍKOVÁ BRAC), u potoka blízko jeskyně Demänová, 900 m n. m. (1928 CEJP PRC). — 2. Pod Pustou, 1200 m n. m. (ZAHRADNÍKOVÁ BRAC). — 3. Borová hora u Lipt. Hrádku (FRITZE et ILSE 1870). — 4. Baba u Lučivné (SCHERFEL 1880a, BARTAL 1903b). — 5. Sokol nad Černým Váhem (WETSCHKY 1872). — 6. Bučina na záp. svahu Murániku, 950 m n. m. (MALOCH 1935b). — 7. Bučina na již. svazích hřebene u Muránské hájovny, 852 m n. m. (DOMIN MS). — 8. Svarín (WETSCHKY 1872). — 9. Červená Magura u Lužné, 1200—1300 m n. m. (SILLINGER 1933). — 10. Kozí chrbát do 1450 m n. m., v *Calamagrostetum arundinaceae altherbosum* (SILLINGER 1933). — 11. Lesní stráž u Korytnice, 820 m n. m. (BRANCSIK 1882a). — 12. Špania dolina (KMONÍČEK PRC). — 13. Štiavnická dolina pod Ďumbierem (FOTT 1930). — 14. Brezno n. Hr. (LENGYEL 1927). — 15. Mezi osadou Zámostí a Predajňou hromadně (LENGYEL 1927). — 16. Malužiná — Niž. Boca, 750 m n. m., melafyr, v bučině v údolí Svídového potoka (SUZA BRNU). — 17. Pod Tepličkou v údolí Č. Váhu, 2 m vysoké exempláře (LENGYEL 1927). — 18. Lubochňa (VRANÝ BRA). — 19. Kópa u Lubochně (KLIKA PR). — 20. Smrekovica ve Svatojánské dolině, vápenec (FOTT PRC). — 21. Mezi Hrádkem a Sv. Janem (KITAIBEL apud KANITZ 1863). — 22. Východná: údolí Bieleho Váhu (1967 SLAVÍK) — není v mapě.

### Vysoké Tatry

1. Velký les u Rakús (SAGORSKI et SCHNEIDER 1891), Dlouhý les u Kežmarku (UECHTRITZ 1857, HAUSSKNECHT 1864). — 2. Vápencové sutě v Bielovodské dolině (SILLINGER PR). — 3. Mlynica, u potoka pod vodopády (DOMIN MS). — 4. Široká (REUSS 1853). — 5. Na svahu Kolové u Javoriny, 1150 m n. m. (DOMIN et KRAJINA PRC).

### Liptovské hole

1. Ráčková dolina, ca 1000 m n. m., v údolí Trnovec (ŠMARDA J. PR). — 2. Osobitá, 1687 m n. m. (VÍTEK BRNM, JÁVORKA BRNU, FUTÁK SLO, RECHINGER et SCHEFFER 1933). — 3. Mokrá místa na úpatí skal v Juráňovej dolině, 880 m n. m., vápenec (FUTÁK BRAC).

## Belanské Tatry

1. Na drolnách dol. kotle Dominova dolu (DOMIN MS). — 2. Muráň (DOMIN PRC). — 3. Na hřebenu pod M. Muráném, 1350 m n. m. (DOMIN MS). — 4. Pod M. Muráném u potoka Javorinky ojedinele (DOMIN MS). — 5. V Tristarskej dolině směrem ke St. Polaně, 1300—1360 m n. m. (DOMIN MS). — 6. Podkošáry, 1220 m n. m. (DOMIN MS), V. a M. Podkošáry, 1140—1230 m n. m. (DOMIN MS). — 7. Červená Hlína u cesty 1160 m n. m. i doleji k Milému potoku (DOMIN MS). — 8. Žihlavník, ca 1200 m n. m. (SOUČEK et PULCHART PRC). — 9. Dolina Siedmich prameňov, na mnoha místech, např. v Lavinovém a Ověm žlabu, v Ověch komínech aj. od 1190 m n. m. po 1750 m n. m., ve spol. *Calamagrostetum variae*, *Aconito-Digitaletum*, *Delphinietum oxysepali*, na suti nebo na šedé až humosní tmavěšedé rendzině o pH 6,4—7,0 na J a JV expozici; kvete v červenci, je spásán kamzíky (HADAČ). — 10. Vrch Kôpa nad Belanským košiarom, 1700 m n. m. (DOSTÁL PRC). — 11. Bujačí, 1760 m n. m. (KOTULA 1890), v *Seslerietum tatrae*, 1750 m n. m. (DOMIN MS). — 12. Jatky (KOTULA 1890). — 13. Roklinka u Tatranské Kotliny u loveckého zámečku, v rokli Drabina (DOMIN MS). — 14. Mezi Faixovou a Horní loukou (KRAJINA PRC), Faixovy steny (KOTULA 1890). — 15. V roklině v ústí Suchého potoka do Bielé, 750 m n. m. (DOMIN MS). — 16. Nad závěrem Suché doliny, 1300 m n. m. (DOMIN MS). — 17. Holica (DOMIN MS). — 18. Hučava, 920 m n. m. (DOMIN MS). — 19. Na sev. svahu Rohové u Javoriny, 1150 m n. m. (DOMIN et KRAJINA PRC). — 20. Cestou ze Širokého Poľa do Ždiaru (1946 FUTÁK SLO). — 21. Okolí Kežmarské chaty (1946 FUTÁK SLO).

## Pieniny

1. Při Dunajci u cesty, 450 m n. m., vápenec (HLAVAČEK BRAC). — 2. Hurka Vengliská u Čer. Kláštoru (1953 MÁJOVSKÝ SLO).

## Intra-Carpaticum

### Spišská kotlina

1. V lískoví mezi Výbornskou pilou a ústím Mühlseifu, 620 m n. m. (DOMIN MS). — 2. Spišská N. Ves (GRESCHIK 1929, 1955 MÁJOVSKÝ SLO).

## Beschidicum occidentale

### Bílé Karpaty (lesní)

1. Skupina Holého vrchu, údolí Bylničky (STANĚK 1927). — 2. Smíšený podhorský les na temeni Tratihoště nad Bylnicí, 650 m n. m. (SILLINGER PR, PRC).

### Hostýnské vrchy

1. Holešov: Jankovice, „Hrabina“ (POSPÍŠIL BRNM).

### Oravská Magura

1. Oravský Podzámok, 700 m n. m. (SOUČKOVÁ et ŠMARDA BRNM, HRABĚTOVÁ BRNU). — 2. Vrch Skalka, 530 m n. m. (FUTÁK BRAC).

## Beschidicum orientale

### Levočské pohorie

1. V lese „Dáblův vrch“ u Levoče (1900 GRESCHIK PRC). — 2. Lesnaté chlumpy u Eubice (UECHTRITZ 1857), Eubický les (WAHLENBERG 1814). — 3. Stráň nad Vápenitým potokem, 645 m n. m. (1964 SLAVÍK). — 4. Záp. stráň údolí k Toryskám proti lomu poblíž Levočské doliny (1964 SLAVÍK). — 5. U potoka při nejvyšší serpentíně silnice od Homalak ke strážnici (1964 SLAVÍK, HADAČ et al.). — 6. Suť JV od kóty Brezová 790 m n. m., v as. *Aceretum pseudoplatani*. (1964 SLAVÍK et HADAČ). — 7. Okraj lesa u silnice nad Kováčovou vilou (1964 SLAVÍK et HADAČ). — 8. Údolí potoka nad Levočskou dolinou (1964 SLAVÍK et HADAČ). — 9. Údolí potoka mezi kopci Kráľovec a Buková vých. od osady Dlhé Stráže nad soutokem potoků (1964 SLAVÍK et HADAČ).

### Ondavská hornatina

1. Údolí potoka Cholínky u Stakčina, v habřině 350 m n. m. (SOJÁK 1958), u Stakčina (BEHRENDSEN 1876). — 2. U Sniny (BEHRENDSEN 1876).

## Carpaticum orientale

### Nížké Poloniny

1. Rabia skala vých. nad obcí Nová Sedlica, ca 1150 m n. m. (SOJÁK 1958).

Published maps of *Pleurospermum austriacum*

1. BRESINSKY (1965) — Northern promontories of Alps (combined dot and contour map); western part of the European area (contour map)
2. CZUBIŃSKI (1950) — dot map of the distribution in Pomerania (26 dots)
3. HORN (1946) — fig. 1., p. 183 — dot map Europe  
— fig. 2., p. 184 — dot map Eurasia  
— fig. 3., p. 186 — dot map S Sweden (21 dots)
4. HULTÉN (1950) — map No. 1317 (4 dots in Sweden)
5. MEUSEL (1943) map No. 24 a (rough contour of the area of *P. austriacum* and *P. uralense*)
6. SILLINGER (1929) — dot map of the distribution in the Bílé Karpaty mountains (12 dots).

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