

## ***Dianthus gratianopolitanus*: variability, differentiation and relationships**

***Dianthus gratianopolitanus*: variabilita, diferenciace a příbuzenské vztahy**

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A taxonomic revision of *Dianthus gratianopolitanus* VILL. was carried out, revealing the presence, at the eastern margin of the distribution area, of a distinct polyploid ( $2n = 60, 90$ ) taxon which cannot satisfactorily be accommodated within the species limits. It is therefore described as a new species *Dianthus moravicus* KOVANDA. Its relationships to *D. gratianopolitanus* VILL. and other members of the section *Plumaria* (OPIZ) ASCHERS. et GRAEB. are considered, taking into account morphology, cytology, ecology and phytogeography. The new species appears closely related to the *D. plumarius* species aggregate (*D. Lumnitzeri* WIESB. in particular) but stands out by its ecological plasticity. Also included is a survey of population variability in *D. gratianopolitanus* VILL., *D. Lumnitzeri* WIESB. and *D. moravicus* KOVANDA. Chromosome numbers are reported for all three taxa.

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### INTRODUCTION

The Cheddar Pink, *Dianthus gratianopolitanus* VILL. (syn.: *D. caesius* SMITH), is by common consensus referred to the section *Plumaria* (OPIZ) ASCHERS. et GRAEB. of the genus *Dianthus* L. (see VIERHAPPER 1901, ASCHERSON et GRAEBNER 1920—1929, NOVÁK 1926, MEUSEL et MÜHLBERG 1971—1978), though it differs from all the other members of the section just in the character upon which the section was primarily based, that is, in the form of the petal limb. This is usually deeply cut (sometimes almost for its entire length) in the section *Plumaria* (except in certain forms of *D. spiculifolius* SCHUR) but is normally only toothed (sometimes doubly so) in *D. gratianopolitanus*. Other unusual characters include pink to red petals and relatively broad calyx (in relation to its length). On the remaining characters, however, *D. gratianopolitanus* clearly fits in the section as usually circumscribed. The inclusion of *D. gratianopolitanus* in section *Barbulatum* WILLIAMS has for a long time been considered inappropriate.

The section *Plumaria*, which is a major subdivision of the genus *Dianthus*, containing about 30 species distributed from Western Europe and North Africa to the Himalayas, was treated as a separate genus by some early authors (e.g. OPIZ 1852). This separation has fallen into oblivion but in these days of hectic activity in splitting well-established genera we may soon be faced with the resurrected genus *Plumaria*.

The genesis and taxonomic relationships of *D. gratianopolitanus* VILL. have been discussed by VIERHAPPER (1901) and NOVÁK (1926)<sup>1</sup>). They both agreed (the latter with some reservation) that *D. gratianopolitanus* is most closely related to what was then known as *D. plumarius* L.<sup>2</sup>) which (or, rather, one of its Alpine races) was its immediate evolutionary ancestor. NOVÁK (l.c.) goes on to suggest that this hypothetical *Dianthus* produced *D. blandus* REICHENB. in the eastern and *D. gratianopolitanus* VILL. in the central and western part of its distribution area. The evolutionary centre of *D. gratianopolitanus* is traced by him to the Swiss Jura. These contentions, though entirely tentative, have proved to be soundly based and have also been confirmed by chorological evidence (see MEUSEL et MÜHLBERG 1971—1978).

Three different chromosome numbers,  $2n = 30, 60, 90$ , have been reported for *D. gratianopolitanus* (see e.g. FEDOROV 1969). Unfortunately, the majority of these counts are based on cultivated material of unknown origin and are therefore almost useless for taxonomic purposes. It is worthy of note that in material from Bohemian localities only  $2n = 60$  and  $90$  has been found (Tab. 1), indicating perhaps that plants from the eastern margin of the range of the species are cytologically more uniform. Similarly, few reliable reports are available for the *D. plumarius* species aggregate (cf. FEDOROV l.c.), but it does seem certain that *D. Lumnitzeri* WIESB. contains tetraploid and hexaploid cytodesmes,  $2n = 60$  and  $90$  (Tab. 1; see also MÁJOVSKÝ et al. 1974) which do not appear to differ in their morphology or ecological preferences. *D. blandus* REICHENB., *D. Hoppei* PORTENSCHLAG and *D. praecox* KIT. are reportedly hexaploid, with  $2n = 90$  (see FEDOROV l.c., MÁJOVSKÝ et al. l.c.).

*D. gratianopolitanus* is confined to rocks throughout much of its distribution area. It is the only saxicolous member of the section *Plumaria* which occurs also on non-calcareous rocks, such as basalt, phonolite, phyllite, granite, syenite, various kinds of conglomerates, sandstone, diabase, porphyry and gneiss (see NOVÁK 1926, MEUSEL et MÜHLBERG 1971—1978). It is of interest to note that limestones are clearly preferred only in the evolutionary centre and in the more southern parts of the distribution area. Towards the north and east the species becomes much less particular about substratum and is found even on acid rocks and sands.

Altitudinally, *D. gratianopolitanus* extends from the lowlands to the alpine zone in the French Alps.

The distribution area of *D. gratianopolitanus* is disjunct, its main part reaching from the Ardennes, Süntel, Harz and Brandenburg to the Swiss Jura and northern forelands of the Alps. Outlying localities are found at Cheddar Gorge in S.W. England, in the French Massif Central, in the southern foothills of the Alps in Italy, in Bohemia, S. Moravia and S.W. Poland (for

<sup>1</sup>) The present study was stimulated by the work of Professor F. A. Novák (1892—1964) and is dedicated to his memory.

<sup>2</sup>) The correct name of *D. plumarius* L. is probably *D. hungaricus* PERS. but, to facilitate understanding, in the present paper it is referred to by the name which has been used hitherto. The name *D. hungaricus* PERS. is based on plants from the Western Carpathians and further study is needed to decide whether the members of the *Dianthus plumarius* species aggregate (*D. praevergens* WILLIAMS, *D. Hoppei* PORTENSCHLAG, *D. blandus* REICHENB., *D. Neilreichii* HAYEK, *D. Lumnitzeri* WIESB., *D. praecox* KIT.; see NOVÁK 1924) may simply be transferred to *D. hungaricus* PERS.

distribution maps, see NOVÁK 1926, MEUSEL et al. 1965, MEUSEL et MÜHLBERG 1971—1978).<sup>3)</sup>

#### VARIATION PATTERNS

For a species occurring in such a wide variety of habitats, the range of morphological variation is surprisingly small. Only a few infraspecific taxa have been described, contrasting with the multiplicity in other *Dianthus* species of comparable distribution range (see e.g. ASCHERSON et GRAEBNER 1920—1929). The following require some comment:

var. *montanus* (GAUD.) THELLUNG in SCHINZ et THELLUNG Fl. Schweiz ed. 3, vol. 2 (Krit. Fl.) 102, 1914.

Syn.: *D. gratianopolitanus* VILL. subsp. *pulchellus* ROUY et FOUCAUD Fl. Fr. 3 : 175, 1896, non *D. pulchellus* PERS.

Densely caespitose, with short stems and short, tough leaves.

This variety has been reported from the higher altitudes in the French Alps and Swiss Jura; it is not known to occur in Czechoslovakia. Perhaps it represents an alpine ecotype of the species but experimental evidence is not available.

var. *adscendens* (GAUD.) THELLUNG in SCHINZ et THELLUNG Fl. Schweiz ed. 3, vol. 2 (Krit. Fl.) 102, 1914.

Syn.: *D. laxus* TAUSCH Hortus Canal. 1 (sine pag.), 1823. — *D. flaccidus* FIEBER Flora 17 : 633, 1834.

Laxly caespitose, usually not conspicuously glaucous; stems flabby to prostrate; leaves up to 4 mm wide.

This striking variation arises polytopically in shady and moderately moist habitats and has been repeatedly described under various names. TAUSCH (1823) and FIEBER (1834) considered it to be a separate species. Tausch's herbarium material survives in PR and a search of the type locality near Karlštejn, C. Bohemia, showed that plants referable to his *D. laxus* still occur there. The variant can easily be produced in cultivation and hardly deserves recognition as a taxon.

var. *incisus* REICHENB. Icon. Fl. Germ. Helv. 6, tab. CCLXV, fig. 5044, 1844.

Syn.: *D. gratianopolitanus* VILL. var. *plumarioides* G. F. W. MEYER Fl. Hannov. 87, 1848.

Limb of petal coarsely dentate to incised.

This variation is found scattered throughout the distribution area of the species. In Czechoslovakia, every population of *D. gratianopolitanus* examined contained plants which might be referable to var. *incisus*. Transitional situations also occur. The taxonomic rank of variety clearly does not apply.

<sup>3)</sup> On Meusel's maps, the two dots showing the presence of *D. gratianopolitanus* in S. Bohemia should be removed and one for the occurrence on the Bezděz hill should be added.

Tab. 1. — List of topodemes examined

Taxon	Number	Locality	2n
<i>D. moravicus</i>	D94	S. Moravia: Moravský Krumlov, rocks near St. Florián chapel (W., S. and N.-facing), calcium-rich conglomerate, 280—300 m*	60
	D128	S. Moravia: Tábor hill, near Rokytná, upper edge of rocks (N.-facing) above the Rokytná river, calcium-rich conglomerate, 280 m	
	D115	S. Moravia: Pekárka hill, near Řeznovice, rocky slope (N.-facing), calcium-rich conglomerate, 240—260 m	60
	D112	S. Moravia: Červená skála hill, near Nové Bránice, rocks below the top (N.E.-facing), granodiorite, 250—260 m	60, 90
	D130	S. W. Moravia: Rocks of the Růžový vrch hill (S., S.W., E., S.E. and W.-facing), near Bitov, gneiss, 350—380 m	90
	D141	S.W. Moravia: Lubnice, near Jemnice, rocks (W.-facing) in the valley of the rivulet Želetavka, N.E. of the village, gneiss, 430—460 m	60, 90
<i>D. Lumnížeri</i>	D95	S. Moravia: Tabulová hora hill, near Klentnice, limestone rocks (W., S. and N.-facing) on the W. margin of the summit plateau, 430—450 m	60
	D28	S. Moravia: Širotčí hrádek ruin near Klentnice, limestone rocks (S., S.E. and E.-facing), 420—430 m	60
	D98	S. Moravia: Děvín hill, near Dolní Věstonice, limestone rocks (N., W. and N.W.-facing) in the summit area, 520—550 m	90
	D103	W. Slovakia: Malé Karpaty Mts., limestone rocks (S. and S.E.-facing) on top of the Raštún hill, 748 m	
<i>D. gratianopolitanus</i> .	D142	C. Bohemia: Štěchovice, rocks (N.E.-facing) above the Vltava river just N.W. of the village, Algonkian schist, 270—290 m	60, 90

Tab. 1 (Contd.)

D52	C. Bohemia: Vrané nad Vltavou, rocks of the Homole hill (W., S.W. and N.-facing), Algonkian schist, 280—300 m	60
D146	C. Bohemia: Zbraslav nad Vltavou, rocks above the railway station (N.W. slope of the Hradiště hill), Algonkian schist, 250—280 m	60
D132	C. Bohemia: Prague, rocks (S.-facing) in the upper part of the Modřanská rokle valley, near Libuš, Algonkian schist, 280—290 m	
D106	C. Bohemia: Rocks (N., E. and W.-facing) in the Berounka river valley, N. of the Střevíc hill near Krupná, limestone, 280—310 m	60
D126	W. Bohemia: Rocks in the Mže river valley (S., E. and W.-facing), S. of Lipno, Algonkian schist, 390—410 m	90
D116	N. Bohemia: Úhošť hill, near Kadaň, rocks on the W. margin of the plateau, basalt, 520—550 m	90
D92	N. Bohemia: České středohoří Mts., rocks in the summit area of the Boreň hill, phonolite, 539 m	60
D105	N. Bohemia: České středohoří Mts., summit rocks of the Lipská hora hill, near Mrsklesy, phonolite, 688 m	
D96	N. Bohemia: Summit rocks of the Bezděz hill, phonolite, 604 m	90
D145	N. Bohemia: Summit rocks of the Malý Bezděz hill, phonolite, 578 m	

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\* This topodeme consists actually of two or even three, separated by a cleft.

The opposite member of this variation series, with petals nearly entire, has been reported from France (see VIERHAPPER 1901) but has not been observed in Czechoslovakia. It should be pointed out that the shape of the limb and the degree of its dentation or incision varies considerably even within a population.

var. *sabulosus* NOVÁK Spisy Přírod. Fak. Karlovy Univ. 1927 (76) : 37, 1927.

Conspicuously glaucous. Stems up to 25 cm tall, 1—4-flowered (most often 2-flowered); leaves up to 50 mm long and 4 mm wide, broadest in the middle, tapering to both ends.

Described from sands in the Oder river basin, S.W. Poland, this variety seems to represent a distinct regional facies of the species.

f. *serotinus* GEISENHEYNER Verh. Bot. Ver. Prov. Brandenburg 63 : 36, 1922.

Laxly caespitose, with elongate stems; flowering time extended until the end of September.

This form was described on plants transplanted from Rheingrafenstein, near Kreuznach, to a private garden, and is only known from the original description. It seems to be related to, or perhaps identical with, var. *adscendens* (GAUD.) THELLUNG. It is worthy of note that late flowering has never been observed in the Czechoslovak *D. gratianopolitanus*, either in natural populations, or in cultivation.

A revision of plentiful material from all parts of the geographical range confirmed that *D. gratianopolitanus* is a very homogeneous and well-defined species. What has struck me since the very beginning, however, was the manifest dissimilarity of plants from S. Moravia, which did not fit into the simple variation pattern of *D. gratianopolitanus*. On certain morphological characters they seemed to belong to the *D. plumarius* species aggregate (*D. Lumnitzeri* in particular) rather than to *D. gratianopolitanus*. The matter was pursued further and population studies covering nearly all Czechoslovak localities (or groups of localities; see Fig. 3) of *D. gratianopolitanus*, in conjunction with experimental cultivation, were carried out in 1978—1981, to gain an insight into the problem. Representative populations of *D. Lumnitzeri* have also been included in the research programme. It appeared that the variation range of the Moravian plants is distinct from that of *D. gratianopolitanus* and *D. Lumnitzeri* and that they represent a separate taxon which cannot very well be subordinated to either of these two. They are therefore considered specifically distinct and described as a new species *D. moravicus* (see the Appendix). The present paper draws on the information gathered on these plants and some of their allies.

#### THE MORAVIAN *DIANTHUS GRATIANOPOLITANUS*

Historical. The Moravian *Dianthus gratianopolitanus* was discovered at a surprisingly late date. Early Moravian botanists were apparently unaware of its presence (see e.g. ROHRER et MAYER 1835, MAKOWSKY 1863). The oldest surviving collections were made by Schwöder in the vicinity of Moravský Krumlov as late as the 1870s and are labelled "*Dianthus plumarius* L.". Probably the first to transfer these plants to *D. gratianopolitanus* was OBORNÝ (1885), who,

Tab. 2. — The distinguishing characters of *D. moravicus*, *D. Lumnitzeri* and *D. gratianopolitanus*

	<i>D. moravicus</i>	<i>D. Lumnitzeri</i>	<i>D. gratianopolitanus</i>
Stem	Terete	Terete to obtusely quadrangular	Terete to obtusely quadrangular
Cauline leaves	Linear or rarely narrowly triangular, tapering in the upper third	Linear or narrowly triangular, tapering in the upper third	Linear, tapering in the uppermost part
Inner epicalyx scales	Mostly mucronate, herbaceous	Mucronate or acuminate, herbaceous	Acuminate or mucronate, usually with a membranous margin
Calyx	Narrowly cylindrical, smooth, (15-)17 — 20(-24) mm long, 2.8-4.0 mm wide	Narrowly cylindrical, smooth, (18-)20 — 24(-26) mm long, 3.2-4.3 mm wide	Irregularly cylindrical, often rugose, (14-)15-17(-18) mm long, 3.3-4.2 mm wide
Calyx teeth	Acute to acuminate, rarely obtuse, mostly without membranous margin, $\pm$ entire	Obtuse to acute, mostly with a membranous margin, $\pm$ entire	Acute to obtuse, mostly with indistinct membranous margin, finely lacerated
Petal limb	Irregularly incise-lacerate, (11-)12 — 15(-17) mm long, pink to red	Irregularly incise-lacerate, (12-)13 — 15(-17) mm long, white, rarely pinkish	Irregularly dentate, (10-)11-13(-15) mm long, pink to red
Claw	Slightly longer than calyx	Slightly longer than calyx	$\pm$ as long as calyx
Capsule	$\pm$ as long as calyx or slightly longer	$\pm$ as long as calyx or slightly longer	1/4-1/3 longer than calyx
Seeds	2.6-3.2 mm long	2.5-2.9 mm long	2.3-2.7 mm long

however, preferred the name *D. caesi* SMITH. His classification was followed by all subsequent authors (e.g. FORMÁNEK 1887, ČELAKOVSKÝ 1897) but, oddly enough, was never supported by further evidence or queried. Only NOVÁK (1926), in a passing note, observed that the Moravian *D. gratianopolitanus* approached *D. plumarius* and suggested that it arose from *D. plumarius* independently of *D. gratianopolitanus*. No attempt at a taxonomic treatment has been ever made, however.

**Morphological characters.** The following are salient: Stems terete, with (2–)3–4(–6) nodes. Leaves linear to narrowly triangular, tapering in the upper third, finely serrulate to entire. Flowers solitary or 2 to 3 per stem, fragrant. Epicalyx scales 4, appressed to the calyx; outer two elliptic or ovate, acute to shortly mucronate, herbaceous, inner two ovate to orbicular-ovate, shortly mucronate (rarely acuminate), herbaceous. Calyx cylindrical, smooth, finely striate, purplish, (15–)17–20(–24) mm long, 2.8–4.0 mm wide; teeth triangular, acute to acuminate, rarely obtuse, mostly without a distinct membranous margin, (3.0–)3.2–4.8(–5.2) mm long. Petal limb

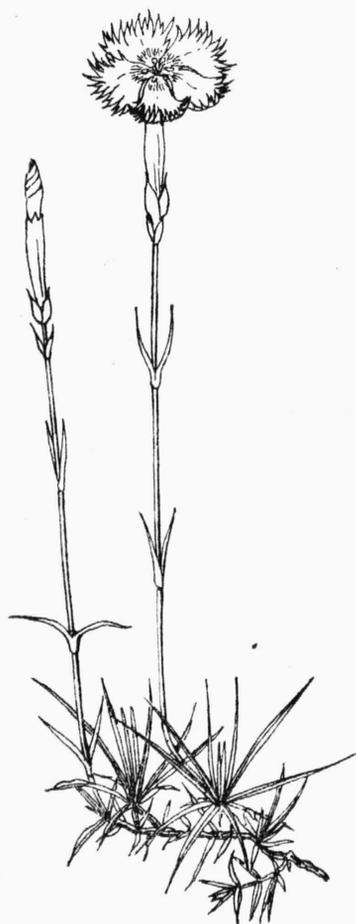


Fig. 1. — *Dianthus moravicus*. Drawing of a plant from the type locality. (Orig. A. Chrtková)

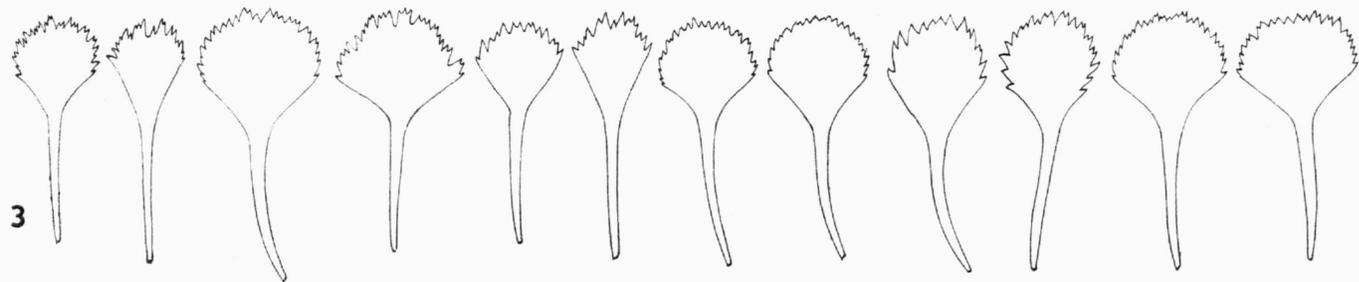
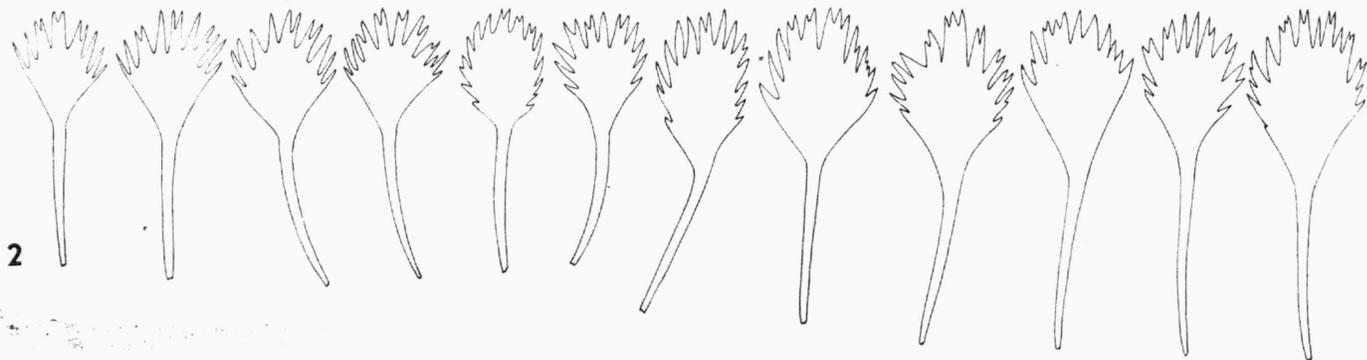
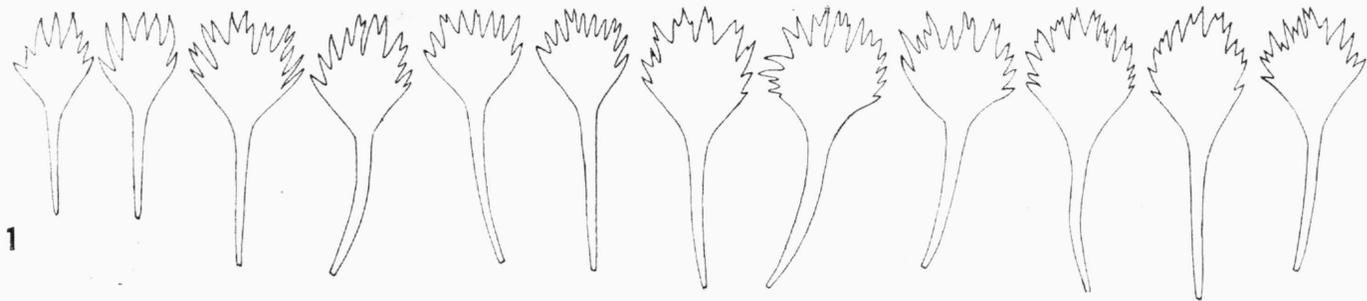


Fig. 2. — Variation in the form of the petal limb in *D. moravicus* (1), *D. Lumnitzeri* (2) and *D. gratianopolitanus* (3). Venation and hairs not shown. (Orig. A. Chrtková).

pink to red, obovate to cuneate, irregularly incise-lacerate, (11—)12—15(—17) mm long. Capsule as long as calyx or slightly longer. (Fig. 1.)

A useful comparison can be made of the distinguishing characters of *D. moravicus* with those of *D. gratianopolitanus* and *D. Lumnitzeri* (see Tab. 2). It is evident from the table that the length of the calyx and the laceration of the petal limb alone would suffice to justify the removal of the Moravian plants from within *D. gratianopolitanus*. The calyx of the latter is usually described as being 12—16 mm long (see e.g. ASCHERSON et GRAEBNER 1920—1929, MEUSEL et MÜHLBERG 1971—1978). NOVÁK (1926) does report “calyx . . . 14—24 mm longus” but the upper limit is clearly a provision for the Moravian plants. In populations from Bohemia studied by the present author, the longest calyx on record was one 19 mm long in the topodemes Štěchovice and Bezděz, constituting a rare exception (see Tab. 3). In the herbarium material from England, France, Switzerland, Germany and Poland, the calyx length varied similarly, from 12 to 18 mm. All members of the *D. plumarius* species aggregate, both Alpine and Carpathian, notably *D. Neilreichii* HAYEK and *D. blandus* REICHENB., differ in having the calyx much longer than *D. moravicus* (20—30 mm).

The calyx is regularly cylindrical and smooth (except for the fine striation) in *D. Lumnitzeri* and *D. moravicus* but is often irregularly cylindrical to narrowly infundibuliform, often rugose in *D. gratianopolitanus*.

As in *D. Lumnitzeri*, the calyx of *D. moravicus* is relatively narrow. In the ratio of calyx length, to calyx width *D. moravicus* approaches *D. Lumnitzeri* rather than *D. gratianopolitanus* which has a much stouter calyx (Tab. 4). The dimensions should always be measured on living plants. In herbarium material, the ratio of calyx length to calyx width decreases, because the calyx is flattened and much wider than in life.

The colour of the calyx is useless as a distinguishing character, the calyx being usually partly or entirely purplish in all three taxa. In *D. Lumnitzeri* it is sometimes entirely green but this is rare in *D. gratianopolitanus* and *D. moravicus*.

At one time, much emphasis was laid on the morphology of the calyx teeth (see e.g. WILLIAMS 1893). A close examination of the material revealed that the importance attached to this character is over-estimated because it is subject to wide variation. The teeth are basically triangular, from obtuse to acute or acuminate, finely hairy to glabrous. In all three taxa discussed, differences may occur even within individuals. No topodeme was found which could be defined on the basis of this character, and no correlation with other features seems to exist. The texture of the teeth is more reliable, the teeth of *D. moravicus* being mostly entirely herbaceous, those of *D. gratianopolitanus* and *D. Lumnitzeri* having usually membraneous margins.

The mode of laceration of the petal limb varies considerably in *D. moravicus*, as it does in other members of the section *Plumaria*, but on the whole it falls within, or largely coincides with, the variation range of *D. Lumnitzeri* (see Fig. 2). In most plants, the laciniae are about 3.5 to 5.2 mm long, up to 1/4—1/3 of the length of the limb. Petals with the limb merely coarsely dentate may occasionally be found, but they are rare.

There is also a marked difference in the length of the limb, *D. moravicus* being somewhat intermediate between *D. gratianopolitanus* and *D. Lumnitzeri* (see Tab. 5.)

Tab. 3. — Variation in calyx length (in mm) in *D. moravicus*, *D. Lumnitzeri* and *D. gratianopolitanus*

Taxon	Number	Range of variation	$\bar{x}$	s	s $\bar{x}$	S
<i>D. moravicus</i>	D94	18—24	19.96	1.61	0.23	50
	D112	17—22	19.75	1.44	0.32	20
	D130	15—21	17.70	1.97	0.28	50
	D141	15—21	17.34	1.49	0.25	35
		15—24	18.61	2.05	0.16	155
<i>D. Lumnitzeri</i>	D95	19—27	22.46	1.59	0.22	50
	D28	19—26	22.05	2.28	0.51	20
	D98	19—24	21.60	1.27	0.27	20
		19—27	22.15	1.80	0.19	90
<i>D. gratianopolitanus</i>	D142	13—19	16.00	1.49	0.33	20
	D106	13—18	16.06	1.07	0.19	30
	D126	14—17	15.40	1.00	0.18	30
	D116	14—18	16.00	1.00	0.20	25
	D96	14—18	16.20	1.09	0.20	30
	D145	14—19	16.86	1.07	0.19	30
	13—19	16.09	1.17	0.08	165	

In the colour of the petals, *D. moravicus* conforms to *D. gratianopolitanus*. White-flowered plants have been reported in *D. gratianopolitanus* by Novák (1926) but have not been observed during field studies by the present author, either in *D. gratianopolitanus* or in *D. moravicus*. By contrast, the petals of *D. Lumnitzeri* are typically white, only rarely pinkish or with pink hairs at the base of the limb (they always assume a tinge of purple when left in a plastic bag for a couple of hours).

The length of the capsule relative to the length of the calyx has not been previously used as a taxonomic character in the section *Plumaria*, but it proved reasonably constant in all three taxa compared. *D. moravicus* can be safely distinguished from *D. gratianopolitanus* when in fruit by its short capsule.

The morphological characters of *D. moravicus* proved stable in cultivation, except that the stems were mostly branched and bore 2 to 8 flowers. The same change was observed in *D. gratianopolitanus* and *D. Lumnitzeri*.

Chromosome number. The plants referred to *D. moravicus* do not appear to have been counted previously. Examination of material from five localities (including the type locality) yielded the chromosome numbers of  $2n = 60$  and  $90$  (see Tab. 1). Apparently, two cytodesmes are present and a study of the morphological differences between them is now in progress.

Ecology. *D. moravicus* is a plant of steep or sheer cliffs in deep river valleys, being particularly abundant in dry, open situations at the upper edge of the rocks. It thrives in shallow, skeletal, humus-rich soils. Occasion-

Tab. 4. — Variation in the ratio of calyx length to calyx width (in mm) in *D. moravicus*, *D. Lumnitzeri* and *D. gratianopolitanus*

Taxon	Number	Range of variation	$\bar{x}$	s	$s\bar{x}$	S
<i>D. moravicus</i>	D94	4.73—8.27	5.96	0.80	0.11	50
	D112	5.43—8.21	6.29	0.73	0.19	15
	D130	3.81—6.77	5.39	0.78	0.11	50
	D141	3.80—7.00	5.11	0.79	0.13	35
		3.80—8.27	5.60	0.88	0.07	150
<i>D. Lumnitzeri</i>	D95	5.40—6.97	6.26	0.49	0.10	25
	D28	5.71—7.58	6.69	0.57	0.12	20
	D98	4.77—7.33	6.21	0.58	0.12	20
		4.77—7.58	6.37	0.57	0.07	65
<i>D. gratianopolitanus</i>	D142	3.42—5.93	4.33	0.71	0.16	20
	D106	2.88—6.72	4.65	0.62	0.08	50
	D126	3.89—6.54	4.72	0.67	0.12	30
	D116	4.00—5.31	4.70	0.74	0.15	25
	D96	3.95—5.31	4.68	0.35	0.06	30
	D145	4.14—6.20	4.94	0.56	0.10	30
		2.88—6.72	4.67	0.58	0.04	185

ally it is found in stabilized scree and rubble. Aspect is apparently of little or no importance, the sites facing all points of the compass, east and south-east being perhaps the least frequent. Of the six localities known at present, three are underlain by a Permian conglomerate (calcium-rich), one by granodiorite and two by gneiss (see Tab. 1). Phytocoenologically, *D. moravicus* may be said to occur in the pioneer plant communities of the orders

Tab. 5. — Variation in the petal limb length (in mm) in *D. moravicus*, *D. Lumnitzeri* and *D. gratianopolitanus*

Taxon	Number	Range of variation	$\bar{x}$	s	$s\bar{x}$	S
<i>D. moravicus</i>	D94	11—16	12.85	1.09	0.24	20
	D112	11—17	13.45	1.35	0.30	20
	D130	11—15	12.60	1.08	0.21	25
	D141	8—14	10.89	1.23	0.21	35
		8—17	11.89	2.47	0.25	100
<i>D. Lumnitzeri</i>	D95	10—16	13.85	1.59	0.36	20
	D28	11—17	14.10	1.55	0.35	20
	D98	12—17	13.95	1.54	0.34	20
		10—17	13.96	1.54	0.20	60
<i>D. gratianopolitanus</i>	D142	10—15	12.20	1.36	0.30	20
	D106	10—14	12.50	1.47	0.33	20
	D126	10—13	11.40	0.81	0.15	30
	D116	8—13	10.84	1.21	0.24	25
	D96	10—15	12.85	1.31	0.29	20
	D145	9—15	12.46	1.67	0.30	30
		8—15	11.92	1.46	0.12	145

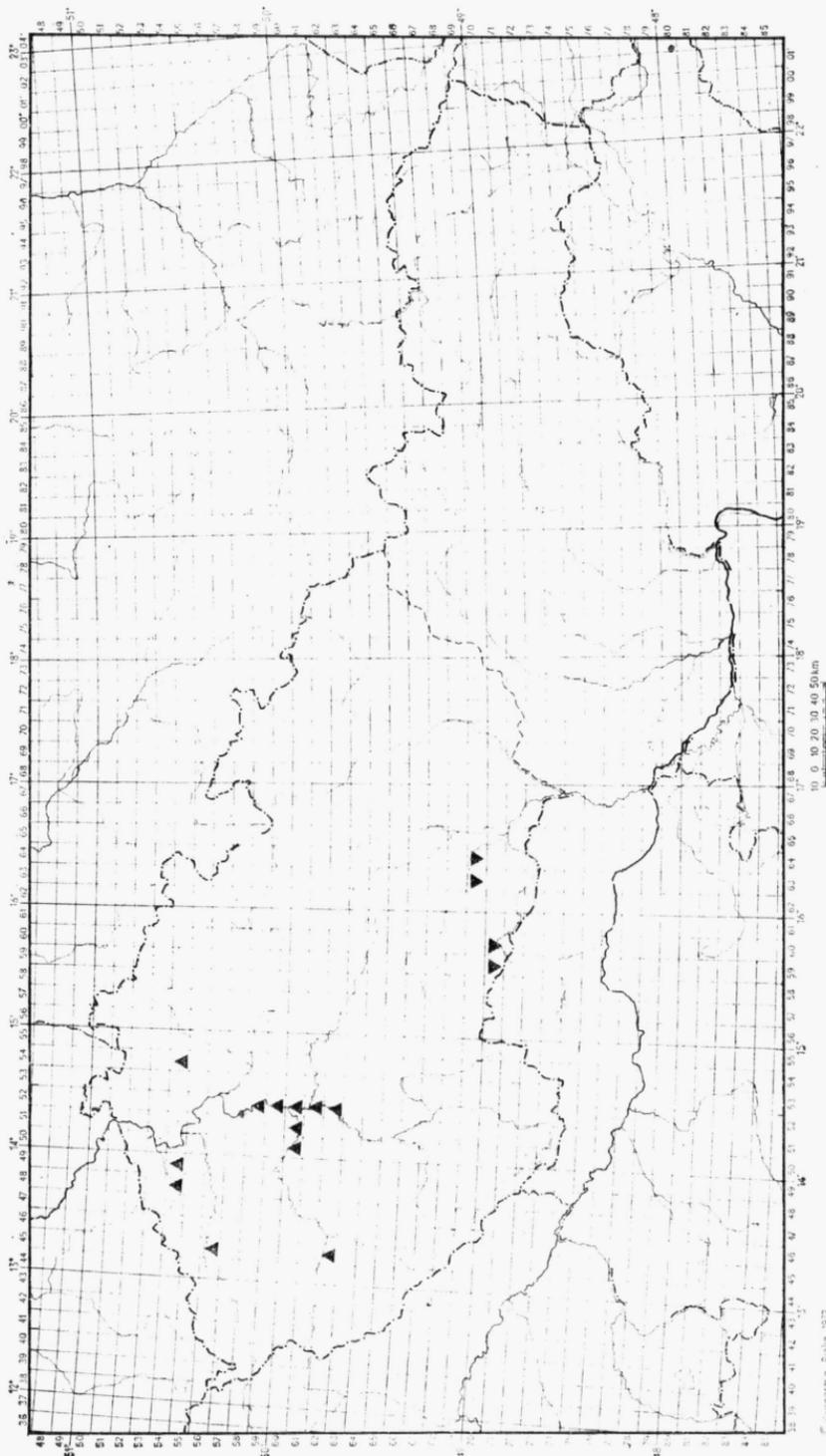


Fig. 3. — Distribution in Czechoslovakia of *D. gratianopolitanus* (▲) and *D. moravicus* (▼).

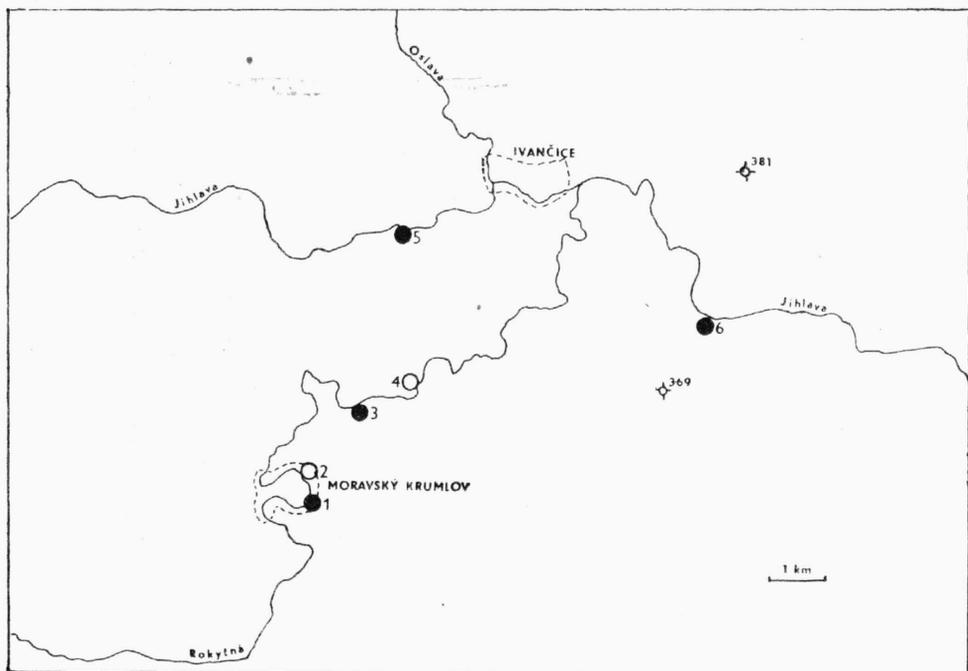
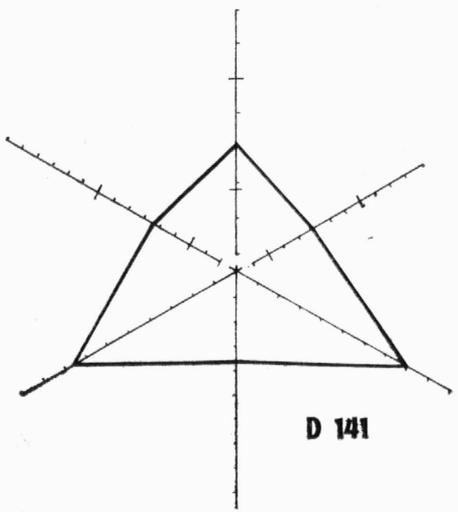
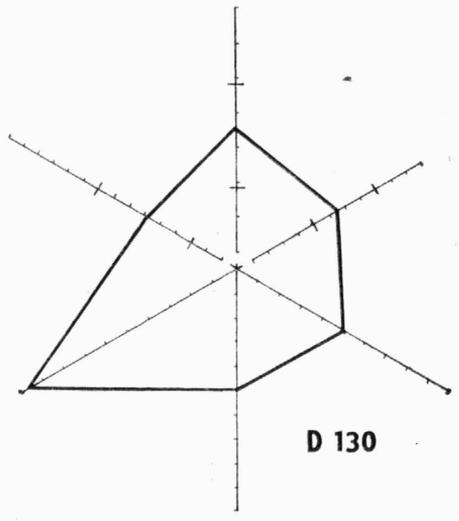
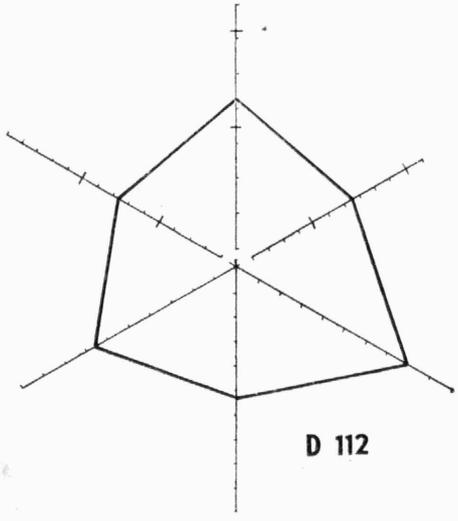
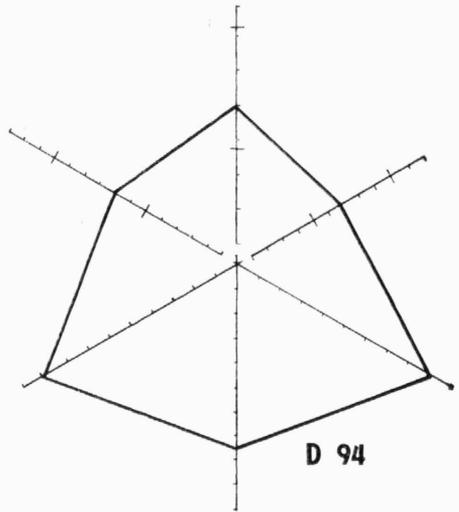
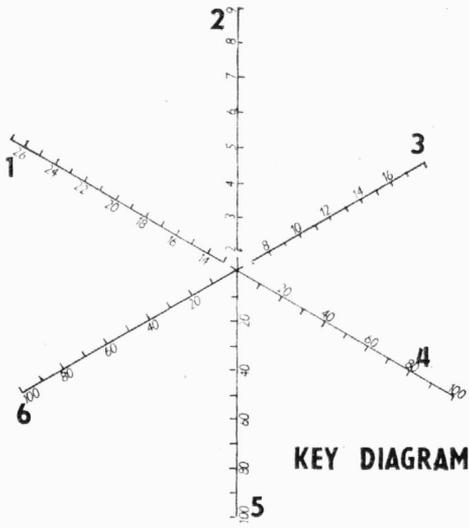
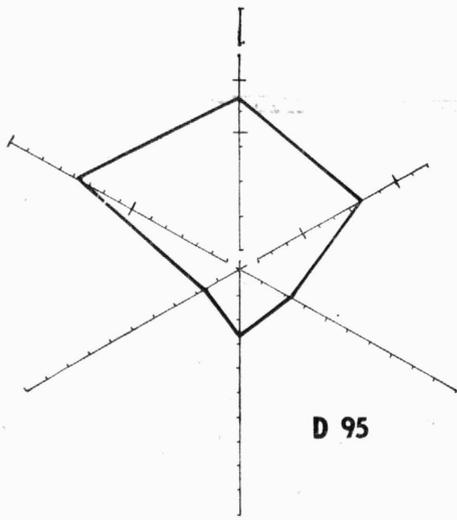


Fig. 4. — Detailed distribution of *D. moravicus* at the confluence of the rivers Oslava, Jihlava and Rokytná (● confirmed, ○ unconfirmed occurrence). 1 — St. Florian (D94), 2 — Křížová hora hill, 3 — Tábor hill (D128), 4 — Baba hill, 5 — Pekárka hill (D115), 6 — Červená skála rocks (D112).

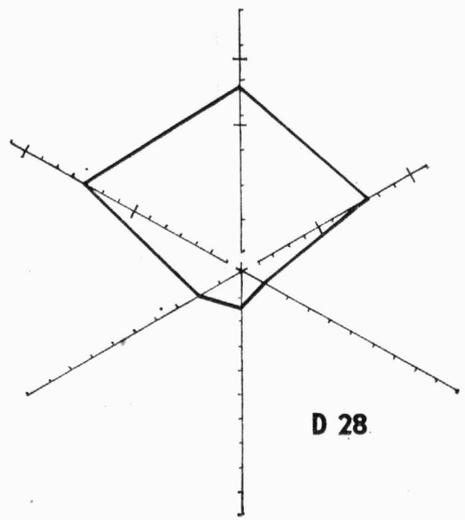
*Alyso-Festucion pallentis*, *Seslerio-Festucion duriusculae* and *Festucion valesiacae*. On the Růžový vrch hill it is associated with *Allium montanum* F. W. SCHMIDT, *Alyssum saxatile* L., *Asplenium septentrionale* (L.) HOFFM., *Carex humilis* LEYSS., *Centaurea Triumfettii* ALL. subsp. *aligera* (GUGLER) DOSTÁL, *Cornus mas* L., *Cotoneaster integerrima* MED., *Festuca pallens* HOST, *Festuca rupicola* HEUFF., *Genista pilosa* L., *Linaria genistifolia* (L.) MILL., *Polygonatum odoratum* (MILL.) DRUCE, *Polypodium vulgare* L., *Pseudolysimachion spicatum* (L.) OPIZ, *Sedum album* L., *Sedum reflexum* L. subsp. *glaucum* (LEJ.) JANCHEN, *Sorbus torminalis* (L.) CRANTZ, *Stachys recta* L., *Teucrium chamaedrys* L., *Trifolium alpestre* L. and *Vincetoxicum hirundinaria* MED. It often starts the succession in rock crevices and on ledges with limited or no competition from other vascular plants. In north-facing habitats it may be found associated with *Sesleria varia* (JACQ.) WETTST. in fragments of

Fig. 5. — Key diagram and polygraphs for four topodemes of *D. moravicus*. The thick continuous line linking the radii indicates the mean value for each character or character index. The extreme limits for each character are indicated by transverse lines across the relevant radii. 1 — calyx length, 2 — ratio of the calyx length, to the calyx width 3 — petal limb length, 4 — percentage of plants with inner epicalyx scales mucronate, 5 — percentage of plants with lower cauline leaves serrulate, 6 — percentage of one-flowered plants.

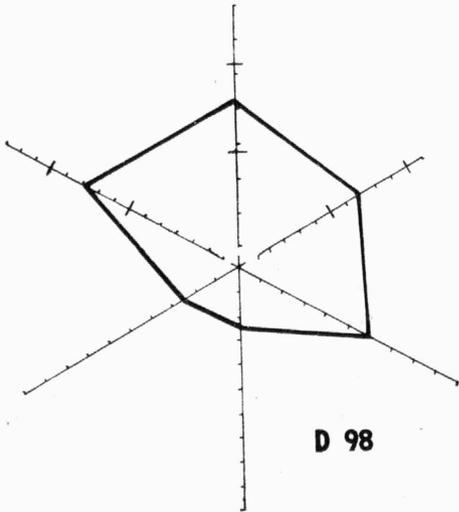




**D 95**



**D 28**

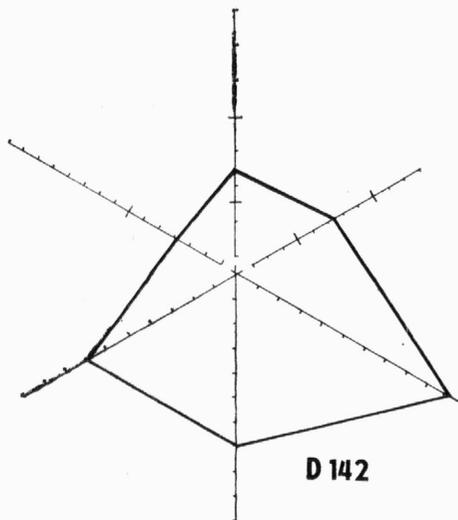


**D 98**

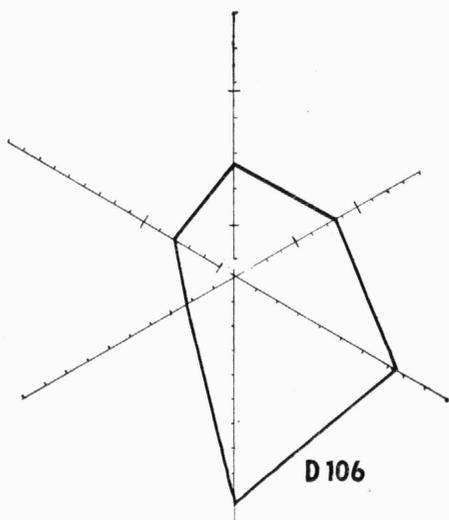
Fig. 6. — Polygraphs for three topodemes of *D. Lumnitzeri*. For explanation and key diagram, see Fig. 5.

dealpine plant communities of the order *Seslerio-Asterion alpini*. It survives in tufts of mosses in moderately shady places but is always absent from closed grassland. All localities are between 240 and 460 m above sea level.

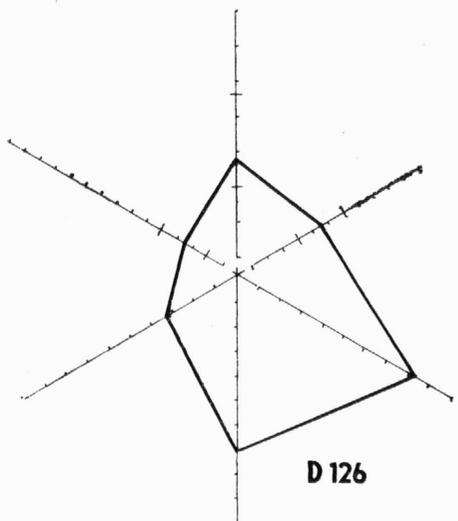
Fig. 7. — Polygraphs for six topodemes of *D. gratianopolitanus*. For explanations and key diagram, see Fig. 5.



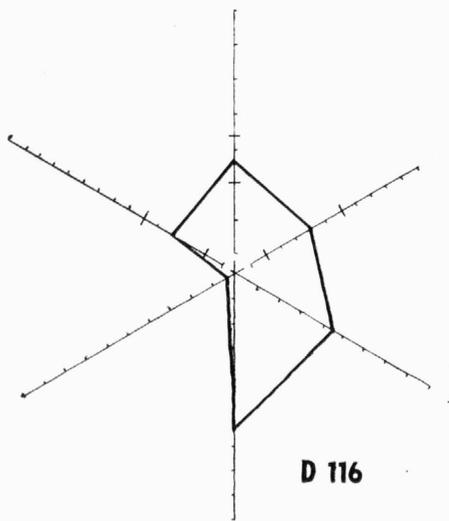
**D 142**



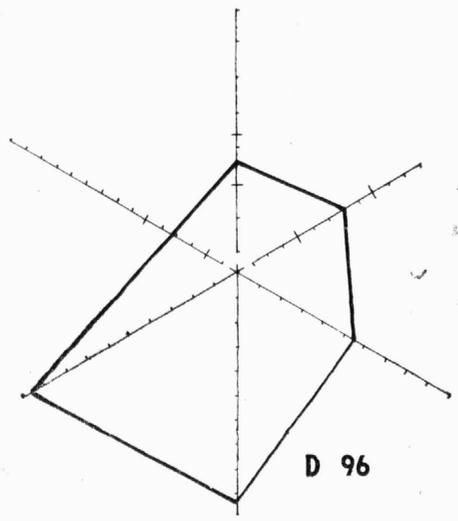
**D 106**



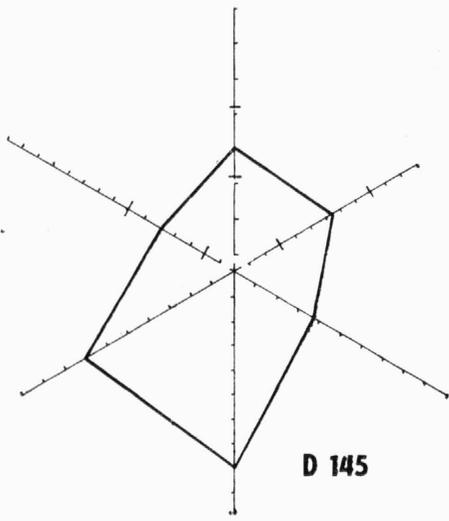
**D 126**



**D 116**



**D 96**



**D 145**

**Geographical distribution.** According to present information, *D. moravicus* occurs only in six localities in the south of Moravia (Fig. 3)<sup>4</sup>. Of these, four are close to each other at the confluence of the rivers Oslava, Jihlava and Rokytná in the vicinity of Moravský Krumlov and Ivančice, within the limits of the Pannonian flora (mean annual temperature, 8 °C; Fig. 4). The other two localities are in the Dyje river basin, about 45 km away, in a transitional zone between the xerothermous region of Moravia and the Bohemian-Moravian Highlands (mean annual temperature, 7 °C). All these sites, known from literature and herbarium material, have been repeatedly visited by the present author in 1978—1980. Details of them are given in Tab. 1 and the respective specimens are cited in the Appendix. The topodemes differ much in their size, the largest being the one from the Růžový vrch hill near Bítov (D130) which contains several hundreds of plants (see SUZA et ŠMARDÁ 1932). On the other hand, only three tufts of *D. moravicus* could be found on the Tábor hill (Fig. 4). In two more sites, documented by herbarium material and literature reports, the Křížová hora and Baba hills (both conglomeratic) near Moravský Krumlov, the search for *D. moravicus* has been unsuccessful. While the first locality is small and easy to survey, leaving no chance for possible future re-discovery, the latter is an extensive system of crags and gorges in which solitary tufts of *D. moravicus* might have passed unnoticed (Fig. 4). The last herbarium record from the Baba hill dates from 1932.

Interestingly, though a great many other suitable habitats exist in all four river valleys and their tributaries, a systematic survey of them has so far failed to detect new occurrences of *D. moravicus*. Perhaps a search in adjacent Austria would be more successful.

**Variation.** The new species appears fairly constant in its morphological characters. The variation encountered in natural populations is largely individual and insignificant from the viewpoint of taxonomy. The topodemes studied are all remarkably homogeneous and uniform in terms of morphology (Fig. 5). The only exceptions are the two isolated populations from the Dyje river basin in which small proportions of plants with shorter calyx (16 to 17 mm) were recorded. Transitional situations were also present, making the range of variation unusually wide. On all other characters, however, these plants conform to the type.

Comparing variation polygons for *D. moravicus*, *D. gratianopolitanus* and *D. Lumnitzeri* (Fig. 5—7), it seems certain that the variation patterns are characteristic of each of the taxa concerned. For instance, the ratio of calyx length to calyx width varies over a wide range in *D. gratianopolitanus* but is much less variable in *D. Lumnitzeri* and *D. moravicus*. The serrulation of the leaves, usually considered diagnostic, is also subject to considerable variation, especially in *D. moravicus* which often has the leaves completely smooth, as in *D. Lumnitzeri*.

It is important to note that except for var. *incisus*, none of the varieties differentiated in *D. gratianopolitanus* seems to have any parallel in *D. moravicus*. This is obviously due to the small geographical area, paucity of localities and small vertical range of distribution. Even the counterpart of

<sup>4</sup> For distribution maps of the Moravian "*D. gratianopolitanus*", see also SUZA (1935) and ŠMARDÁ (1963).

var. *adscendens* is missing, suggesting that *D. moravicus* is perhaps less tolerant of shady and moist habitats.

The variation of some of the characters which were examined is shown in Tab. 3—5 and Fig. 5—7.

Relationships to other species. As indicated above, *D. moravicus* shows most affinity with the *Dianthus plumarius* species aggregate, in particular with *D. Lumnitzeri*, and less with *D. Neilreichii* and *D. blandus*. This contention is supported by morphological evidence: *D. moravicus* and *D. Lumnitzeri* have many characters in common by which they both differ from *D. gratianopolitanus* and other members of the section *Plumaria*. On the other hand, the morphological differences between *D. moravicus* and *D. Lumnitzeri* are always quite sufficient to distinguish these two taxa and to allow one to regard them, in the absence of transitional forms, as distinct species. By its geographical distribution, *D. moravicus* fits within the chain of vicarious taxa of the *D. plumarius* complex which extends from the Eastern Alps to the Western Carpathians (see NOVÁK 1924, 1927), and is aberrant in the area of *D. gratianopolitanus*. Were it not for its ecological plasticity, which is characteristic of *D. gratianopolitanus*, *D. moravicus* could well be included in *D. plumarius* agg. Perhaps we have in *D. moravicus* a surviving relict of the ancestral stock from which *D. gratianopolitanus* evolved at the end of the Tertiary, or a taxon very close to it. Another possibility would be that *D. moravicus* and *D. gratianopolitanus* diverged from a common ancestor, thus representing parallel lines of evolution. To gain support for either of these hypotheses, a detailed study is required of the Alpine representatives of the *D. plumarius* complex.

#### APPENDIX

##### *Dianthus moravicus* KOVANDA, sp. nova

Syn.: *D. caesius* auct. fl. morav., non SMITH. — *D. gratianopolitanus* auct. fl. morav., non VILL.

Diagnosis: Caespitosus, glaucus; caulibus teretibus, nodis (2—)3—4(—6) interstinctis; foliis caulinis linearibus usque angustissime triangularibus, margine serrulatis vel integerrimis; floribus singulis vel binis usque ternis, odoratis; squamis calycinis 4, calyce appressis (exterioribus ellipticis vel ovatis, acutis usque breviter mucronatis, herbaceis, interioribus ovatis usque orbiculato-ovatis, breviter mucronatis, rarius acuminatis, herbaceis); calyce cylindrico, recto, subtiliter striato, purpurascente, (15—)17—20(—24) mm longo, 2.8—4.0 mm lato; dentibus calycinis triangularibus, acutis usque acuminatis (rarius obtusis), plerumque sine margine membranaceo distincto, (3.0—)3.2—4.8(—5.2) mm longis; limbo petalino roseo vel rubro, obovato usque cuneato, antice usque ad tertiam partem irregulariter inciso-lacerato, (11—)12—15 (—17) mm longo; capsula calycem longitudine aequante vel eo paulo longiore. Floret Junio mense.

Holotypus: „Florianiberg bei Kromau”, ROTHE 1893 BRNU.

Specimina examinata: Moravský Krumlov [“Kromau”], OBORNÝ 1884 PR, PODPĚRA 1922 BRNU, LHOTSKÁ 1963 PR, anon. s.d. BRNM; Sv. Florián [“Florianiberg”], FIALA 1882 BRNU, NIESEL 1898 BRNU, TEUBER 1898 BRNM, WILDT 1901 BRNM, DVOŘÁK 1909 BRNM, WILDT 1909 BRNM, SUZA 1909 BRNU, OBORNÝ 1911 PRC, SKŘIVÁNEK 1938 PRC, KOVANDA 1978 PR, 1979 PR, 1980 PR; Křížová hora [“Kreuzberg”], ZIMMERMANN 1884 PRC, OBORNÝ 1884 BRNU; Tábor, KOVANDA 1979 PR; Baba, FORMÁNEK 1882 PRC, SUZA 1932 BRNU; Pekárka [“Rzeznowitz Berg”], SCHWÖDER 1879 BRNU, BÍLÝ 1905 BRNM, 1914 BRNM, SUZA 1931 BRNU, SEDLÁČEK 1944 PRC, KOVANDA 1978 PR, ŠTORÝ 1978 BRNM; Červená skála, STANĚK 1921 BRNU, SKŘIVÁNEK 1922 BRNU, BÍLÝ 1924 BRNM, SKŘIVÁNEK 1924 PRC, SUZA 1932 BRNU, WEBER 1935 PR, KOVANDA 1978 PR; Růžový vrch [“Rosenberg”], SUZA 1932 BRNU, HRABĚTOVÁ 1953 BRNU, 1957 BRNU, KOVANDA 1979 PR, 1980 PR; Lubnice, KOVANDA 1980 PR.

Druh *Dianthus gratianopolitanus* VILL. je taxonomicky homogenní a proti ostatním členům sekce *Plumaria* (OPIZ) ASCHERS. et GRAEB. rodu *Dianthus* L. jasně ohraničený. Jeho variabilita má všeobecně velmi nízkou taxonomickou hodnotu. K význačné diferenciaci dochází pouze při východním okraji areálu (jižní a jihozápadní Morava). Tyto rostliny se vymykají z variačního rozpětí druhu *D. gratianopolitanus* a jsou proto popsány jako nový druh *D. moravicus*. V práci se vztahuje jeho variabilita a vztahy k jiným zástupcům sekce. Morfologickými znaky [lodyžní listy v horní třetině zúžené, kalich úzce válečovitý, rovný, (15–)17–20(–24) mm dl., 2,8–4,0 mm šir., čepel korunních plátků ± do 1/3 drúpená, (11–)12–15(–17) mm dl., tobolka zděli kalicha nebo nepatrně delší se *D. moravicus* řadí do blízkosti komplexu *D. plumarius* L. (= *D. hungaricus* PERS.), jmenovitě taxonu *D. Lumnitzeri* WIESB. Svým geografickým rozšířením rovněž zapadá do řetězce vikarisujících areálů jednotlivých členů komplexu *D. plumarius*, který zasahuje z Východního Alp do Západních Karpat. Ekologickou plasticitou se *D. moravicus* naopak podobá druhu *D. gratianopolitanus*. Studium vybraných morfologických znaků na reprezentativních vzorcích přirozených populací ukázalo, že každý ze sledovaných taxonů (*D. moravicus*, *D. Lumnitzeri*, *D. gratianopolitanus*) má svůj charakteristický způsob variability, jímž se liší od ostatních. Chromosomové počty byly zjištěny u všech tří taxonů.

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