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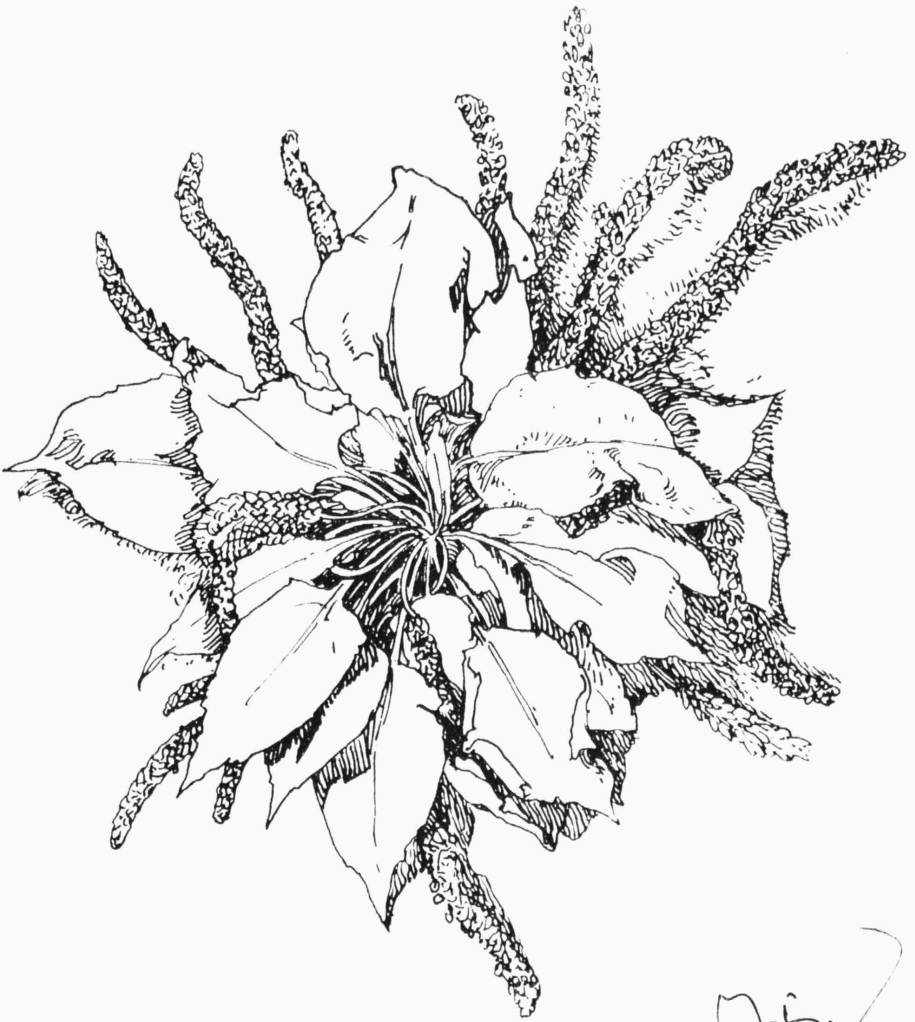
## Humifuse Forms of some Species and their Ecological Signification.

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(With 1 plate.)

During the last twenty years I had opportunity to observe in many places interesting humifuse forms, some of which are described as varieties or forms; descriptions and dried specimens, however, cannot explain their proper value from the ecological point of view. In August 1920 I was able to see under what habitat conditions these ecomorphoses originate. These observations were made on the back-yard of the elementary school in Povážská Bystrica (Western Slovakia) where on sunny places on the river-sand covering the yard many such forms were growing, undoubtedly descendents of normal forms growing on loamy and ruderal places of the same back-yard. They were therefore only biaiometamorphoses grown from seeds of normal plants but under the pressure of special habitat conditions. The sand is, of course, a highly permeable substratum and its upper layer becomes quickly dry and is therefore for shallow-rooting plants very unfavourable. In all these ecomorphoses we observe a marked tendency to cover the soil with the vegetative organs as thickly as possible and to keep thus more humidity, and to adapt, besides, its root-system to such habitat. The characters of these more or less humifuse forms are not hereditary, as plants grown under normal conditions from their seeds, are again typical. Notwithstanding, some species (as *Herniaria glabra*, *Illecebrum verticillatum*) growing on similar habitats, are remarkable by their fixed humifuse habit.

Since 1920 I saw on many localities similar humifuse forms, always adapted to a substratum (mostly sand or fine talus) with an upper layer letting water quickly through and therefore becoming quickly dry. In summer 1931 I systematically studied those forms on sandy places or on fine talus along the river Váh near the famous spa Piešťany. They grow here in great abundance and some species even in more than one form, avoiding only places where the sand is dry to a considerable depth. Some of them are to be found also on loamy or clayey places but less frequently. The ecological adaptations of all these forms aim at a better keeping back of the water in the upper layer. During a rainy season in the second part of August and the beginning of September I was able to ascertain by repeated investigations that they succeed in this to a marked degree. Whereas the bare places became in comparatively short time perfectly dry, the soil under these forms kept wet and retained a considerable quantity of water. The plasticity of individual species is, of course, different and more or less limited by their specific characters and especially so by the adaptative power of the

K. DOMIN: *Humifusc* Forms.



M. B.

*Plantago pauciflora* GILIB. (DOM. ampl.) var. *scopulorum* (FRIES) DOM. f. *humifusa* DOM. from Piešťany. — Reproduction of an original drawing ALFONS MUCHA'S, drawn from nature.



root-system. In this preliminary study I shall try to classify some of these forms according to their growth (P. is abbreviation for Piešťany, P. B. for Povázská Bystrica).

I. Species growing normally in humifuse forms.

To this category belong in our Flora for instance *Herniaria glabra*, *Portulaca oleracea*, *Coronopus Ruellii*, *Illecebrum verticillatum*, *Peplis portula*, *Limosella aquatica*, *Callitriche vernalis* var. *caespitosa*, *Polycnemum majus*, *P. arvense*.

II. Species growing commonly in humifuse forms but very often also in more or less erect forms.

A good example of this category is the well-known *Polygonum aviculare* L.

III. Species forming only occasionally humifuse ecomorphoses, not seldom also transitory forms to the normal form.

### A. Rosulate humifuse ecomorphoses.

Forms with densely rosulate leaves appressed to the ground and thus protecting it before quick drying up. Stems erect or more or less decumbent. *Roripa silvestris* BESS. (f. *rosulans*): folia radicalia numerosissima solo appressa, in rosulam densam conferta, caules humiliores (P.). *F. subacaulis* HAUSM. differt caule brevissimo.

*Erodium cicutarium* L'HÉRIT. (f. *appressum*): folia numerosissima majora, solo arcte appressa et rosula densissima solum continue obtegentia (P.).

*Taraxacum officinale* WEB. (f. *appressum*): folia in rosulam magnam densam solo arcte appressam disposita; scapus basi infra folia arcuato-decumbens et dein ascendens, interdum erectus (P. B., P.).

*Capsella bursa-pastoris* L. (f. *appressa*): folia radicalia in rosulam densam solo arcte appressam disposita (P. B.).

*Anthemis arvensis* L. (f. *rosulans*): folia radicalia quam in typo multo numerosiora, diutius persistentia, rosulatim solo appressa (P. B.).

*Plantago lanceolata* L. et *P. media* L. (f. *decumbens*): folia in circulo solo accumbentia et in rosulam in specie priori sat densam, in *P. media* densissimam disposita. Scapi normales, raro decumbentes vel arcuato-ascendentes.

*Plantago pauciflora* GILIB. (f. *humifusa*)\*: formae robustae, foliis in rosulas densas appressas dispositis, scapis (basi sub foliis) arcuato-ascendentibus (P., P. B.).

Plantaginis species in ditione nostra obviae formas foliis solo appressas efformant (*P. lanceolata* rarissime) sed in utraque specie secundum scapi directionem formae ternae distingui possunt, prima scapo decumbente, altera e basi arcuato-decumbente ascendente, tertia scapo erecto.

*Potentilla anserina* L. (f. *appressa*): rosulae densae, solo appressae et solum omnino tegentes, stolones elongati, undique excurrentes (P. B.).

Somewhat aberrant are the following rosulate forms:

*Diplotaxis muralis* DC.: folia dense congesta et rosulam magnam haud solo appressam sed solum bene obtegentem efformantia; caules floriferi breves, oblique ascendentes (P.).

*Bellis perennis* L.: folia numerosissima, in caespitem hemisphaericum condensata; scapi pernumerosi (usque 20), breves (P.).

*Salvia pratensis* L. (f. *rosulans*): foliorum rosulae densae, persistentes, solo arcte appressae, caules breves (P.).

*Centaurea rhenana* BOREAU (f. *rosulans*): foliorum rosulae densae, persistentes, appressae, caules abbreviati, capitula pauca gerentes (P.). Transitus ad typum B.

\* Forms of *P. major* see apud PILGER in Fedde Repertor. spec. nov. XVIII. 269 (1922).

## B. Ecomorphoses with abbreviated, more densely leaved stems forming more or less dense but not humifuse tufts.

*Oxalis stricta* L. (f. *condensata*): caespites densissimi hemisphaerici, caules flori-feri abbreviati, folia parum excedentes (P.).

*Bidens tripartita* L. (f. *condensatus*): forma a basi ramosissima, multicaulis, late expansa, humilis, sat densa (P.).

*Reseda lutea* L. (f. *condensata*): in glareosis prope rivum Váh (P.) et etiam hic inde secus vias forma occurrit humilis, a basi perramosa, manifeste densior quam in typo et cum caulibus floriferis arcuato-ascendentibus caespites expansas efformans.

*Gentaurea cyanus* L. (f. *condensata*): in glareosis prope rivum Váh (P.) raro occurrit forma humilis, a basi expansa, longe et crebre ramosa.

*Erigeron droebachiensis* MÜLL. (f. *condensatus*): forma multicaulis, ramosa, humilis, oblique ascendens (transitus ad typum C) (P.).

*Gnaphalium uliginosum* L. (f. *condensatum*): humile, crebre ramosum, late expansum (P.).

## C. Humifuse ecomorphoses with all stems decumbent not forming, however, dense tufts.

The following subtypes may be recognised:

1. All stems decumbent.
2. Stems not exactly decumbent but more or less obliquely ascendent.
3. Central stem present but very much abbreviated, lateral stems elongated and prostrate.

*Medicago falcata* L. (f. *minor* GAUD., = var. *diffusa* SCHUR); rami elongati appressi (P.).

*Medicago lupulina* L. (f. *prostrata* ROB. KELLER): caules solo arcte appressi, saepe valde elongati, sed occurrunt etiam formae humifusae brevicaulis ad typum E. transientes (P., P. B.).

*Medicago sativa* L. (f. *prostrata*): raro occurrunt formae caulibus paucis, elongatis, prostratis sed haud arcte appressis notabiles (P.).

*Chenopodium botrys* L. (f. *prostratum*): hic inde occurrit forma caulibus in circulo humifuse a basi ramosis, solo appressis vel accumbentibus (P.).

*Chenopodium glaucum* L. (f. *prostratum* BECK): caules expansi, elongati, humifusi, in centro rosulas densas arcte appressas efformantes, in circuitu ramos floriferos abbreviatos arcuato-ascendentes gerentes (P.). Transitus ad typum E. Rarius occurrit forma minor (f. *humile* PETERM.).

*Chenopodium album* L. (f. *humifusum* LUDWIG): hic inde occurrit forma caulibus sat longis, humifusis, apice florifero interdum breviter arcuato-ascendentibus, modo laxis, modo sat densis et transitum ad typum E. formantibus (P.).

*Chenopodium polyspermum* L. (f. *humifusum*): in valle prope Čertova Pec ad Piešťany solo arenoso humido formam reperi robustam pluricaulem, undique in circulo prostratam et solo appressam, sat densam et hanc ob causam aliquantum ad typum E. vergentem.

*Chenopodium rubrum* L. (f. *humile* [HOOK.] MOQ.): descriptionem plantae bohemicae, a me in terra nuda argilloso-arenosa piscinae Sv. Štěpán prope Zbiroh repertae, vide apud DOMIN, Dritter Beitrag p. 58 (1904).

*Verbena officinalis* L. (f. *prostrata* GREN. et GODR.): caules prostrati, sed etiam formae transitoriae caulibus oblique ascendentibus reperiuntur (P.).

*Polygonum lapathifolium* L.: hic inde formae occurrunt caulibus elongatis, in circulo humifusis sat densis, tantum apice spicis breviter ascendentibus (P.);

- formae hae cum f. *pallidum* (WITH.) comparandae sunt. *P. Brittingeri* OPIZ, prope rivum Váh solo argilloso sat frequens, habitum humifusum semper ostendit. Speciei hujus formam specialem in P. B. observavi: habet caules omnes humifusos, supra fusco-purpureos, subtus purpureo-maculatos, folia ovata, macula magna ornata. Forma haec caulibus densis solum fere continue obtegit et propterea typo E. propius accedit.
- Anchusa officinalis* L. (f. *prostrata*): raro occurrunt formae caulibus floriferis plane prostratis vel oblique ascendentibus (P.).
- Anagallis arvensis* L. et *A. femina* MILL. (formae *prostratae*): solo glareoso vel arenoso hic inde formae occurrunt caulibus omnibus prostratis (sed haud solo arcte appressis) (P.). Formae hae interdum sat densae sunt, interdum caules decumbentes ab invicem separatas habent.
- Salix purpurea* L. (f. *prostrata*): solo glareoso prope rivum Váh solitarie frutices robustae speciei hujus obviae ramos usque 1.5 m longos, omnes prostratos et solo appressos ostendunt.
- Capsella bursa-pastoris* L. (f. *prostrata*): raro occurrunt formae multicaules caespitosae humifusae, racemis decumbentibus abbreviatis (P.).
- Galium verum* L. (f. *prostratum*): caules omnino decumbentes, solo subappressi (P.).
- Salsola kali* L. (f. *prostrata*): caulis medius rudimentaris, caules laterales longe prostrati (P.).
- Solanum nigrum* L. (f. *prostratum*): caespites expansi, decumbentes, caules prostrati et apice paulum arcuato-ascendentes (P.). In P. B. formae occurrunt, caulem medium floriferum abbreviatum (circa 5 cm altum) et caules laterales longiores etiam sub anthesi arcte appressos ostendentes.
- Stachys annua* L. (f. *prostrata*): caulis omnino prostratus (planta ideo unilateralis), ramos laterales utroque latere decumbentes, quasi repentes et interdum immo apice arcuato-ascendentes et ad ipsam ramorum basin floriferos gerens (P.).
- Convolvulus arvensis* L.: occurrunt haud raro formae arcte appressae, haud densae, sed etiam ob ramulos numerosos breves densae et solum continue obtegentes (typus E., P.).
- Matricaria suaveolens* BUCH. (f. *prostrata*): rami principales stellatim expansi et solo arcte appressi, ramulos laterales, folia et capitula conferta gerentes, emittentes (P.).
- Amarantus silvester* DESF. (f. *diffusus* MORIÈRE): ramis omnibus prostratis solo arcte appressis, interdum densis et caespitem fere continuum efformantibus (transitus ad typum E.) (P.).
- Lotus corniculatus* L. (f. *prostratus*): caules cum floribus solo arcte appressi, aut ab invicem distantes, aut densae et fere caespitem continuum efformantes (P.). Formae hae, transitum ad typum E. praebentes, habitu varietatem *alpestris* LAMOTTE revocant.
- Anthemis arvensis* L. (f. *prostrata*): in glareosis prope rivum Váh formae occurrunt late expanse et decumbentes, caulibus primo prostratis, dein arcuato-ascendentibus.
- Equisetum arvense* L. (f. *decumbens* G. F. W. MEYER): formae aestivales graciles, caulibus arcte appressis (P.).
- Malva neglecta* WALLR. (f. *prostrata*): primo rosulae foliorum petiolis inaequilongis insidentium et decumbentium typum A. sistunt, sed posterius ramuli breves usque satis longi undique expansi et appressi enascuntur; folia ramulorum omnia ita contorta sunt, ut laminas plane supra solum expandunt. Caulis medius valde est abbreviatus et folia ramulorum lateralium vix superat. Folia et flores congesti, flores pernumerosi (P. B.).

*Veronica byzantina* MAZZ. (f. *prostrata*) : typus specialis. Plantae germinantes caulem simplicem, cito contortum et decumbentem emmittunt. Dein planta ex axillis cotyledonum sat longe persistentium ramificatur. In axillis cotyledonum gemmae duae seriales descendentes adsunt, quarum superior in ramulum abbreviatum foliosum, basi contortum et decumbentem excrescit (P. B.).

#### D. Lateral stem decumbent, central erect, otherwise as c.

*Secale cereale* L. (f. *semidecumbens*) : forma singularis, praeter culmum centralem erectum sat altum (sed humiliorem quam in typo) caules spiciferos plurimos stellatim expansos et omnino humifusos emmittens (P.).

*Chenopodium botrys* L. (f. *semidecumbens*) : caulis medius erectus, rami laterales numerosi omnino humifusi (P.).

*Chenopodium polyspermum* L. (f. *semidecumbens*) : caulis unicus erectus, brevis, rami omnes elongati, humifusi et arcte appressi (P. B.).

*Chenopodium rubrum* L. (f. *semidecumbens*) : rami appressi, tantum unicus oblique ascendens (P. B.).

*Amarantus retroflexus* L. (f. *semidecumbens*) : caulis erectus brevis, rami omnes arcte appressi (P. B.).

To this category belongs also *Linaria vulgaris* MILL. f. *prostrata* DOM. in Beih. Bot. Centralbl. Bd. XXVI, II, p. 266 et fig. 3 (1910).

#### E. Humifuse ecomorphoses forming with leaved branches dense tufts.

*Trifolium repens* L. (f. *caespitosum*) : caespites densi, continui, arcte appressi (P.). Forma typica ut plurimum typo C. attribuenda est (forma parvifolia nomen f. *microphyllum* ASCHERS. u. GRÄBN. Syn. VI, 2, p. 499 (1907) ducit.

*Trifolium pratense* L. (f. *caespitosum*) : forma singularis, pulvinem densum solo arcte appressum efformans, capitulis in peripheria brevissime arcuato-ascendentibus (P.).

*Ranunculus repens* L. (f. *caespitosus*) : forma Trifolii repentis formam caespitosam revocans (P.).

*Glechoma hederacea* L. (f. *caespitosa*) : prostrata, solo arcte appressa, densa (P.). In P. B. formam reperi, cujus caulis medius fere ad rosulam abbreviatus fuit, dum undique stolones breves foliosi, solo haud arcte appressi sed arcuato versus solum decumbentes enascuntur. Hunc in modum foliorum opere tessellato solum obtegitur (P. B.).

*Roripa silvestris* BESS. (f. *decumbens*) : raro occurrunt formae caulibus omnibus humifusis caespites sat densos efformantes (P.).

*Medicago lupulina* L. (f. *caespitosa*) : praeter formam prostratam, caulibus humifusis ab invicem distantibus notabilem et supra descriptam occurrunt formae humifusae multicaules, in pulvinem rotundum continuum congestae (P.). Praeterea formam reperi (f. *heteroclada*) praeter pulvinem centralem densissimum caules paucos longissimos humifusos ostendentem (P.).

#### F. Humifuse grassy type with numerous stems.

*Eragrostis minor* HOST (f. *humifusa*) : caespites densissimi, stellatim expansi, humifusi et solo arcte appressi, saepe maximi (usque 1 m diametientes sed interdum multo minores), culmos numerosissimos (usque plus quam 200) exhibentes (P.).

*Digitaria filiformis* KOEL. (f. *prostrata*\*) : caespites densi, orbiculares, humifusi (P.).

*Setaria viridis* ROEM. et SCHULT. (f. *humifusa*) : ut praecedens (P.), sed modo spicis caespitem haud excedentibus, modo rosulam centralem densam longe excedentibus.

*Panicum miliaceum* L. (f. *humifusum*) : culmi numerosi, breves, omnes humifusi vel in angulo humillino oblique erecti (P.).

*Echinochloa crus-galli* L. (f. *humifusa*) : formae humifusae condensatae multicaules, culmis floriferis nunc abbreviatis, nunc elongatis (P.).

*Lolium perenne* L. (f. *humifusum*) : caespites densissimi humifusi (P., P. B.).

*Poa annua* L. (f. *humifusa*) : caespites densissimi arcte appressi (P. B.). Forma *reptans* HAUSKN. in Mitt. Thür. Ver., Bd. IX, 7 (1891) culmis elongatis per-ramosis decumbentibus et a nodos radicanibus differt.

To the same category belongs

*Carex cyperoides* L. f. *aggregata* DOMIN, Dritter Beitrag p. 77 (1904), *Coleanthus subtilis* SEIDL and *Sclerochloa dura* P. B.

\*) = *Panicum lineare* KROCKER B. *prostratum* ASCHERS. u. GRÄBN. Syn. II. 67.