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Tuexenia 29: 369–390. Göttingen 2009.

Dry grasslands on sandy soils in the forest and forest-steppe zones of the plains region of Ukraine: present state of syntaxonomy

– Anna Kuzemko –

Abstract

This paper compiles and synthesizes the present knowledge of dry grassland vegetation on sandy soils in northern Ukraine, based on published and unpublished sources. In total, 391 relevés from 29 association-level syntaxa of the class *Koelerio-Corynephoretea* (incl. *Sedo-Scleranthetea* and *Festucetea vaginatae*), as well as of the alliance *Agrostion vinealis* from the class *Molinio-Arrhenatheretea* were used for the analysis. Based on cluster analysis and comparison of synoptic tables, a compact classification scheme of the sandy dry grassland vegetation in the forest and forest-steppe zones of the plains region of Ukraine has been developed. It comprises 10 associations from the *Koelerio-Corynephoretea* and one from the *Agrostion vinealis* (*Molinio-Arrhenatheretea*).

The *Koelerio-Corynephoretea* include four orders in Ukraine: *Alysso-Sedetalia, Trifolio arvensis-Festucetalia ovinae, Corynephoretalia canescentis,* and *Sedo acris-Festucetalia.* The *Alysso-Sedetalia* are represented by two associations, the *Aurinio saxatilis-Allietum podolici* and the *Minuartio auctae-Festucetum pallentis* from West Podillya. The associations *Stipetum pulcherrimae, Astragalo-Stipetum*, and *Poetum versicoloris*, which also had been included in the *Alysso-Sedetalia* by some authors, are assigned to the class *Festuco-Brometea* based on their species composition. All Ukrainian stands of the *Trifolio arvensis-Festucetalia ovinae* are assigned to the association *Thymo pulegioides-Festucetum ovinae.* They develop on granite outcrops within Ukrainian crystalline shield. Communities of the *Corynephoretalia canescentis* are described from the Polissya region, where fluvioglacial sediments dominate. These relevés are provisionally assigned to the associations *Cornicularo aculeatae-Corynephoretum canescentis* and *Corynephoro-Silenetum tataricae. Sedo acris-Festucetalia* communities have mainly been recorded in the Dnieper Valley, and some relevés come from Zhytomyr Polissya. This order includes two alliances. The *Koelerion glaucae* is represented by two associations, namely *Veronico dillenii-Secalietum sylvestris* and *Diantho borbasii-Agrostietum syreistschikovii.* The *Festucion beckeri* is represented by three associations (*Centaureo borysthenicae-Festucetum beckeri, Chamaecytiso ruthenici-Festucetum beckeri* and perhaps *Poo bulbosae-Caricetum colchicae*), which are distributed in the Dnieper Valley. The *Agrostion vinealis* alliance from the *Galietalia veri* order has been assigned to the *Molinio-Arrhenatheretea.* The present analysis revealed a significant similarity among the previously described associations of this alliance, which allowed the reduction of them to one association, the *Koelerio-Agrostietum vinealis*. It occurs mostly in the Dnieper Valley and its left bank tributaries. Among the right bank tributaries, it occurs only along lower stretches of rivers and around their confluences with the Dnieper. Most of the dry grassland communities on sandy soils within the study area require further detailed investigation.

Zusammenfassung: Sandtrockenrasen in der Wald- und Waldsteppenzone des ukrainischen Flachlandes: aktueller Stand der Syntaxonomie

Dieser Artikel synthetisiert das gegenwärtige Wissen zur Vegetation der Sandtrockenrasen in der nördlichen Ukraine basierend auf publizierten und unpublizierten Quellen. Insgesamt wurden 391 Aufnahmen von 29 Syntaxa auf Assoziationsebene aus der Klasse *Koelerio-Corynephoretea* (incl. *Sedo-Scleranthetea* und *Festucetea vaginatae*) sowie aus dem Verband *Agrostion vinealis* (Klasse *Molinio-Arrhenatheretea*) für die Analyse verwendet. Basierend auf einer Clusteranalyse und der erstellten Stetigkeitstabelle wurde eine konsistente Klassifikation der Sandtrockenrasenvegetation in der Wald- und Waldsteppenzone des ukrainischen Flachlandes entwickelt. Sie umfasst 10 Assoziationen der Klasse *Koelerio-Corynephoretea* und eine aus dem *Agrostion vinealis* (*Molinio-Arrhenatheretea*).

Zu den *Koelerio-Corynephoretea* gehören im Gebiet vier Ordnungen: *Alysso-Sedetalia, Trifolio arvensis-Festucetalia ovinae, Corynephoretalia canescentis* und *Sedo acris-Festucetalia.* Die *Alysso-Sedetalia* sind durch zwei Assoziationen vertreten, das *Aurinio saxatilis-Allietum podolici* und das *Minuartio auctae-Festucetum pallentis* West-Podoliens. Die Assoziationen *Stipetum pulcherrimae, Astragalo-Stipetum* und *Poetum versicoloris*, die von manchen Autoren ebenfalls in den *Alysso-Sedetalia*

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eingeschlossen wurden, werden hier aufgrund ihrer Artenkombination zur Klasse *Festuco-Brometea* gestellt. Alle ukrainischen Bestände der Ordnung *Trifolio arvensis-Festucetalia ovinae* werden in eine einzige Assoziation gestellt, das *Thymo pulegioides-Festucetum ovinae.* Dieses tritt im Bereich von Granitfelsen im Ukrainischen Tafelland auf. Gesellschaften der Ordnung *Corynephoretalia canescentis* werden aus Polesien beschrieben, wo fluvioglaziale Sedimente vorherrschen. Derartige Aufnahmen werden provisorisch den Assoziationen *Corniculario aculeatae-Corynephoretum canescentis* und *Corynephoro-Silenetum tataricae* zugeordnet. Gesellschaften der Ordnung *Sedo acris-Festucetalia* wurden vor allem im Dnepr-Tal nachgewiesen, wobei einige Aufnahmen auch aus der Oblast Schytomyr stammen. Diese Ordnung ist im Gebiet durch zwei Verbände vertreten. Zum *Koelerion glaucae* gehören das *Veronico dillenii-Secalietum sylvestris* und das *Diantho borbasii-Agrostietum syreistschikovii.* Das *Festucion beckeri* ist durch drei Assoziationen vertreten (*Centaureo borysthenicae-Festucetum beckeri, Chamaecytiso ruthenici-Festucetum beckeri* und möglicherweise *Poo bulbosae-Caricetum colchicae*), die alle im Dnepr-Tal vorkommen. Der Verband *Agrostion vinealis* aus der Ordnung *Galietalia veri* wird zur Klasse *Molinio-Arrhenatheretea* gestellt. Es zeigte sich, dass die verschiedenen zuvor in diesem Verband unterschiedenen Gesellschaften alle untereinander so ähnlich sind, dass sie in einer Assoziation zusammengefasst werden sollten, dem *Koelerio-Agrostietum vinealis*. Dieses kommt in den Tälern des Dnepr und seiner linksseitigen Zuflüsse vor. Dagegen tritt es an den rechtsseitigen Zuflüssen nur im Unterlauf auf. Zusammenfassend lässt sich feststellen, dass für die Mehrzahl der behandelten Gesellschaften weitere Untersuchungen erforderlich sind.

Keywords: *Agrostion vinealis*, *Festuco-Brometea, Galietalia veri, Koelerio-Corynephoretea, Molinio-Arrhenatheretea,* Dnieper Valley, Podillya, Polissya.

1. Introduction

The vegetation of Ukraine has been studied using the Braun-Blanquet approach for about 30 years. The results of the preliminary inventory of coenotic-level phytodiversity were generalized in the first "Prodrome of Ukrainian vegetation" (SOLOMAKHA 1996). During the initial stages of developing a syntaxonomic classification of the country, Ukrainian phytosociologists faced the problem of difficulty of access of important literature on European vegetation. Moreover, there was a lack of vegetation data from the more eastern regions in most cases. This causes difficulty in aligning syntaxa described from the territory of Ukraine with those described from other regions. There were no opportunities to analyze syntaxa within their complete distribution range. Thus, some syntaxa were misapplied in the "Prodrome of Ukrainian vegetation", their distribution actually being limited to more western areas of Europe. Additionally, it turned out that some syntaxa that have been described as new for science from the territory of Ukraine actually had previously been described elsewhere. In particular, some syntaxa have repeatedly been described under different names from the territories of Ukraine, Belarus and the Russian Federation.

During the last 10 years, the preparation of the multi-volume "Vegetation of Ukraine" has commenced, with the first three volumes already published (MALINOVSKIY & KRICHFALUSHIY 2000, DUBYNA 2006, DUBYNA et al. 2007). Further, substantial information has been accumulated in recent publications, e.g. in series of monographs "Nature Protected Territories of Ukraine. Plant World" (ORLOV & YAKUSHENKO 2005, GAL'CHENKO 2006), in surveys of the vegetation of some regions of Ukraine (GONCHARENKO 2002, DUBYNA et al. 2004, GRIGORA et al. 2005) and in several dissertations dealing with Ukrainian vegetation. As a result, a considerable amount of phytosociological data has been accumulated that requires systematization, generalization and comparison with vegetation of adjacent regions. It is necessary also to clarify which vegetation classes and which regions of Ukraine need further detailed investigation and for which of them the level of knowledge is satisfactory.

Therefore, the aim of this work was to generalize all data on dry sandy grassland vegetation available in literature and archive sources for the forest and forest-steppe zones of the plains region of Ukraine; to compare the syntaxa, and to outline the direction and the tasks of further research.

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2. Study area

The study area includes the forest and forest-steppe zones of the plains region of Ukraine. According to the latest version of the physiographic zonation of Ukraine (MARINICH & SHYSHCHENKO 2005, RUDENKO 2007), the forest zone was divided into the zone of mixed forests and the zone of deciduous forests (Fig. 1). The Dnieper River divides Ukraine into two parts, referred to as Right-Bank Ukraine and Left-Bank Ukraine in this paper.

The **zone of mixed forests** of the East European Plain occupies the northern part of Ukraine. This zone is characterised as having lowland relief with prevalence of sandy and clay-sandy deposits, temperate continental climate with positive moisture balance and a high-density river network with wide river valleys that regularly flood. The mixed forest zone is the most humid region of the plains region of Ukraine. The geomorphological structure of the zone is heterogeneous. In the west it occupies a part of the Volyno-Podilska plate and the Halytsko-Volynska depression, the central portion occupies the northern portion of the Ukrainian crystalline shield, and the eastern portion occupies the Dniprovsko-Donetska depression and the slopes of the Voronezh crystalline massif. The zone occupies polygenic lowland plains, formed mainly from alluvial, glacial, fluvioglacial, and atmogenic sediments (MARINICH & SHYSHCHENKO 2005). Sod-podzol soils, dominate, particularly weakly-developed podzol soils which are distributed on sandy terraces and moraine plains on the tops and gentle slopes of the moraine hills and ridges. On the elevated convex or flat areas of terraces with dry pine forests sod-sandy soils with clearly sandy microstructure have developed. In isolated sites, particularly in Zhytomyr Polissya, sod-skeletal soils occur. They develop on crystalline rock outcrops, and consist of sand and broken stones. In shallow watershed depressions with weak discharge, on river terraces above floodplains, and in the middle and high-level floodplains, sod-gley and meadow soils are formed. Their texture varies between light sandy and loamy (VERNANDER et al. 1986). Zonal vegetation is represented by coniferous and mixed forests with predominance of *Pinus sylvestris* and *Quercus robur*.



Fig. 1: Physiographic zonation of Ukraine (adapted from RUDENKO 2007). The study deals with the three highlighted vegetation zones.

Abb. 1: Physiografische Gliederung der Ukraine (nach RUDENKO 2007). Der Artikel beschäftigt sich mit den drei hervorgehobenen Vegetationszonen.

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The **zone of deciduous forests** occupies the western part of the Ukrainian territory between the Carpathians, the mixed forest zone, and the forest-steppe zone. This zone extends over the West-Ukrainian physiographic region, and is partitioned by numerous rivers within the Dnister, Pivdenny Bug, Visla and Prip'yat' basins. The valleys of left tributaries of the Dnister are canyons, cutting through the section of paleozoic and mesoneozoic sediments. The cliffy, partitioned limestone hills of Tovtry are prominent in relief. They are the remainders of barrier reefs and atolls of the Neogenic Sea. The Tovtry rises about 50–60 m above the surrounding area, and its peak altitude is 350–400 m a.s.l. (MARINICH & SHYSHCHENKO 2005). The distribution of sandy soils is connected with crystalline rock exposures, where weathering of some elements takes place. As a result, sandy and skeletal soils of different thickness are formed. The exception is Male Polissya, where the natural and territorial complexes of the forested lowland prevails in the landscape: areas with outwashed, moraine-outwashed and outwash-alluvial plains with sod-weakly developed podzol soils (MARINICH & SHYSHCHENKO 2005). Zonal vegetation includes deciduous forests dominated by *Quercus robur* and *Carpinus betulus*.

The **forest-steppe zone** stretches from the zone of deciduous forests in the west to the west spurs of the Middle-Russian Highland in the east. Its northern border coincides with that of continuous distribution of north-forest-steppe landscapes. Their indicators are grey forest soils and podzolic chernozems on the loess stratum. The southern border is traceable on the line of the deep middle-humus chernozem. Formation and development of the forest-steppe landscapes are dependent on the optimal balance of heat and moisture, and during the growing season, evaporation almost equals the amount of precipitation. The soil formation in the Dnieper Right-Bank part of the zone is influenced by crystalline outcrops and weathering processes. Sandy soils occupy greater areas in the Dnieper Valley, especially in the Left-Bank region. This is caused by erosion and accumulative processes in the Dnieper Valley and its tributaries. Their floodplains are formed by alluvial sands with the strata of loamy sand, loam and buried soils. The sandy areas with pine forests are raised up to 10–12 m above the floodplain with the peak altitude mark of 140–150 m a.s.l. They are composed of ancient alluvial anisomerous sands, which lie over the fluvioglacial stratum. Their surface topography is diversified by sandy ridges, dunes, and blow-outs. Alluvial sediments are widespread in valleys of the Left-Bank tributaries on palaeogenic sediments (Kharkiv sands, Kiev marl). Sandy areas covered mainly with pine forests are distributed in the valleys of Sula, Psel, and Khorol and other rivers. They rise up to 10–12 m above the floodplains with a peak altitude of 120–128 m a.s.l. Typical of these sandy areas are atmogenic ridge-hilly relief and sod-podzol sandy and sabulous soils. The sandy terrace of the Vorskla River is 2–7 km wide. The sandy hills with a peak altitude of 80–100 m a.s.l. are distributed at its outside edge. In the eastern part of Ukraine, sandy terraces are located in river valleys of the Kharkiv hillside-elevated region, where floodplain sandy terraces form a belt 0.4–4.0 km wide (MARINICH & SHYSHCHENKO 2005). Zonal vegetation is represented by deciduous forests (dominated by *Quercus robur* and *Carpinus betulus, Acer platanoides* and *Tilia cordata*) and meadow steppes (dominated e.g. by *Festuca valesiaca, Stipa capillata* and *Botriochloa ischemum*).

3. Material and methods

3.1. Plant nomenclature

In general, the nomenclature for vascular plants follows CHEREPANOV (1995), that of mosses IGNATOV & AFONINA (1992), and that of lichens KONDRATYUK et al. (1998). As an exception, the nomenclature of some vascular plant taxa follows MOSYAKIN & FEDORONCHUK (1999) because some taxonomic interpretations by CHEREPANOV (1995) caused difficulties.

In the following cases, microspecies were included in aggregates and were not considered as separate taxa in the present paper: *Medicago falcata* agg. (including *M. procumbens* Besser – absent in CHEREPANOV's list and *M. romanica* Prodán – present in CHEREPANOV's list as only species), *Thymus pulegioides* agg. (including *T. clandestinus* Schur. and *T. ucrainicus* (Klokov & Des.-Shost.) Klokov –

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absent in CHEREPANOV's list), *Hylotelephium maximum* agg. (including *H. polonicum* (Błocki) Holub – absent in CHEREPANOV's list, *H. stepposum* (Boriss.) Tzvelev – present in CHEREPANOV's list as only species), *Hylotelephium telephium* agg. (including *H. argutum* (Haw.) Holub – absent in CHEREPANOV's list and *H. triphyllum* (Haw.) Holub – present in CHEREPANOV's list as only species). *Seseli libanotis* (L.) W. D. J. Koch subsp. *intermedium* is considered as a subspecies although all cited authors applied the old name of this taxon *Seseli intermedium* (Rupr.) V. Vodopianova (but in CHEREPANOV's list it is given as *Seseli libanotis*). In the nomenclature of several species absent in CHEREPANOV's checklist, I followed MOSYAKIN & FEDORONCHUK (1999): *Asparagus polyphyllus* Steven, *Pilosella caespitosa* (Dumort.) P. D. Sell & C. West, *Seseli campestre* Besser, and *Stipa borysthenica* Klokov ex Prokudin.

3.2. Relevés

For the survey of the *Koelerio-Corynephoretea*, phytosociological materials published in Ukrainian literature were used. Relevés of the alliance *Agrostion vinealis* (order *Galietalia veri*, class *Molinio-Arrhenatheretea*) were taken from archive data and historical relevés from "phytocoenotheka" (archives of paper-copy relevés of the Department of Geobotany at the M. G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine). Additionally, unpublished data of the author were used. All available phytosciological data (single relevés and synoptic tables) originally assigned either to the *Koelerio-Corynephoretea* s.l. (incl. *Sedo-Scleranthetea, Festucetea vaginatae*) or the alliance *Agrostion vinealis* were used for the analysis. Regarding the *Molinio-Arrhenatheretea*, only those syntaxa occurring on dry sandy soils were included in the study. Appendix A gives an overview of relevés included in the analysis.

In the analysis, I tried to use the greatest possible number of relevés of each syntaxon. Unfortunately, for some syntaxa newly described from the territory of Ukraine only very few relevés exist. Thus, the range of relevé numbers varies from 3 to 61 in different syntaxa, which may have affected the accuracy of results to a certain extent. The information about plot sizes was absent in literature sources in most cases. In those cases with available information, the size varies noticeably from 2 m^2 to 100 m^2. Another problem is the absence of information on bryophytes and lichens in some syntaxa (this is indicated in Table 1 in the Supplement). I fully realize that such variation of raw data may have an essential influence on the reliability of the results but I decided to use all data available from sandy dry grasslands in the forest and forest-steppe zone of the plains region of Ukraine because their small quantity did not allow for further reduction based on quality criteria.

3.3. Phytosociological classification and cluster analysis

A comparative analysis of the 29 "syntaxa" included was carried out to evaluate the diagnostic value of species delimited as diagnostic in original publications/information sources and to assess how well-founded their assignment was to higher syntaxa.

All the data were summarized into a synoptic table where the constancy of each species is expressed in percent (Table 1 in the Supplement). If in sources only constancy classes were given, I transformed these back to percentage constancies approximately (V: 90%; IV: 70%; III: 50%; II: 30%; I: 10%). The relevés were grouped according to the original association names assigned by the authors, with two exceptions. The two localities of the *Veronico dillenii-Secalietum sylvestris* differed considerably in their floristic composition and were therefore analyzed separately. The same was true for the *Centaureo borysthenicae-Festucetum beckeri*.

Species with constancy at least two times as high than in other syntaxa were considered as differential (DENGLER 2003). Delimitation of character species of higher syntaxa was based on literature sources (MUCINA 1997, BERG et al. 2001, MATUSZKIEWICZ 2001, DENGLER 2003, RUSINA 2005, RUPRECHT et al. 2009). Similarity among syntaxa was determined by cluster analysis with the program STATISTICA 7.0 (STATSOFT, INC. 2005). The agglomerative hierarchical method known as Ward's method was applied. As a resemblance measure, Euclidean distance was employed.

A nomenclatural revision of the involved syntaxa was not a focus of this paper. However, misspelled names were corrected according to the regulations of the International Code of Phytosociological Nomenclature (further as ICPN; WEBER et al. 2000). Full author citations of all mentioned syntaxa are given in the syntaxonomic overview (section 5.4).

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4. Results

4.1. Comparison of syntaxa in synoptic table (Table 1 in the Supplement)

Syntaxa SS1, SS2 and SS3 are characterized by high constancy and abundance of the *Festuco-Brometea* character species and low constancy of the *Koelerio-Corynephoretea* character species with the exception of species of the alliance *Alysso alyssoidis-Sedion*. The high constancy of the later probably was the reason why ABDULOEVA (2002) in the original publication assigned them to the *Sedo-Scleranthetea*.

Diagnostic species of syntaxa SS4 and SS5 are *Thymus ×oblongifolius, Cephalaria uralensis* and *Minuartia aucta*, which do not occur in any other syntaxon. Vegetation is composed mainly of diagnostic species of the *Alysso-Sedion* and the *Koelerio-Corynephoretea*.

Syntaxa SS6, SS7, SS8, SS9 and SS10 contain a number of species of the *Hyperico perforati-Scleranthion perennis*, allowing them to be included into this alliance. Considerable differences among these syntaxa were not observed in the synoptic table, and there appears to be no reason to delimit them as separate associations.

Syntaxa KC1, KC3 and FV8 do not possess good diagnostic species at the association level. Most probably they belong to the *Corynephorion canescentis* alliance although the group of character species of the named alliance (only *Corynephorus canescens, Jasione montana* and *Thymus serpyllum*) and also of the *Koelerio-Corynephoretea* class (only 14 species with low constancy) is represented weakly. By contrast, syntaxon KC4 has good association-level diagnostic species. This syntaxon is probably the transition from *Corynephorion canescentis* to *Koelerion glaucae* alliances as species of both alliances are present.

Syntaxon FV7 has good association-level diagnostic species, and also includes character species of the class *Koelerio-Corynephoretea* and the alliance *Koelerion glaucae*.

Syntaxa SS11, FV5, FV1b and FV2b show a pronounced similarity in floristic composition, and can be assigned to the alliance *Koelerion glaucae* (order *Sedo acris-Festucetalia*, class *Koelerio-Corynephoretea*).

Syntaxa FV3, FV4 and FV6 contain the same set of diagnostic species and approximately equal numbers of character species of the *Koelerion glaucae* and *Festucion beckeri* alliances, indicating the transitional nature of these syntaxa.

Syntaxa FV2a and FV1a are well differentiated by such diagnostic species as *Agropyron pectinatum, Centaurea pseudomaculosa, Dianthus platyodon, Erysimum canescens, Kochia prostrata Linaria dulcis* and *Tragopogon borysthenicus*. Character species of both the alliance *Festucion beckeri* and the order *Sedo acris-Festucetalia* are well represented.

Syntaxon SS12 has a clear diagnostic species group, and some character species of the *Sedo acris-Festucetalia* and the *Koelerio-Corynephoretea* have a high constancy.

Syntaxa AV1, AV2 and AV3 demonstrate considerable similarity in floristic composition, suggesting their inclusion into a single association. This is distinguished by a high number of the *Molinio-Arrhenatheretea* character species as well as character species of the *Koelerio-Corynephoretea*. These syntaxa represent transitional vegetation between both phytosociological classes.

Syntaxon KC2 has no diagnostic species. The *Koelerio-Corynephoretea* character species are nearly absent but the *Molinio-Arrhenatheretea* class is represented quite well with some species having high constancy.

4.2 Cluster analysis

The dendrogram of the cluster analysis demonstrates clear division of the processed syntaxa into two large groups (Fig. 2). The first of them includes syntaxa of communities which occur on stony outcrops while the second contains syntaxa developing on sandy deposits. The extreme branches of the dendrogram include groups questionably positioned syntaxonomically within the *Koelerio-Corynephoretea*. Syntaxa SS1–SS3 are assigned to the *Festuco-Brometea* class in conventional classification schemes, and syntaxa AV1–AV3 traditionally are assigned to the *Molinio-Arrhenatheretea* class.

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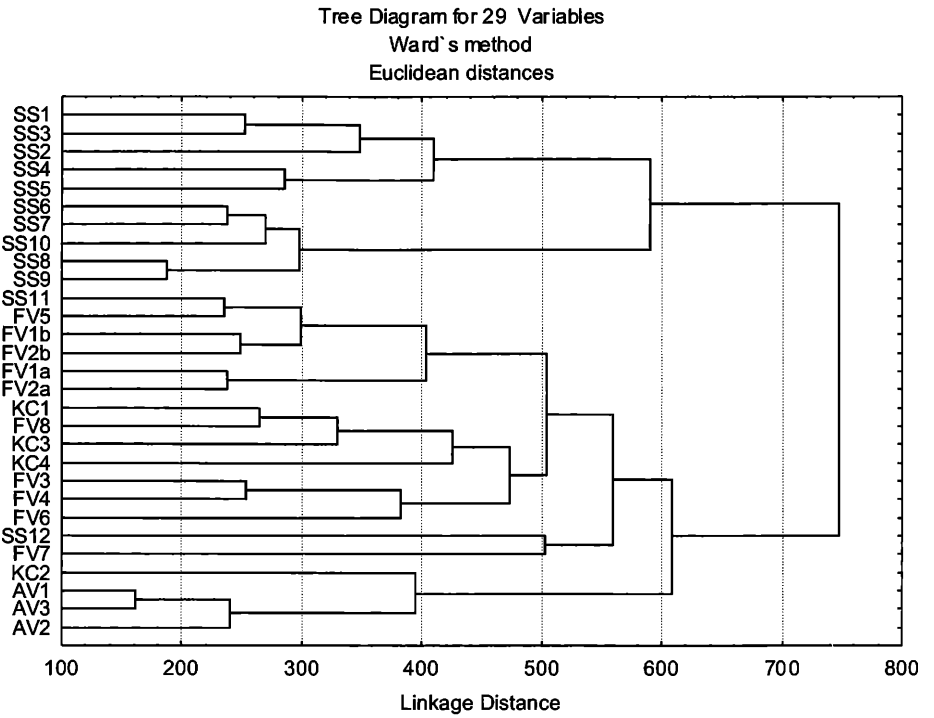


Fig. 2: Dendrogram of the cluster analysis of 29 sandy dry grassland syntaxa. The code numbers refer to Appendix A.

Abb. 2: Dendrogramm der Clusteranalyse von 29 Sandtrockenrasen-Syntaxa. Die Codes sind in Anhang A aufgeschlüsselt.

In total, six groups of clusters were obtained. The first group is formed by syntaxa SS1, SS2, SS3, SS4, and SS5. They include communities on limestone outcrops in West Podillya. The second group includes syntaxa SS6, SS7, SS8, SS9 and SS10, communities of which are described from granite outcrops of forest and forest-steppe zones of the Right-Bank Ukraine. This group is floristically quite homogeneous.

The third group is more heterogeneous. One branch is formed by syntaxa SS11, FV5, FV1b, and FV2b, and it includes phytocenoses occurring on sands of the Dnieper floodplain. The second branch contains syntaxa FV1a and FV2a with communities that were described on sands of the Left-Bank forest-steppe.

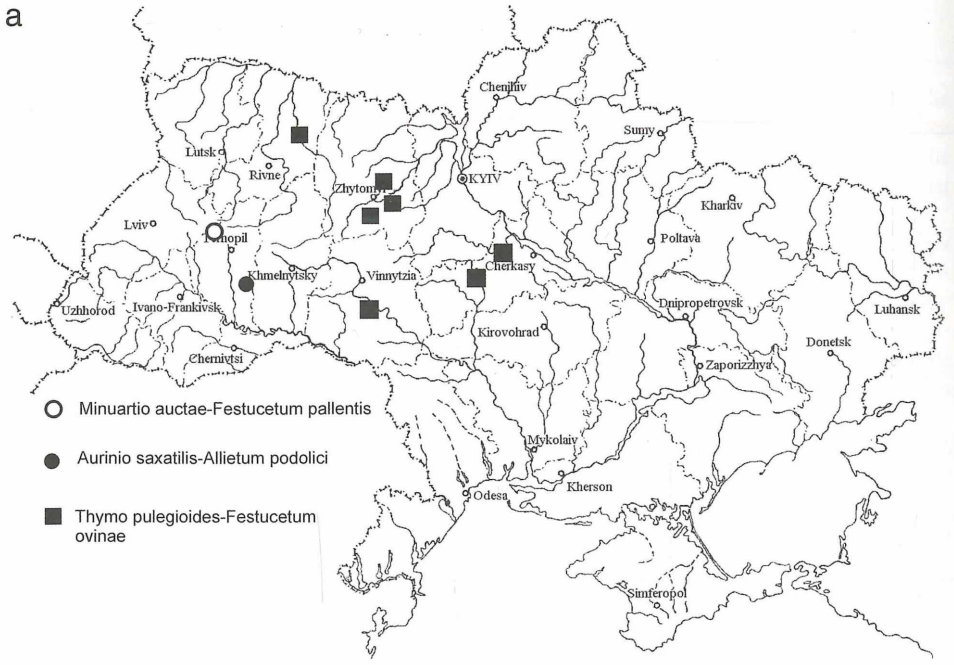
The fourth group is the most heterogeneous. One branch combines syntaxa KC1, FV8, KC3, and KC4, which include communities of sandy deposits, mainly fluvioglacial sediments of forest zone. The other branch is formed by syntaxa FV3, FV4, and FV6, which are represented by the Dnieper sandy terrace communities.

Syntaxa of the fifth group are SS12 and FV7. They demonstrate slight similarity with each other and with other syntaxa. These syntaxa include communities from the Dnieper Valley: FV7 communities are described at the most northern frontier, while SS12 occurs in the south part of the study area.

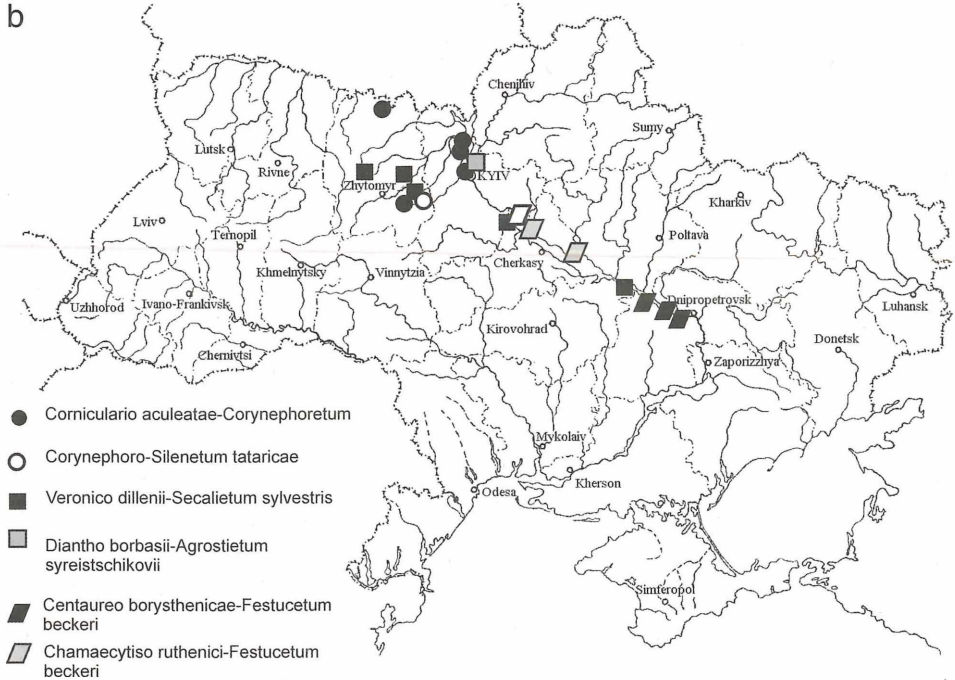
The sixth group includes syntaxa KC2, AV1, AV2 and AV3. They include communities of high sections of floodplains, and they are the most dissimilar to all other examined syntaxa. Syntaxa AV1, AV2 and AV3 are characterized by greater density of herb vegetation, but syntaxon KC2 is clearly separated from them.

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a



b



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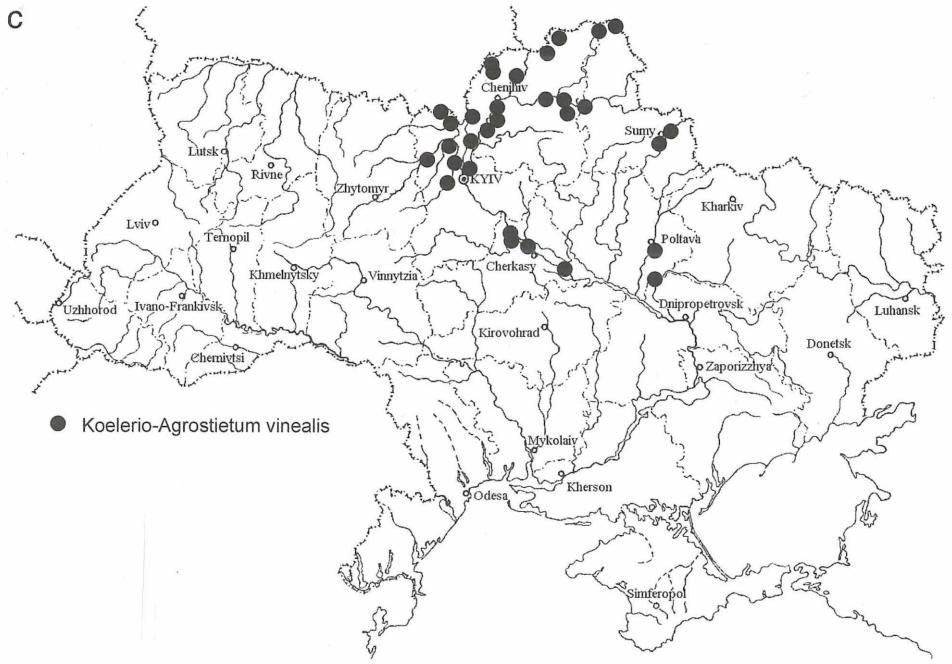


Fig. 3: Distribution of sandy dry grassland communities in the forest and forest-steppe zones of the plains region of Ukraine: a – orders *Alysso-Sedetalia* and *Trifolio arvensis-Festucetalia ovinae* (*Koelerio-Corynephoretea*), b – orders *Corynephoretalia canescentis* and *Sedo acris-Festucetalia* (*Koelerio-Corynephoretea*), c – alliance *Agrostion vinealis* (*Molinio-Arrhenatheretea*).

Abb. 3: Verbreitung der Sandtrockenrasengesellschaften in der Wald- und Waldsteppenzone des ukrainischen Flachlandes. a – Ordnungen *Alysso-Sedetalia* und *Trifolio arvensis-Festucetalia ovinae* (*Koelerio-Corynephoretea*), b – Ordnungen *Corynephoretalia canescentis* und *Sedo acris-Festucetalia* (*Koelerio-Corynephoretea*), c – Verband *Agrostion vinealis* (*Molinio-Arrhenatheretea*).

5. Discussion

5.1. *Festuco-Brometea*

The associations *Stipetum pulcherrimae* (SS1), *Astragalo-Stipetum* (SS2), and *Poetum versicoloris* (SS3) were originally assigned to the alliance *Alysso-Sedion* within the *Sedo-Scleranthetea* by ABDULOEVA (2002). The current analysis of their floristic composition (Table 1 in the Supplement) revealed a considerable representation of *Festuco-Brometea* character species, while the *Koelerio-Corynephoretea* species were less frequent. Based on the results of cluster analysis (Fig. 2), I propose the inclusion of these associations into the *Festuco-Brometea* class, namely into the alliance *Festucion valesiacae* in the order *Festucetalia valesiacae*. Therefore these syntaxa must be considered as steppe communities and not sandy grassland communities. Further studies should be carried out to define their syntaxonomical position more precisely.

5.2. *Koelerio-Corynephoretea*

5.2.1. *Alysso-Sedetalia*

The associations *Aurinio saxatilis-Allietum podolici* (SS4) and *Minuartio auctae-Festucetum pallentis* (SS5), described by ONISHCHENKO (2001) on the territory of Nature Reserve "Medobory", showed considerable distinctiveness from other syntaxa. This can be explained by their unique floristic composition with such endemic species as *Allium podolicum* and *Minuartia aucta*. Floristically, the associations correspond well to the *Alysso-Sedion* alliance

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(*Koelerio-Corynephoretea*; see Table 1 in the Supplement). Some common features with the three associations from the *Festuco-Brometea* class (Fig. 2) are indicative of the transitional nature of these syntaxa.

Thus, communities of *Alysso-Sedetalia* order (Fig. 3a, Fig. 4) are represented only by two associations in the plains region of Ukraine. Apparently, these two associations are endemic to West Podillya. Further inspection of limestone outcrops of this region, especially Tovtry Ridge, valleys of Dnister and its tributaries probably will make it possible to discover new localities of these communities. Taking into account the specific environmental characteristics of the territory may make possible the discovery of additional plant communities of this alliance new for science.



Fig. 4: Stand of the *Aurinio saxatilis-Allietum podolici* (order *Alysso-Sedetalia*) with *Allium podolicum*, *Aurinia saxatilis*, and *Gypsophila paniculata* in the National Nature Park "Podils'ki Tovtry" (A. Kuzemko, 08/2008).

Abb. 4: Bestand des *Aurinio saxatilis-Allietum podolici* (Ordnung *Alysso-Sedetalia*) mit *Allium podolicum*, *Aurinia saxatilis* und *Gypsophila paniculata* im Nationalen Naturpark „Podils'ki Tovtry" (A. Kuzemko, 08/2008).

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5.2.2. *Trifolio arvensis-Festucetalia ovinae*

Communities on granite outcrops of forest and forest-steppe zones were assigned by DIDUKH & KONTAR (1998) and KONTAR (2000) to two orders, two newly described alliances and five new associations. Nevertheless, the floristic composition of all five associations is very similar (Table 1 in the Supplement), as confirmed by cluster analysis (Fig. 2). Thus, these syntaxa should be included in one alliance, *Hyperico perforati-Scleranthion perennis* from the order *Trifolio arvensis-Festucetalia ovinae*, and probably must be merged into one association *Thymo pulegioides-Festucetum ovinae.*

At present, few localities of this community are known, namely on granite outcrops within the Ukrainian crystalline shield (Fig. 3a and 5). Further research is needed to reveal any new localities of this association and to assess its overall distribution in Ukraine.

5.2.3. *Corynephoretalia canescentis*

Those communities described by VICHEREK (1972) in the Dnieper Valley under the name *Veronico dillenii-Corynephoretum* (FV8) can be included into the *Corynephorion canescentis* alliance without doubt. Regarding the communities from Polissky Nature Reserve (KC1) which were included into the *Helichryso-Jasionetum* association by VOROBYOV et al. (1998), I would surmise that their floristic composition is similar to *Corniculario aculeatae-Corynephoretum canescentis* communities. The comparison of these communities with phytocenoses of *Helichryso-Jasionetum* from Latvia (RŪSIŅA 2007) and Germany (BERG et al. 2001) make it clear that diagnostic species of this association (e.g. *Cladonia rangiformis, Cetraria aculeata, Hypnum cupressiforme, Carex arenaria,* and others) are absent in relevés from Polissky Nature Reserve. Probably, the distribution area of *Helichryso-Jasionetum* lies outside Ukraine.

The associations *Artemisio campestris-Dianthetum borbasi* (KC3) and *Corynephoro-Silenetum tataricae* (KC4) from Zhytomyr Polissya were included within the same cluster with the previous two syntaxa by the cluster analysis (Fig. 2). Thus, I assign these syntaxa to the above mentioned alliance, the first one as a synonym of *Corniculario-Corynephoretum* and a second one as a single association. However, their floristic composition indicates the transitional nature of these associations.

Stands of the *Corniculario-Corynephoretum* have been described from Dnieper Valley and some plots within Zhytomyr Polissya (Fig. 3b and 6). In my opinion, the association has wider distribution in the forest zone. There is need for further research to clarify the distributional range of the association *Corniculario-Corynephoretum*. In addition, it is possible that communities of other associations of this order occur on fluvioglacial sediments of Polissya.

5.2.4. *Sedo acris-Festucetalia*

The communities of *Artemisio dniproicae-Sedetum sexangularis* (SS11) were described by SCHEVCHYK et al. (1996) in Dnieper islands at the border of Kaniv Nature Reserve. He assigned them to the *Corynephorion canescentis* alliance. However, these communities differ considerably from other syntaxa of this alliance (Table 1 in the Supplement). Moreover, this syntaxon was merged together with the *Festuco psammophilae-Koelerietum glaucae* (FV5) from the Dnieper islands in the Kremenchig Reservoir (GAL'CHENKO 2006), the *Veronico dillenii-Secalietum sylvestris* (FV1b), and the *Centaureo borysthenicae-Festucetum beckeri* (FV2b) relevés from islands of the Kaniv Nature Reserve in the cluster analysis (Fig. 2). Based on the results of cluster analysis, all mentioned syntaxa were merged into one association within the *Koelerion glaucae* alliance with the name *Veronico dillenii-Secalietum sylvestris* as the oldest available name.

The other associations that were assigned to the class *Festucetea vaginatae* according to Ukrainian phytosociological tradition have to be included into the *Festucion beckeri* alliance. As can be seen from the cluster analysis, the communities from the Left-Bank forest-steppe that were delimited by DIDUKH & KOROTCHENKO (1996) as two different

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Fig. 5: Stand of the *Thymo pulegioides-Festucetum ovinae* (order *Trifolio arvensis-Festucetalia ovinae*) with *Festuca ovina* and *Sedum sexangulare* in the Pivdenny Bug Valley (A. Kuzemko, 05/2006).

Abb. 5: Bestand des *Thymo pulegioides-Festucetum ovinae* (Ordnung *Trifolio arvensis-Festucetalia ovinae*) mit *Festuca ovina* und *Sedum sexangulare* im Tal des Pivdenny Bug (A. Kuzemko, 05/2006).



Fig. 6: Stand of the *Corniculario aculeatae-Corynephoretum* (order *Corynephoretalia canescentis*) with *Corynephorus canescens* and *Cladonia* sp. in the Polissky Nature Reserve (A.Kuzemko, 06/2008).

Abb. 6: Bestand des *Corniculario aculeatae-Corynephoretum* (order *Corynephoretalia canescentis*) mit *Corynephorus canescens* and *Cladonia* sp. im Naturschutzgebiet Polissky (A.Kuzemko, 06/2008).

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associations, *Veronico dillenii-Secalietum sylvestris* (FV1a) and *Centaureo borysthenicae-Festucetum beckeri* (FV2a), possess substantial resemblance (Fig. 2). The high level of similarity becomes apparent also in Table 1. Therefore, they should be considered as single association: *Centaureo borysthenicae-Festucetum beckeri.*

Floristic composition is very similar also between the associations *Chamaecytiso ruthenicae-Festucetum beckeri* (FV3) and *Thymo pallasiani-Centauretum sumensis* (FV4), which were described by SHEVCHYK & SOLOMAKHA (1996) in Kaniv Nature Reserve. In my opinion, they must be considered as synonyms, with *Chamaecytiso ruthenicae-Festucetum beckeri* being the oldest available name. They should be placed within the *Festucion beckeri* and not the *Koelerion glaucae* as was proposed in the original publication.

The syntaxonomical position of the *Cladonietum* from the *Koelerion glaucae* alliance, which was provisionally described as new by SHEVCHYK & POLISHKO (2000) from a sandy terrace of the Dnieper River, remains unclear. The name of the association is not valid according to the Art. 3g, ICPN. The *Cladonietum* was included in the same cluster as the two previous associations but floristical comparison of these syntaxa is troublesome as non-vascular plants were treated in FV6 but not in syntaxa FV3 and FV4. It is necessary to conduct further investigation to clarify the correct placement of this syntaxon.

The same applies to the *Poetum bulbosi* (SS12), which was described by the same authors and classified in a newly described alliance *Trifolio arvensis-Sedion* within the *Sedo-Scleranthetea* class. However, the floristic composition of this association is very similar to the earlier described association *Poo bulbosae-Caricetum colchicae* from Biruchy Island spit in the Azov Sea (DUBYNA et al. 1994), though it differs from the latter in regional peculiarities caused by its distribution in the different zone. The syntaxonomic position of this association remains unclear. In its original diagnosis, it was assigned to the *Festucion beckeri*, but the character species of this alliance are absent in the available relevés of the association (see Table 1). Unfortunately, only three relevés were available, which is insufficient for comparative analysis and final decision on syntaxonomy of these communities.

The *Poo bulbosae-Caricetum colchicae* created a single cluster together with the *Diantho borbasii-Agrostietum syreistschikovii* (FV7). The later was described by VICHEREK (1972) from the Dnieper Valley and included by him into the *Koelerion glaucae* alliance within the class *Festucetea vaginatae*. The floristic composition of both syntaxa differs substantially (Table 1). Thus, they can be interpreted as separate associations. They are located separately from other syntaxa of both alliances (*Koelerion glaucae* and *Festucion beckeri*) in the cluster dendrogram (Fig. 2). Nonetheless, the *Diantho borbasii-Agrostietum syreistschikovii* should be included into the first alliance, and the *Poo bulbosae-Caricetum colchicae* into the second alliance based on their floristic composition (Table 1).

Thus, the results of the analysis showed considerable similarity of communities that were included in either of the two classes *Festucetea vaginatae* and the *Koelerio-Corynephoretea* by different authors in Ukraine. It is not surprising that the correlation of these syntaxa has repeatedly been discussed in literature. For instance, VICHEREK (1972) included the *Koelerion glaucae* alliance into the *Festucetea vaginatae*. Also CHYTRÝ & TICHÝ (2003) recognize the independence of the *Festucetea vaginatae* class. The same point-of-view is traditional in Ukrainian phytosociology and in some other European countries. However, in some large-scale overviews on the vegetation of Europe, the authors have presented opposing opinions. MUCINA (1997) considers *Festucetea vaginatae* class as syntaxonomic synonym of the *Festuco-Brometea*. A similar opinion is shared by RODWELL et al. (2002). DENGLER (2001, 2003) considers the *Festucetalia vaginatae* order as synonym of the *Sedo acris-Festucetalia*. I agree with the last point-of-view because this assignment is confirmed by the present analysis of floristic composition of syntaxa and the results of cluster analysis. Concerning the syntaxonomic position of the alliance *Koelerion glaucae*, I believe that it is more appropriate to assign this alliance to the *Sedo acris-Festucetalia* order instead of *Corynephoretalia canescentis* or *Festuco-Astragaletalia arenarii*.

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Fig. 7: Stand of the *Veronico dillenii-Secalietum sylvestris* (order *Sedo acris-Festucetalia*) with *Anthemis ruthenica* and *Sedum acre* in the Psel River floodplain (A. Kuzemko, 05/2008).

Abb. 7: Bestand des *Veronico dillenii-Secalietum sylvestris* (Ordnung *Sedo acris-Festucetalia*) mit *Anthemis ruthenica* und *Sedum acre* in der Psel-Aue (A. Kuzemko, 05/2008).



Fig. 8: Communities of the alliance *Festucion beckeri* (order *Sedo acris-Festucetalia*, class *Koelerio-Corynephoretea*) with *Secale sylvestre, Rumex acetosella*, and *Potentilla argentea* in the Kolomak River floodplain (A. Kuzemko, 05/2008).

Abb. 8: Gesellschaften des Verbandes *Festucion beckeri* (Ordnung *Sedo acris-Festucetalia*, Klasse *Koelerio-Corynephoretea*) mit *Secale sylvestre, Rumex acetosella* und *Potentilla argentea* in der Kolomak-Aue (A. Kuzemko, 05/2008).

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Communities of the *Sedo acris-Festucetalia* order are investigated mainly in the Dnieper Valley and in some plots in Zhytomyr Polissya (Fig. 3b, 7 and 8) but predominantly in protected areas. They need further detailed investigation and comparison with other syntaxa of this order that have been described from the steppe zone of Ukraine, where they show a considerable variability (more than 40 associations have been described, but probably a portion of them needs revision).

5.3. *Molinio-Arrhenatheretea*

The *Galietalia veri* order is probably one of the most disputable syntaxa in Europe. The alliance *Agrostion vinealis* was first described from the territory of Ukraine (SIPAYLOVA et al. 1985) and was subsequently included into the newly described order *Poo-Agrostietalia vinealis* (SHELYAG et al. 1985). Almost simultaneously MIRKIN & NAUMOVA (1986) published the name *Galietalia veri*. These names must be considered as synonyms (KUZEMKO & DZYUBA 2002). *Galietalia veri* is the correct name because the name *Poo-Agrostietalia vinealis* was not validly published according to the rules of the last edition of ICPN. Both orders appeared mainly in publications from the former USSR (STSEPANOVICH 2000, BULOKHOV 2001, YAMALOV et al. 2003; 2004, MARTYNENKO et al. 2005 and others). The majority of European phytosociologists do not agree with the existence of such syntaxa, but see RODWELL et al. (2002), who lists the order *Poo-Agrostietalia vinealis* with the two alliances *Agrostio-Avenulion schellianae* Royer 1991 and *Agrostion vinealis* within the *Festuco-Brometea*. I disagree with that a point of view because in the present investigation a considerable number of *Molinio-Arrhenatheretea* species were present in *Agrostion vinealis* stands (Table 1 in the Supplement) and it is impossible to ignore this fact in classification, whereas the *Festuco-Brometea* species group was noticeably weaker.



Fig. 9: Communities of the alliance *Agrostion vinealis* (order *Galietalia veri*, class *Molinio-Arrhenatheretea*) with *Galium verum, Rumex thyrsiflorus*, and *Achillea millefolium* in the Dnieper River floodplain (T. Vinichenko, 05/2005).

Abb. 9: Gesellschaften des Verbandes *Agrostion vinealis* (Ordnung *Galietalia veri*, Klasse *Molinio-Arrhenatheretea*) mit *Galium verum, Rumex thyrsiflorus* und *Achillea millefolium* in der Dnepr-Aue (T. Vinichenko, 05/2005).

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The distribution of *Agrostion vinealis* communities on dry sandy soils, which was the reason for their inclusion in the present publication, leads to the idea of including them into the *Koelerio-Corynephoretea.* The cluster analysis showed that the *Agrostion vinealis* syntaxa are indeed related to this class. On the other hand, the synoptic table revealed a very weak presence of *Koelerio-Corynephoretea* species group in syntaxa of the *Agrostion vinealis* (Table 1). Consequently, I follow the opinion that the *Agrostion vinealis* alliance and the *Galietalia veri* order should be treated independently, and that it is necessary to place these syntaxa within the *Molino-Arrhenatheretea.* Affinity of these syntaxa with *Koelerio-Corynephoretea* syntaxa is evidence of their transitional character.

Finally, examination of synoptic table and cluster analysis results revealed considerable similarity of the *Koelerio-Agrostietum vinealis,* the *Festuco valesiacae-Agrostietum vinealis* and the *Agrostio vinealis-Calamagrostietum epigeii* associations, which had been considered as separate units for more than 20 years. I propose to consider these syntaxa as one association under the oldest available name *Koelerio delavignei-Agrostietum vinealis.*

The *Euphorbio cyparissiae-Festucetum ovinae*, which was originally described from the Desna River floodplain within the *Agrostion vinealis* (SHELYAG-SOSONKO et al. 1987), but later was transferred to the *Corynephorion canescentis* (SIPAYLOVA & SHELYAG-SOSONKO 1996), shows high similarity to the *Molinio-Arrhenatheretea* syntaxa (Fig. 2) as it contains many species of *Molinio-Arrhenatheretea*, particularly *Deschampsia caespitosa, Festuca rubra, Prunella vulgaris,* and *Trifolium pratense* with high constancy (Table 1). Therefore, I consider its original inclusion in the *Koelerio-Corynephoretea* as a mistake and suggest to place these stands in the *Molinio-Arrhenatheretea.* However, I refrain from further classifying these stands as they probably comprise a complex of several associations from different alliances and even orders.

The communities of *Agrostion vinealis* are known mostly from the Dnieper Valley and its left tributaries, at Right-Bank they occur only in lower and mouth parts of the Dnieper tributaries (Fig. 3c and 9). At the present stage of knowledge, these communities have been inventoried and investigated rather carefully.

5.4. Classification scheme

As a consequence of the results and the preceding considerations, I suggest the following new compact classification scheme of the dry grassland vegetation on sandy soils in the forest and forest-steppe zones of the plains region of Ukraine. It can be integrated into a modern classification system of European vegetation. Synonyms are indicated with "="; some narrow syntaxa, that were assigned to the broader syntaxa in the present paper are indicated with "incl." Associations whose syntaxonomic position within the next higher syntaxon is doubtful are marked with "?"

FB *Festuco-Brometea* Br.-Bl. & Tx. ex Klika & Hada 1944
- **FB1** *Festucetalia valesiacae* Br.-Bl. & Tx. ex Br.-Bl. 1950
  - **FB1.1** *Festucion valesiacae* Klika 1931
    - **FB1.1.1** (?) *Stipetum pulcherrimae* Soó 1942
    - **FB1.1.2** (?) *Astragalo-Stipetum* R. Knapp 1944 nom. inval.
    - **FB1.1.3** (?) *Poetum versicoloris* Kukovitsa et al. 1992

KC *Koelerio-Corynephoretea* Klika in Klika & Novák 1941 (incl. *Sedo-Scleranthetea* Br.-Bl. 1955, *Festucetea vaginatae* Soó ex Vicherek 1972)
- **KC1** *Alysso-Sedetalia* Moravec 1967
  - **KC1.1** *Alysso-Sedion* Oberdorfer & Müller in Müller 1961
    - **KC1.1.1** *Aurinio saxatilis-Allietum podolici* Onishchenko 2001
    - **KC1.1.2** *Minuartio auctae-Festucetum pallentis* Onishchenko 2001
- **KC2** *Trifolio arvensis-Festucetalia ovinae* Moravec 1967
  - **KC2.1** *Hyperico perforati-Scleranthion perennis* Moravec 1967 (incl. *Thymo pulegioidis-Sedion sexangularis* Didukh & Kontar 1998, *Poo compressae-Rumicion acetosellae* Didukh & Kontar 1998)

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KC2.1.1 *Thymo pulegioides-Festucetum ovinae* Oberdorfer 1957 (incl. *Thymo pulegioidis-Sedetum sexangularis* Didukh & Kontar 1998, *Artemisio austriacae-Teucrietum chamaedrys* Didukh & Kontar 1998, *Sempervivo ruthenicae-Sedetum ruprechti* Didukh & Kontar 1998, *Vincetoxico hirundinariae-Rumicetum acetosellae* Didukh & Kontar 1998, *Melico transsylvanicae-Sedetum ruprechti* Kontar 1998)

KC3 *Corynephoretalia canescentis* Klika 1934

KC3.1 *Corynephorion canescentis* Klika 1931

KC3.1.1 *Corniculario aculeatae-Corynephoretum canescentis* Steffen 1931 nom. invers. propos. (incl. *Veronico dillenii-Corynephoretum* Passarge 1960, *Helichryso-Jasionetum* sensu Vorobyov et al. 1998 non Libbert 1940, *Artemisio campestris-Dianthetum borbasi* Yakushenko 2004)

KC3.1.2 *Corynephoro-Silenetum tataricae* Libbert 1931

KC4 *Sedo acris-Festucetalia* Tx. 1951 nom. invers. propos. (= *Festucetalia vaginatae* Soó ex Vicherek 1972)

KC4.1 *Koelerion glaucae* Volk 1931

KC4.1.1 *Diantho borbasii-Agrostietum syreistschikovii* Vicherek 1972

KC4.1.2 *Veronico dillenii-Secalietum sylvestris* Shevchyk & Solomakha 1996 (incl. *Artemisio dniproicae-Sedetum sexangularis* Shevchyk & Solomakha in Shevchyk et al. 1996, *Festuco psammophilae-Koelerietum glaucae* sensu Gal'chenko 2006, non Klika 1931, *Centaureo borysthenicae-Festucetum beckeri* sensu Shevchyk & Solomakha 1996, non Vicherek 1972)

KC4.2 *Festucion beckeri* Vicherek 1972 (incl. *Trifolio arvensis-Sedion* Shevchyk & Polishko 2000)

KC4.2.1 *Chamaecytiso ruthenicae-Festucetum beckeri* Shevchyk & Solomakha 1996 (incl. *Thymo pallasiani-Centauretum sumensis* Shevchyk & Solomakha1996, *Cladonietum* Shevchyk et Polishko 2000 nom. inval.)

KC4.2.2 *Centaureo borysthenicae-Festucetum beckeri* Vicherek 1972 (incl. *Veronico dillenii-Secalietum sylvestri* sensu Didukh & Korotchenko 1996, non Shevchyk & Solomakha 1996)

KC4.2.3 (?) *Poo bulbosae-Caricetum colchicae* Dubyna et al. 1994 (incl. *Poetum bulbosae* Shevchyk & Polishko 2000)

MA *Molinio-Arrhenatheretea* R.Tx. 1937

MA1 *Galietalia veri* Mirkin & Naumova 1986 (= *Poo-Agrostietalia vinealis* Shelyag et al. 1985 nom. inval.)

MA1.1 *Agrostion vinealis* Sipaylova et al. 1985

MA1.1.1 *Koelerio-Agrostietum vinealis* (Sipaylova et al. 1985) Shelyag et al. 1987 (incl. *Festuco valesiacae-Agrostietum vinealis* Shelyag et al. in Shelyag et al. 1985, *Agrostio vinealis-Calamagrostietum epigeii* (Shelyag et al. 1981) Shelyag et al. 1985)

MA? (?) *Euphorbio cyparissiae-Festucetum ovinae* Shelyag-Sosonko et al. 1987 (probably a mixture of several associations)

6. Conclusions

Dry grasslands on sandy soils have a considerable distribution in the forest and steppe-forest zones of the plains region of Ukraine. While some of them (communities of the *Trifolio arvensis-Festucetalia ovinae* and *Corynephoretalia canescentis*) are similar to analogous syntaxa from central and western Europe, the others are characterized by the originality of their floristic composition. A significant part of their diagnostic species belongs to the Podolian (communities of *Alysso-Sedion*) and Pontic (communities of *Koelerion glaucae* and *Festucion beckeri*) centers of endemism. Communities of the *Agrostion vinealis* probably have no analogs in the vegetation of countries west of Ukraine. Their development seems to be conditioned by hydrological and geomorphological peculiarities of the floodplains of the Dnieper River and its tributaries as well as the regional climate.

Data on sandy dry grassland communities in Ukraine are still very scarce, despite their high diversity and the large size of the study area. Additionally, usage of varying plot sizes, inconsistent vascular plant nomenclature, and ignoring of non-vascular plants in some cases considerably impair the quality of available data. Finally, the absence of a common phytosociological database seriously hinders large-scale syntaxonomic studies in Ukraine, not only of dry grasslands. Presently, phytosociological data are scattered in various archives, theses, monographs, reports, and so on. These methodological and organizational problems need to be solved before the preliminary results of the present study can be replaced by a more complete inventory and consistent analysis of the sandy dry grasslands of Ukraine.

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Acknowledgements

The author expresses sincere thanks to Dr. Jürgen Dengler for his idea and encouragement to prepare the article, to Dr. Nicholai Ermakov for his helpful advice in the course of preparing the publication and to Dr. Christian Dolnik for the possibility to present the research at the "Dry Grassland Meeting 2008". I am grateful to Dr. Tatiana Dzyuba for making available several literature sources with limited access and to Mrs. Tatiana Sukhomeilo for her assistance in editing the English version of the manuscript. Special gratitude to Dr. Solvita Rusina for scientific and linguistic editing of the manuscript and her valuable comments. Finally, I thank Curtis Björk for his kind improvement of the English usage.

Appendix A: Descriptions of associations used in this study and their sources

Syntaxon names are corrected orthographically if necessary.
Appendix A: Assoziationsbeschreibungen, die in dieser Arbeit Verwendung fanden, und deren Quellen. Syntaxonnamen wurden erforderlichenfalls orthografisch korrigiert.

Code number	Name of syntaxon in original publication	Syntaxonomic position according to original publication (alliance, order, class)	Source	Number of relevés	Region	Localities of relevés	Ecotope	Plot size (m²)
SS1	*Stipetum pulcherrimae*	*Alysso-Sedion, Alysso-Sedetalia, Sedo-Scleranthetea*	ABDULOEVA (2002)	13	Western forest-steppe	Pokuttia (Ivano-Frankovsk region)	chalky outcrops	no information given
SS2	*Astragalo-Stipetum*	*Alysso-Sedion, Alysso-Sedetalia, Sedo-Scleranthetea*	ABDULOEVA (2002)	19	Western forest-steppe	National Natural Park "Podilski Tovtry" (Khmelnitsk region)	stony outcrops	no information given
SS3	*Poetum versicoloris*	*Alysso-Sedion, Alysso-Sedetalia, Sedo-Scleranthetea*	ABDULOEVA (2002)	6	Western forest-steppe	National Natural Park "Podilski Tovtry" (Khmelnitsk region)	shaly clay	no information given
SS4	*Aurinio saxatilis-Allietum podolici*	*Alysso-Sedion, Alysso-Sedetalia, Sedo-Scleranthetea*	ONISHCHENKO (2001)	12	Western forest-steppe	Natural reserve Medobory	limestone outcrops	2–33
SS5	*Minuartio auctae-Festucetum pallentis*	*Alysso-Sedion, Alysso-Sedetalia, Sedo-Scleranthetea*	ONISHCHENKO (2001)	6	Western forest-steppe	Kremenetski hills	carbonate rocks	3–20
SS6	*Artemisio austriacae-Teucrietum chamaedrys*	*Thymo pulegioidis-Sedion sexangularis, Festuco-Sedetalia, Sedo-Scleranthetea*	DIDUKH & KONTAR (1998)	19	Right-Bank forest zone	Pivdenny Bug Valley (Vinnitsa region)	granite outcrops	no information given
SS7	*Thymo pulegioidis-Sedetum sexangularis*	*Thymo pulegioidis-Sedion sexangularis, Festuco-Sedetalia, Sedo-Scleranthetea*	DIDUKH & KONTAR (1998)	10	Right-Bank forest zone	Sluch Valley (Rivno region), Pivdenny Bug Valley (Vinnitsa region), Teteriv Valley (Zhytomyr region)	granite outcrops	no information given
SS8	*Vincetoxico hirundinariae-Rumicetum acetosellae*	*Poo compressae-Rumicion acetocellae, Sedo-Sclerathetalia, Sedo-Scleranthetea*	DIDUKH &KONTAR (1998)	21	Right-Bank forest zone	Hnylopiat' Valley (Zhytomyr region), Sluch Valley (Rivno region)	granite outcrops	no information given
SS9	*Sempervivo ruthenicae-Sedetum ruprechti*	*Poo compressae-Rumicion acetocellae, Sedo-Sclerathetalia, Sedo-Scleranthetea*	DIDUKH & KONTAR (1998)	15	Right-Bank forest zone	Sluch Valley (Rivno region), Pivdenny Bug Valley (Vinnitsa region), Teteriv Valley (Zhytomyr region)	granite outcrops	no information given
SS10	*Melico transsylvanicae-Sedetum ruprechti*	*Thymo pulegioidis-Sedion sexangularis, Festuco-Sedetalia, Sedo-Scleranthetea*	KONTAR (2000)	19	Right-Bank forest-steppe	Hnylij Tikych Valley, Ros' Valley (Cherkasy region), Pivdenny Bug (Vinnitsa region)	granite outcrops	no information given
SS11	*Artemisio dniproicae-Sedetum sexangulare*	*Corynephorion canescentis, Corynephoretalia canescentis, Sedo-Scleranthetea*	SHEVCHYK et al. (1996), GAL'CHENKO (2006), own data of author 1999	11	Middle Dnieper Valley	Kaniv Nature Reserve, Ros' river mouth (Cherkassy region), Kremenchuk Regional Landscape Park, (Poltava region)	alluvial deposits	25–?
SS12	*Poetum bulbosi*	*Trifolio arvensis-Sedion, Trifolio arvensis-Festucetalia ovinae, Sedo-Scleranthetea*	SHEVCHYK & POLISHKO (2000)	3	Left-Bank Dnieper Valley	Liplava forestry (Cherkassy region)	pinery terrace	no information given
KC1	*Helichryso-Jasionetum*	*Corynephorion canescentis, Corynephoretalia canescentis, Sedo-Scleranthetea*	VOROBYOV et al. (1998)	15	Polissky Nature Reserve	Polissky Nature Reserve (Zhytomyr region)	sandy hills with granite outcrops	no information given
KC2	*Euphorbio cyparissiae-Festucetum ovinae*	*Corynephorion canescentis, Corynephoretalia canescentis, Sedo-Scleranthetea*	SIPAYLOVA & SHELYAG-SOSONKO (1996)	11	Left-Bank forest zone	Desna floodplain (Chernigiv region)	high plots of the central and near-riverbed parts pf floodplain	no information given
KC3	*Artemisio campestris-Dianthetum borbasi*	*Koelerion glaucae, Corynephoretalia canescentis, Koelerio-Corynephorenea*	YAKUSHENKO (2004)	11	Riht-Bank forest zone	Zytomyr Polyssia (Zytomyr region)	disturbed sandy plots	no information given
KC4	*Corynephoro-Silenetum tataricae*	*Koelerion glaucae, Corynephoretalia canescentis, Koelerio-Corynephorenea*	ORLOV & YAKUSHENKO (2005)	3	Riht-Bank forest zone	Projected Korostyshiv National Nature Park (Zytomyr region)	slopes of sandy terrace	no information given
FV1a	*Veronico dillenii-Secalietum sylvestris*	*Festucion beckeri, Festucetalia vaginatae, Festucetea vaginatae*	DIDUKH & KOROTCHENKO (1996)	10	Left-Bank forest-steppe	Vorskla river Valley, islands of Dneprodzerzhinsk and Pechenizhsky reservoirs (Poltava region)	sandy terraces and alluvial deposits	100

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Code number	Name of syntaxon in original publication	Syntaxonomic position according to original publication (alliance, order, class)	Source	Number of relevés	Region	Localities of relevés	Ecotope	Plot size (m^2)
FV1b	*Veronico dillenii-Secalietum sylvestris*	*Festucion beckeri, Festucetalia vaginatae, Festucetea vaginatae*	SHEVCHYK et al. (1996)	9	Middle Dnieper Valley	Kaniv Nature Reserve, islands (Cherkassy region)	sandy deposits on the tops of hills and downs	no information given
FV2a	*Centaureo borysthenicae-Festucetum beckeri*	*Festucion beckeri, Festucetalia vaginatae, Festucetea vaginatae*	DIDUKH & KOROTCHENKO (1996)	5	Left-Bank forest-steppe	Vorskla river mouth, islands of Dneprodzerzhinsk and Pechenizhsky reservoirs (Poltava region)	alluvial deposits	100
FV2b	*Centaureo borysthenicae-Festucetum beckeri*	*Festucion beckeri, Festucetalia vaginatae, Festucetea vaginatae*	SHEVCHYK et al. (1996)	5	Middle Dnieper Valley	Kaniv Nature Reserve, islands (Cherkassy region)	plain sections of the inter-ridge depressions in floodplaine	no information given
FV3	*Chamaecytiso ruthenicae-Festucetum beckeri*	*Koelerion glaucae, Festuco-Astragaletalia arenarii, Festucetea vaginatae*	SHEVCHYK et al. (1996)	4	Middle Dnieper Valley	Kaniv Nature Reserve, islands (Cherkassy region)	sandy terrace	no information given
FV4	*Thymo pallasiani-Centauretum sumensis*	*Koelerion glaucae, Festuco-Astragaletalia arenarii, Festucetea vaginatae*	SHEVCHYK et al. (1996), SHEVCHYK & POLISHKO (2000), POLISHKO (2005)	13	Middle Dnieper Valley	Kaniv Nature Reserve, islands (Cherkassy region)	sandy terrace	no information given
FV5	*Festuco psammophilae-Koelerietum glaucae*	*Koelerion glaucae, Festuco-Astragaletalia arenarii, Festucetea vaginatae*	GAL'CHENKO (2006)	8	Middle Dnieper Valley	Kremenchuk Regional Landscape park (Poltava region)	high plots of floodplain	16–100
FV6	*Cladonietum*	*Koelerion glaucae, Festuco-Astragaletalia arenarii, Festucetea vaginatae*	SHEVCHYK & POLISHKO (2000), POLISHKO (2005)	7	Middle Dnieper Valley	Chihyryn forestry (Cherkassy region)	pinery teracces	no information given
FV7	*Dianthо borbasii-Agrostietum syreistschikovii*	*Koelerion glaucae, Festuco-Astragaletalia arenarii, Festucetea vaginatae*	VICHEREK (1972)	10	Lower and Middle Dnieper Valley	Truchaniv Island, Kyiv	alluvial deposits	16
FV8	*Veronico dillenii-Corynephoretum*	*Corynephorion canescentis, Corynephoretalia canescentis, Sedo-Scleranthetea*	VICHEREK (1972)	15	Lower and Middle Dnieper valley	Dnieper Valley (Kyiv region)		16
AV1	*Koelerio-Agrostietum vinealis*	*Agrostion vinealis, Galietalia veri, Molinio-Arrhenatheretea*	Phytocenotheka (Afanasiev 1949–1972, Sipaylova 1974, 1976, Sitenko 1976), own data of author (1999, 2005)	61	forest and forest-steppe zones	Dnieper, Desna, Seim, Ros' & Teteriv floodplains	high sections of floodplain	16–100
AV2	*Festuco valesiacae-Agrostietum vinealis*	*Agrostion vinealis, Galietalia veri, Molinio-Arrhenatheretea*	Phytocenotheka (Afanasiev 1972, Sipaylova 1980, 1982, Iutina 1998, Fitsailo 1997, 1998), own data of author (2003, 2005)	22	forest and forest-steppe zones	Dnieper, Desna, Seim, Ros', Psel & Pivdenny Bug floodplains	high sections of floodplain	16–100
AV3	*Agrostio vinealis-Calamagrostietum epigeii*	*Agrostion vinealis, Galietalia veri, Molinio-Arrhenatheretea*	Phytocoenotheka (Afanasiev 1949–1968, Sipaylova 1974–1982, Panchenko 1996–1998), own data of author (1999, 2003, 2005)	28	forest and forest-steppe zones	Dnieper, Desna, Sudost', Ros', Oril', Vilshanka floodplains	high sections of floodplain	16–100

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Managing editor: Jürgen Dengler
Manuscript received 07.11.2008, accepted 21.02.2009.

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Zu Kuzemko: Dry grasslands on sandy soils in the forest and forest-steppe zones of the plains part of Ukraine: present state of syntaxonomy

Table 1 (part 1): Synoptic table of the dry grassland vegetation of sandy soils in the forest and forest-steppe zones of the plains region of Ukraine. Differential species of associations (D; including potential character species) are shaded in dark grey and character species (Ch) of higher syntaxa in light grey. Taxa within differential species blocks are arranged by their constancy in the differentiated syntaxon, while taxa within character species blocks are arranged by their total constancy. Non-diagnostic "Other species" are sorted alphabetically. "?" denotes unknown values.

Tab. 1 (Teil 1): Stetigkeitstabelle von Sandtrockenrasen in der Wald- und Waldsteppenzone des ukrainischen Flachlandes. Differenzialarten von Assoziationen (D; einschließlich möglicher Assoziationskennarten) sind dunkelgrau hinterlegt, Charakterarten höherer Syntaxa hellgrau. Innerhalb der Differenzialartenblöcke sind die Arten nach fallender Stetigkeit im jeweiligen Block, ansonsten nach fallender Gesamtstetigkeit angeordnet. Nicht diagnostische sonstige Arten sind alphabetisch angeordnet. Das „?" steht für fehlende Daten.

Class	*Festuco-Brometea*			*Koelerio-Corynephoretea*																								*Molinio-Arrhenatheretea*			
Final designation of association (see classification scheme in the Section 5.4)	FB1.1.1	FB1.1.2	FB1.1.3	KC1.1.1	KC1.1.2	KC2.1.1					KC3.1.1			KC3.1.2	KC4.1.1	KC4.1.2				KC4.2.1			KC4.2.2		KC4.2.3	MA1.1.1			MA?
Original designation of association (see Table 1)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	FV8	KC1	KC3	KC4	FV7	SS11	FV5	FV1b	FV2b	FV4	FV3	FV6	FV2a	FV1a	SS12	AV1	AV2	AV3	KC2
Number of relevés	13	19	6	12	6	19	10	21	15	19	15	15	11	3	10	11	8	9	5	13	4	7	5	10	3	61	22	28	11
Plot sizes [m²]	?	?	?	2–33	3–20	?	?	?	?	?	16	?	?	?	16	25–?	16–100	?	?	?	?	?	100	100	?	16–100	16–100	16–100	?
Cumulative species richness of vascular plants	83	59	55	75	41	79	60	102	77	60	14	71	78	28	32	61	49	38	27	83	30	48	62	68	25	145	149	157	32
Mean species richness of vascular plants	?	?	?	19	13	16	10	13	14	8	4	15	10	20	21	16	14	12	12	22	10	10	23	17	17	18	25	23	?
Treatment of non-vascular plants (Y = yes; N = no)	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N
Cumulative species richness of non-vascular plants	?	?	?	18	11	19	10	16	16	15	8	13	2	1	7	?	?	?	?	3	?	10	?	?	?	?	?	?	?
Mean species richness of non-vascular plants	?	?	?	3	2	4	3	3	3	3	4	3	1	1	4	?	?	?	?	0	?	6	?	?	?	?	?	?	?
D *Stipetum pulcherrimae*																													
Stipa pulcherrima	90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jurinea arachnoidea	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Securigera varia	50	10	10	17	.	.	.	5	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.
Lembotropis nigricans	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D *Astragalo-Stipetum*																					.			.	.				
Chamaecytisus austriacus	.	90	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stipa pennata	.	90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium montanum	.	90	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum rostratum	.	70	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus monspessulanus	.	70	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picris hieracioides	.	70	10	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.
D *Poetum versicoloris*																													
Poa versicolor	30	.	90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris hungarica	10	.	50	.	.	.	.	5	13	11	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.
Stipa capillata	.	10	50	8	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ch *Festuco-Brometea*																													
Salvia verticillata	70	90	70	8	.	5	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium chamaedrys	90	50	70	8	.	79	10	.	7	.	.	.	.	.	.	.	.	.	.	8	25	.	.	.	.	.	.	.	.
Euphorbia cyparissias	50	70	10	33	33	53	50	48	53	16	.	.	.	20	.	.	11	.	38	75	14	.	.	.	.	.	14	.	71
Elytrigia intermedia	50	30	90	8	17	32	.	14	33	.	.	.	9	.	.	.	.	.	.	8	.	.	.	.	.	.	5	.	.
Bothriochloa ischaemum	50	90	.	.	.	21	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inula ensifolia	30	70	10	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca valesiaca	10	30	50	58	17	5	.	.	.	26	.	.	.	.	.	18	100	.	.	.	.	.	.	10	.	5	91	11	.
Medicago falcata agg.	10	10	30	25	33	26	20	5	13	.	.	.	9	67	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.
Koeleria cristata	30	10	50	50	17	5	30	.	.	.	.	.	.	33	.	.	.	.	.	.	.	.	.	.	.	7	5	.	.
Stachys recta	50	50	.	.	17	37	20	10	13	.	.	.	.	.	.	.	.	.	.	15	.	.	20	.	.	.	.	.	.
Campanula sibirica	50	30	.	33	33	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium campestre	10	50	10	.	.	5	10	5	.	.	.	.	.	.	.	9	.	.	.	.	.	.	40	20	.	.	27	.	.
Allium sphaerocephalum	.	70	.	.	.	53	10	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.
Hieracium cymosum	30	10	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.	.
Thalictrum minus	.	10	10	25	17	5	.	5	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrimonia eupatoria	.	10	.	.	.	11	.	5	13	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.
Filipendula vulgaris	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	23	7	51
Aurinia saxatilis	10	.	10	67	.	.	.	.	.	74	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis macrocephala	10	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	.	.
Hieracium echioides	.	30	.	.	.	32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	10	.	.	.	.	.	.
Festuca rupicola	10	10	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fragaria viridis	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	9	.	.
Astragalus onobrychis	10	.	.	8	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex humilis	10	.	.	8	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea collina	.	10	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum falcatum	10	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helictotrichon desertorum	10	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aster amellus	.	50	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypericum elegans	10	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea scabiosa	10	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D *Aurinio saxatilis-Allietum podolici*																					.			.	.				
Allium podolicum	.	.	.	58	.	.	.	.	16	37	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardaminopsis arenosa	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.
Thymus ×oblongifolius	.	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cephalaria uralensis	.	.	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Seseli libanotis subsp. *intermedium*	10	.	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D *Minuartio auctae-Festucetum pallentis*																					.			.	.				
Minuartia aucta	.	.	.	.	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca pallens	.	.	.	.	83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum turkestanicum	.	.	.	.	50	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.
Asplenium ruta-muraria	.	.	.	25	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ch *Alysso alyssoidis-Sedion*																													
Acinos arvensis	.	.	.	67	50	16	50	10	16	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula cynanchica	30	90	10	25	50	74	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Allium montanum	10	.	30	42	50	.	.	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ch *Hyperico perforati-Scleranthion perennis*																													
Hylotelephium maximum agg.	10	.	.	33	.	53	20	52	73	74	.	13	.	.	.	27	.	22	20	8	.	.	.	.	.	.	.	.	.
Centaurea rhenana	10	20	10	33	17	74	20	48	53	26	.	.	.	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca ovina	.	.	.	.	.	89	60	57	13	68	.	53	36	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	91
Poa compressa	.	.	.	50	.	11	10	38	60	16	.	.	64	.	.	.	.	.	.	.	.	.	.	.	.	2	.	7	.
Steris viscaria	.	.	.	.	.	42	10	48	60	.	.	7	9	.	.	.	.	.	.	8	25	.	.	.	.	.	14	.	.
Sempervivum ruthenicum	.	.	.	33	17	.	10	.	67	21	.	.	.	.	.	.	.	.	.	31	.	.	.	.	.	.	.	.	.
Thymus pulegioides agg.	.	.	.	.	.	74	100	19	16	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.	.
Allium oleraceum	.	.	.	.	.	5	30	19	60	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.
Melica transsilvanica	10	.	.	50	.	26	.	10	27	95	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phleum phleoides	10	.	.	.	.	.	.	5	33	.	.	7	.	.	.	.	.	.	.	31	.	.	.	.	.	.	.	.	.
D *Corynephoro-Silenetum tataricae*																					.			.	.				
Scabiosa ochroleuca	10	30	10	17	17	.	.	10	.	.	.	.	.	100	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.
Silene tatarica	.	.	.	.	.	.	.	.	.	.	.	.	.	100	.	18	.	11	.	.	.	.	40	.	.	.	.	29	.
Ch *Corynephorion canescentis*																													
Jasione montana	.	.	.	.	.	.	.	14	.	.	.	80	45	.	10	.	.	.	.	46	.	57	20	.	.	2	.	.	.
Corynephorus canescens	.	.	.	.	.	.	.	.	.	.	100	93	36	.	.	.	.	.	.	.	.	.	.	.	.	3	.	7	.
Thymus serpyllum	.	.	.	.	17	.	.	29	.	.	.	6	64	67	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Table 1 (part 2)

Class	*Festuco-Brometea*			*Koelerio-Corynephoretea*																												*Molinio-Arrhenatheretea*			
Final designation of association (see classification scheme in the Section 5.4)	FB1.1.1	FB1.1.2	FB1.1.3	KC1.1.1	KC1.1.2	KC2.1.1						KC3.1.1		KC3.1.2	KC4.1.1	KC4.1.2					KC4.2.1			KC4.2.2		KC4.2.3	MA1.1.1			MA?	
Original designation of association (see Table 1)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	FV8	KC1	KC3	KC4	FV7	SS11	FV5	FV1b	FV2b	FV4	FV3	FV6	FV2a	FV1a	SS12	AV1	AV2	AV3	KC2						
D *Diantho borbasii-Agrostietum syreistschikovii*																																			
Psammophiliella muralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80	.	.	.	.	.	.	.	20	.	.	25	9	7	.						
Herniaria polygama	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	.	.	10	33	5	9	18	.						
Kochia laniflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.	.	.	.	.	20	.	.	.	.	.	.						
Pleconax subconica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Ch *Koelerion glaucae*																																			
Silene borysthenica	.	.	.	.	.	.	.	.	.	.	.	7	21	.	50	.	38	.	20	15	.	14	.	10	.	.	5	.	.						
Oenothera rubricaulis	.	.	.	.	.	.	.	.	.	.	.	.	9	33	.	36	25	.	20	.	.	.	.	.	.	11	9	.	.						
Plantago arenaria	.	.	.	.	.	.	.	.	.	.	.	7	9	.	.	.	13	.	.	.	.	.	.	.	.	3	.	.	.						
D *Chamaecytiso ruthenici-Festucetum beckeri*																																			
Chamaecytisus ruthenicus	.	.	.	8	17	.	.	10	.	.	.	7	27	33	.	.	.	22	.	85	100	86	.	.	.	.	14	.	.						
Peucedanum oreoselinum	.	.	.	.	.	.	.	.	7	.	.	.	18	.	.	.	.	33	.	54	75	.	20	.	.	.	.	.	.						
Centaurea sumensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	54	25	.	.	.	.	.	.	.	.						
Carex ericetorum	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	31	25	.	.	.	.	.	.	.	.						
Jurinea pseudocyanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	.	43	.	.	.	.	.	.	.						
Pulsatilla pratensis	.	.	.	.	.	5	.	.	.	5	.	.	.	.	.	.	.	.	.	38	.	.	.	.	.	.	.	.	.						
D *Centaureo borysthenicae-Festucetum beckeri*																																			
Dianthus platyodon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80	50	.	.	.	.	.						
Anchusa gmelinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	60	.	.	.	.	.						
Centaurea pseudomaculosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	30	.	.	14	.	.						
Achillea micrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	30	.	.	.	.	.						
Linaria dulcis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	20	.	.	.	.	.						
Kochia prostrata	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	50	.	.	.	.	.						
Tragopogon borysthenicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	40	.	.	.	.	.						
Erysimum canescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	10	.	.	.	.	.						
Seseli tortuosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	20	.	.	.	.	.						
Jurinea charcoviensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	.	.	.	.	.	.						
Polygonum arenarium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	14	60	.	.	.	.	4	.						
Thymus ×tschernjajevii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.	.						
Agropyron dasyanthum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.	.						
Syrenia montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.						
Galium ruthenicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	20	.	.	.	.	.	.						
Asperula graveolens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.						
Dianthus eugeniae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.						
Oberna behen	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.						
Ch *Festucion beckeri*																																			
Festuca beckeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.	66	100	92	100	29	60	20	.	11	.	14	.						
Thymus pallasianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	85	.	43	40	50	.	.	.	.	.						
Senecio borysthenicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	40	40	.	.	.	.	.						
D *Poetum bulbosi*																																			
Anisantha tectorum	.	.	.	.	.	5	.	10	.	16	.	.	.	.	.	.	.	22	.	8	.	.	.	10	100	.	.	.	.						
Arenaria uralensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	100	.	.	.	.						
Ch *Festuco-Sedetalia acris*																																			
Helichrysum arenarium	10	30	10	.	.	.	.	19	.	.	.	67	55	.	40	36	63	.	40	31	.	14	100	100	.	10	9	11	.						
Koeleria glauca	.	.	.	.	.	.	.	.	.	.	.	7	18	.	100	55	100	55	80	92	.	71	100	10	33	.	.	7	.						
Linaria genistifolia	30	10	30	.	.	.	.	.	.	.	.	47	9	.	40	.	38	.	20	23	25	57	20	20	.	.	.	.	.						
Asparagus officinalis	10	10	.	.	.	.	.	.	.	.	.	.	9	.	40	55	13	33	80	23	.	14	.	.	.	20	.	29	.						
Hieracium umbellatum	.	.	.	.	.	32	.	14	13	.	.	.	9	.	100	.	.	.	.	23	20	43	20	.	.	28	.	4	31						
Dianthus borbasii	.	.	.	.	.	.	.	.	.	.	.	.	100	.	100	63	75	33	.	46	.	.	.	.	.	52	18	39	.						
Secale sylvestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	50	100	20	8	50	.	60	100	67	.	.	.	.						
Carex colchica	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	36	75	44	40	8	.	.	.	30	.	8	.	21	.						
Tragopogon ucrainicus	.	.	.	.	.	.	.	.	.	.	13	7	.	.	50	.	38	.	100	15	.	.	20	20	.	.	.	18	.						
Centaurea borysthenica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	11	60	54	25	43	20	30	.	.	.	.	.						
Euphorbia seguieriana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	18	50	11	.	23	.	.	100	70	.	.	.	.	51						
Chondrilla juncea	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	9	25	.	.	46	.	.	40	20	33	.	.	7	.						
Lepidium densiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	66	.	.	.	.	.	.	100	.	.	.	.						
Ch *Koelerio-Corynephoretea*																																			
Rumex acetosella	.	.	.	.	.	42	20	67	27	.	47	67	36	33	80	73	38	44	100	31	.	29	80	50	.	56	41	57	71						
Sedum acre	.	.	10	100	67	37	60	14	27	53	.	.	55	.	80	63	50	22	20	.	.	.	.	20	100	31	27	39	71						
Artemisia campestris	.	.	.	.	67	84	10	57	40	.	.	.	100	100	100	100	13	44	100	23	.	.	100	90	.	8	18	11	.						
Trifolium arvense	.	.	.	.	.	63	60	14	13	11	.	7	18	.	.	63	.	.	.	8	.	14	20	10	100	2	18	4	.						
Sedum sexangulare	.	.	.	.	.	63	100	24	.	32	.	.	9	100	50	100	50	11	20	.	.	.	.	10	.	7	5	4	.						
Poa bulbosa	.	.	.	.	.	.	.	10	.	21	7	.	9	.	100	.	.	33	.	8	.	14	.	40	100	3	14	.	.						
Herniaria glabra	.	.	.	.	.	.	40	5	.	.	.	7	9	.	.	.	.	.	.	.	.	.	20	10	.	7	.	7	.						
Veronica dillenii	.	.	.	.	.	.	.	.	.	.	100	7	14	.	100	.	.	88	40	.	25	.	.	.	.	.	.	.	.						
Anthemis ruthenica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.	55	.	.	.	.	40	20	100	3	.	7	.						
Scleranthus annuus	.	.	.	.	.	.	20	10	7	.	.	27	.	.	70	.	.	.	.	.	.	.	.	.	.	5	5	.	.						
Potentilla arenaria	30	.	30	75	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	69	.	43	.	.	.	.	.	.	.						
Myosotis micrantha	.	.	.	.	.	.	.	.	.	.	47	.	9	.	80	9	.	.	20	.	.	.	.	.	.	2	.	.	.						
Cerastium semidecandrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.	.	.	.	.	.	100	10	14	7	.						
Centaurea diffusa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	38	.	.	.	.	.	20	.	.	5	5	11	.						
Scleranthus perennis	.	.	.	.	.	.	10	10	.	.	.	2	27	.	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Cerastium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	13	.	.	.	.	.	.	.	.	3	9	.	.						
Dianthus deltoides	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	5	.	31						
Chrysaspis campestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	7	.						
Erophila verna	.	.	.	.	.	.	.	.	.	.	47	.	.	.	100	.	.	.	.	.	.	.	.	.	67	.	.	.	.						
Arabidopsis thaliana	.	.	.	.	.	16	.	5	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Veronica verna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	14	.	.	100	.	.	.	.						
Sedum reflexum	.	.	.	.	.	.	10	5	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Trifolium scabrum	.	.	.	.	.	5	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Sedum spurium	.	.	.	.	.	.	.	5	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.						
Campanula rotundifolia	.	.	.	.	33	.	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.						

continued on separate sheet

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Zu Kuzemko: Dry grasslands on sandy soils in the forest and forest-steppe zones of the plains part of Ukraine: present state of syntaxonomy

Table 1 (part 3): Synoptic table of the dry grassland vegetation of sandy soils in the forest and forest-steppe zones of the plains region of Ukraine. Differential species of associations (D; including potential character species) are shaded in dark grey and character species (Ch) of higher syntaxa in light grey. Taxa within differential species blocks are arranged by their constancy in the differentiated syntaxon, while taxa within character species blocks are arranged by their total constancy. Non-diagnostic "Other species" are sorted alphabetically. "?" denotes unknown values.

Tab. 1 (Teil 3): Stetigkeitstabelle von Sandtrockenrasen in der Wald- und Waldsteppenzone des ukrainischen Flachlandes. Differenzialarten von Assoziationen (D; einschließlich möglicher Assoziationskennarten) sind dunkelgrau hinterlegt, Charakterarten höherer Syntaxa hellgrau. Innerhalb der Differenzialartenblöcke sind die Arten nach fallender Stetigkeit im jeweiligen Block, ansonsten nach fallender Gesamtstetigkeit angeordnet. Nicht diagnostische sonstige Arten sind alphabetisch angeordnet. Das „?" steht für fehlende Daten.

Class	*Festuco-Brometea*			*Koelerio-Corynephoretea*																										*Molinio-Arrhenatheretea*			
Final designation of association (see classification scheme in the Section 5.4)	FB1.1.1	FB1.1.2	FB1.1.3	KC1.1.1	KC1.1.2	KC2.1.1						KC3.1.1		KC3.1.2	KC4.1.1	KC4.1.2					KC4.2.1			KC4.2.2		KC4.2.3	MA1.1.1			MA?	
Original designation of association (see Table 1)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	FV8	KC1	KC3	KC4	FV7	SS11	FV5	FV1b	FV2b	FV4	FV3	FV6	FV2a	FV1a	SS12	AV1	AV2	AV3	KC2	
Ch *Agrostion vinealis*																																
Agrostis vinealis	.	.	.	.	.	.	.	.	.	.	.	27	.	.	100	9	.	33	.	23	.	14	.	10	.	98	82	100	91			
Carex praecox	.	.	.	.	.	5	.	.	.	.	.	9	.	.	.	.	.	.	.	8	.	.	.	.	.	70	14	75	.			
Koeleria delavignei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	27	21	.			
Rumex thyrsiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	.	.	.	.	.	.	.	.	.	34	18	43	.			
Euphorbia virgultosa	.	.	.	.	.	.	.	.	.	.	.	14	67	.	18	.	11	.	31	.	.	.	.	.	.	10	9	39	.			
Amoria montana	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	23	11	.			
Ch *Molinio-Arrhenatheretea*																																
Achillea millefolium	.	.	.	33	.	32	20	57	47	16	.	2	55	100	.	18	.	55	.	15	50	14	20	10	.	80	91	46	91			
Plantago lanceolata	.	.	.	.	.	21	30	33	7	.	.	9	67	60	27	.	.	.	.	.	.	.	.	30	33	54	55	54	51			
Agrostis tenuis	.	.	.	.	.	.	10	29	7	.	.	13	27	.	.	.	13	.	.	.	.	43	.	.	.	11	9	4	71			
Taraxacum officinale	.	.	10	17	.	.	10	5	.	.	.	.	.	.	9	.	.	.	.	.	.	29	.	.	.	8	27	7	91			
Rumex acetosa	.	.	.	.	.	11	.	.	.	.	.	7	18	33	.	.	.	.	.	15	25	.	.	.	.	8	23	7	.			
Carex hirta	.	.	.	.	.	.	.	14	.	.	.	2	55	67	.	.	.	.	.	.	25	.	.	.	.	3	18	21	11			
Poa pratensis	.	.	.	.	.	.	10	19	.	11	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	20	18	39	31			
Festuca pratensis	.	.	.	8	17	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	18	21	.			
Festuca rubra	.	.	.	.	.	.	.	.	.	5	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	33	32	14	91			
Lotus corniculatus	.	.	.	.	.	21	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26	55	14	71			
Stellaria graminea	.	.	.	.	.	.	.	.	.	.	.	7	.	.	9	.	.	.	.	.	.	.	.	.	.	52	36	11	.			
Medicago lupulina	.	.	.	.	.	.	.	5	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	27	7	.			
Amoria repens	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16	14	32	91			
Arrhenatherum elatius	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	11	.			
Dactylis glomerata	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	9	14	.			
Alopecurus pratensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	11	9	32	.			
Deschampsia cespitosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	4	91			
Leucanthemum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	18	21	11			
Prunella vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	50	25	71			
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	41	11	31			
Veronica chamaedrys	.	.	.	.	.	5	.	.	.	.	.	7	.	.	.	.	.	.	.	.	25	.	.	.	.	.	23	.	.			
Potentilla anserina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	11	31			
Stellaria hippoctona	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	18	.			
Allium angulosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	9	21	.			
Centaurea jacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	14	14	.			
Cerastium holosteoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	14	11	.			
Coccyganthe flos-cuculi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	9	7	.			
Leontodon autumnalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	9	14	.			
Ranunculus acris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	36	18	.			
Phleum pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	5	11	.			
Plantago major	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	7	5			
Vicia cracca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	7	.	21	.			
Rumex crispus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	14	3			
Anthoxanthum odoratum	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	51			
Briza media	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.			
Ranunculus polyanthemos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	27	.	.			
Agrostis gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	14	.			
Carex lachenalii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	11	.			
Galium boreale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	4	.			
Gratiola officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	18	.			
Potentilla erecta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.			
Ranunculus repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	4	.			
Inula britannica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	11	.			
Juncus atratus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	11	.			
Poa palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	4	.			
Amoria hybrida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	18	.			
Mentha arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.			
Widespread species of dry grassland and dry ruderal communities																																
Galium verum	10	30	70	8	.	74	10	29	7	21	.	.	9	.	80	18	.	11	.	46	50	.	20	10	.	66	50	21	.			
Poa angustifolia	10	10	10	8	.	27	.	5	.	11	.	7	.	.	.	18	.	22	.	31	50	.	.	10	33	67	27	46	51			
Potentilla argentea	.	.	30	.	.	95	70	57	87	53	.	7	91	.	.	55	25	33	.	23	50	.	40	.	.	66	55	46	71			
Verbascum lychnitis	30	.	10	17	.	58	30	10	27	26	.	13	18	100	.	27	.	.	.	38	100	.	.	.	.	.	18	7	.			
Hieracium pilosella	.	.	.	8	.	5	30	38	27	.	.	4	64	.	.	9	13	.	.	.	25	71	.	30	.	5	27	.	51			
Calamagrostis epigeios	.	.	.	.	.	.	.	.	7	.	.	27	73	.	10	63	13	22	.	54	75	86	40	40	.	43	18	100	.			
Echium vulgare	10	50	30	14	.	21	20	10	27	16	.	.	18	33	.	.	13	.	.	.	.	.	.	.	.	3	23	.	.			
Artemisia absinthium	.	.	30	25	.	5	10	24	53	16	.	.	27	33	.	.	13	.	.	.	.	.	.	.	33	.	14	.	.			
Berteroa incana	.	.	.	.	.	84	40	14	60	53	.	.	45	100	.	18	13	.	.	.	.	.	60	40	.	15	23	18	.			
Vicia tetrasperma	.	.	.	.	.	21	.	10	13	5	.	.	.	.	.	36	13	22	.	.	.	.	.	.	.	11	36	7	.			
Vincetoxicum hirundinaria	.	10	.	33	17	.	.	57	27	.	.	7	.	.	.	.	.	.	.	23	25	14	.	.	.	.	.	.	.			
Conyza canadensis	.	.	.	.	.	.	.	.	7	.	.	.	14	.	.	.	.	44	40	15	.	57	20	10	100	8	5	18	.			
Oenothera biennis	.	.	.	.	.	.	.	10	.	.	.	13	45	33	.	.	.	44	40	.	.	.	.	.	.	7	.	18	.			
Veronica spicata	.	.	.	.	33	16	20	14	.	5	.	.	.	.	.	9	25	22	80	46	.	14	.	.	.	11	23	14	.			
Hypericum perforatum	.	.	10	25	.	26	.	29	27	.	.	67	18	.	.	.	.	.	.	8	.	.	.	.	.	5	27	7	.			
Elytrigia repens	.	.	.	.	.	11	20	10	13	.	.	13	18	.	.	9	25	.	.	.	.	.	.	.	.	20	32	32	.			
Artemisia austriaca	.	.	10	.	.	63	30	.	.	37	.	.	.	.	.	9	25	.	.	.	.	.	.	40	.	3	14	7	.			
Phalacroloma annuum	.	.	.	8	.	5	10	14	7	11	.	.	9	33	.	.	13	.	.	.	.	.	.	.	.	.	18	.	.			
Genista tinctoria	.	.	.	.	.	.	.	.	7	.	.	2	55	67	.	9	.	.	.	1	.	.	.	.	.	7	5	11	.			
Anthericum ramosum	.	70	.	.	17	.	10	.	13	.	.	27	.	.	.	.	.	.	.	8	.	.	.	.	.	.	2	.	4	.			
Artemisia marschalliana	50	70	30	.	.	.	.	.	.	.	.	.	.	.	.	27	.	.	.	38	.	14	.	.	33	.	.	7	.			
Other species																																
Achillea nobilis	.	.	.	.	.	5	10	5	.	16	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.			
Achillea setacea	.	.	.	.	.	11	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.			
Agropyron pectinatum	10	.	.	.	.	.	.	.	.	21	.	.	.	.	.	.	.	.	.	.	.	.	40	10	.	.	.	.	.			
Ajuga genevensis	.	.	.	.	.	.	.	19	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	23	.	.			
Ajuga orientalis	.	.	.	.	.	.	20	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Allium waldsteinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	2	.	.	.			
Anthemis subtinctoria	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Apera spica-venti	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	10	.	.	.	.	.			
Arctium nemorosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	10	.	.	.	.	.			
Aristolochia clematitis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	33	.	.	.	.	.	10	.	.	.	25	.			
Artemisia vulgaris	.	.	.	.	.	.	.	5	.	5	.	13	.	.	.	.	25	.	.	.	.	.	.	.	.	.	14	7	.			
Asclepias syriaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	2	.	.	.			
Asplenium septentrionale	.	.	.	.	.	16	.	24	53	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Asplenium trichomanes	.	.	.	.	.	16	20	5	27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Astragalus sulcatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	20	10	.	.	.	.	.			
Beckmannia eruciformis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	4	.			
Betula pendula	.	.	.	.	.	.	.	.	.	.	.	33	9	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.			
Bromopsis inermis	.	.	.	.	.	.	.	5	.	5	.	.	.	.	.	18	.	.	40	.	.	.	.	.	.	8	18	39	.			
Bromus japonicus	.	.	.	.	.	5	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Bromus mollis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	4	31			
Bromus secalinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27	25	.	.	.	.	.	.	.	.	.	.	.	.			
Bromus squarrosus	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	18	.	.	.	.	.	.	.	.	67	.	.	.	.			
Campanula bononiensis	.	.	.	.	.	16	.	.	7	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Campanula persicifolia	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.			
Campanula rapunculoides	.	.	.	8	.	.	10	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Carduus acanthoides	.	.	10	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Carex contigua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	14	.	.			
Chelidonium majus	.	.	.	.	.	5	.	5	7	5	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	.	.	.	.			
Chenopodium album	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.			
Chrysaspis aurea	.	.	.	.	.	.	10	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.			
Cichorium intybus	10	30	.	.	.	11	.	5	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	9	4	.			
Clematis recta	.	.	.	17	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Clinopodium vulgare	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.			
Convallaria majalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.	.	.	.	2	.	.	.			
Convolvulus arvensis	10	.	30	.	.	11	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23	.	.			
Cotoneaster melanocarpus	.	.	30	.	.	.	.	10	13	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Crepis tectorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50	9	.	11	20	.	.	29	.	.	67	10	5	32	.			
Cystopteris fragilis	.	.	.	.	.	.	10	5	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
Daucus carota	.	.	30	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	11	.			

continued on the back side

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Table 1 (part 4)

Class	*Festuco-Brometea*			*Koelerio-Corynephoretea*																										*Molinio-Arrhenatheretea*			
Final designation of association (see classification scheme in the Section 5.4)	FB1.1.1	FB1.1.2	FB1.1.3	KC1.1.1	KC1.1.2	KC2.1.1					KC3.1.1		KC3.1.2	KC4.1.1	KC4.1.2				KC4.2.1			KC4.2.2		KC4.2.3	MA1.1.1			MA?
Original designation of association (see Table 1)	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	FV8	KC1	KC3	KC4	FV7	SS11	FV5	FV1b	FV2b	FV4	FV3	FV6	FV2a	FV1a	SS12	AV1	AV2	AV3	KC2
Dianthus pseudosquarrosus	.	.	.	17	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryopteris carthusiana	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	29	.	.	.	.	.	.	.
Echinops sphaerocephalus	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Equisetum arvense	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	20	23	21	.
Equisetum pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	4	.
Erigeron acris	.	.	.	.	.	.	.	.	.	.	2	9	.	.	.	.	.	.	.	.	.	.	.	.	2	14	.	.
Eryngium planum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27	25	.	.	.	.	.	20	.	.	10	14	11	.
Euonymus europaea	.	.	.	8	.	.	.	5	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia virgata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	7	.
Falcaria vulgaris	10	10	10	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fallopia convolvulus	.	.	8	.	5	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Festuca pseudovina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	4	.
Fragaria vesca	.	.	.	.	.	.	10	7	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	2	.	.	.
Frangula alnus	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	.	.	.	.
Galium aparine	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	4	.
Galium campanulatum	50	.	.	67	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium exoletum	10	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Glechoma hederacea	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	14	4	.
Gypsophila paniculata	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	20	.	.	.	.	.	.
Hieracium vaillantii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	8	.	.	.	.	.	.	.	.	.
Hierochloe odorata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	8	50	.	.	.	.	3	.	.	.
Humulus lupulus	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.
Hylotelephium telephium agg.	.	.	.	.	.	.	.	.	.	.	.	18	.	60	.	.	.	.	.	.	.	.	.	.	25	.	22	.
Juncus bufonius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	4	.
Lamium album	.	.	.	.	.	.	5	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium purpureum	.	.	.	.	.	.	.	7	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria vulgaris	.	.	8	.	.	10	.	.	.	.	.	9	.	.	.	.	.	.	8	.	14	.	10	.	3	5	.	.
Luzula pallidula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	25	.	.	.	.	2	.	.	.
Melandrium album	.	.	.	.	.	.	.	7	.	.	.	9	33	.	.	.	.	.	.	.	14	20	10	.	3	5	.	.
Melilotus albus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	2	.	.	.
Melilotus officinalis	30	10	.	8	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis arvensis	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Orchis coriophora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	4	.
Origanum vulgare	.	.	.	.	.	.	20	14	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Persicaria maculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	7	.
Petasites spurius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	25	.	20	.	.	.	.	.	.	.	.	.	.
Phlomoides tuberosa	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.
Pimpinella saxifraga	.	.	.	.	.	.	5	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.
Pinus sylvestris (juv.)	.	.	.	.	.	.	.	.	.	.	67	45	67	.	.	.	.	.	23	.	86	.	.	.	.	5	.	.
Planiago media	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	32	4	.
Poa nemoralis	.	.	.	.	.	10	14	27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	23	.	.
Polygonatum odoratum	10	.	.	8	.	.	.	.	.	.	.	9	.	.	.	.	.	.	8	.	14	.	.	.	.	.	.	.
Polygonum aviculare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	.	.	18	.
Polypodium vulgare	.	.	.	.	.	.	5	7	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	.	.	.	.
Potentilla impolita	.	.	.	.	.	.	.	.	.	5	.	.	.	.	9	.	.	.	.	.	.	.	.	67	5	23	7	.
Potentilla reptans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	5	.	.
Prunus spinosa	10	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pteridium aquilinum	.	.	.	.	.	.	5	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus communis	10	.	.	.	5	.	.	7	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Quercus robur (juv.)	.	.	.	.	.	.	5	.	.	.	7	18	.	.	.	.	.	.	.	.	14	.	.	.	.	.	.	.
Ranunculus pedatus	.	.	.	.	.	10	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Reseda lutea	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamnus cathartica	.	.	17	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus aestivalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	9	.	.
Rhinanthus serotinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	.
Rhinanthus vernalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	27	.	.
Rosa canina	.	.	.	.	.	.	.	13	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.
Rumex confertus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	9	7	.
Salix acutifolia (juv.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	20	.	.	.	.	.	.	.	.	7	.
Salvia pratensis	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.	.	.	.	.	14	.	.
Saponaria officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	.	.	10	.	.	5	.	.
Senecio erucifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	25	.	.	.	.	.	40	.	.	.	.	.	.
Senecio jacobaea	.	.	10	.	.	.	.	.	.	.	7	.	33	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
Setaria viridis	.	.	.	.	.	.	5	.	.	.	13	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sideritis comosa	30	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sieglingia decumbens	.	.	.	.	.	.	.	.	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Silene eugeniae	10	.	.	25	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene nutans	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.
Solidago virgaurea	.	.	.	.	.	5	.	5	.	.	47	18	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.
Spergularia rubra	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	51
Spiraea media	.	.	.	.	.	5	.	19	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tanacetum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	45	13	.	.	.	.	.	20	.	.	.	.	32	.
Thymus marschallianus	10	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus moldavicus	.	10	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon major	.	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	4	.
Trifolium alpestre	.	.	.	.	5	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Trifolium medium	10	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum densiflorum	30	10	30	8	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum nigrum	.	10	.	.	.	10	43	.	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Verbascum thapsus	.	.	10	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	40	30	.	.	.	.	.
Veronica incana	.	.	50	58	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica officinalis	.	.	.	.	.	.	.	.	.	.	7	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola arvensis	.	.	.	.	.	11	10	.	7	.	47	9	33	.	.	.	.	.	8	.	.	.	.	.	.	14	.	.
Viola matutina	.	.	.	8	.	.	.	5	.	.	.	.	.	.	.	.	.	.	8	25	.	.	.	.	.	.	.	.
Non-vascular plants:																					.							
Ch *Alysso-Sedetalia*																					.							
Abietinella abietina	?	?	?	25	17	11	.	.	7	21	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Tortella tortuosa	?	?	?	50	17	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Camptothecium lutescens	?	?	?	17	17	.	.	.	.	.	.	.	.	.	?	?	?	?	.	.	?	.	?	?	?	?	?	?
Rhytidium rugosum	?	?	?	17	17	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Encalypta streptocarpa	?	?	?	8	17	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Encalypta vulgaris	?	?	?	8	17	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Pseudoleskeella catenulata	?	?	?	33	.	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Ditrichum flexicaule	?	?	?	.	33	.	.	.	.	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Ch *Trifolio arvensis-Festucetalia ovinae*																												
Hypnum cupressiforme	?	?	?	25	17	53	40	19	7	57	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Grimmia laevigata	?	?	?	.	.	47	70	29	27	47	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Neofusceliaa pulla	?	?	?	.	.	37	10	14	27	11	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Xanthoparmelia somloensis	?	?	?	.	.	37	30	38	33	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Hedwigia ciliata	?	?	?	.	.	16	30	33	40	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Bryum argenteum	?	?	?	8	.	11	.	.	7	21	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Parmelia sulcata	?	?	?	.	.	.	30	24	13	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Cladonia coniocraea	?	?	?	.	.	.	10	10	16	.	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Grimmia pulvinata	?	?	?	.	.	32	.	.	.	37	.	.	.	.	?	?	?	?	?	.	?	.	?	?	?	?	?	?
Ch *Koelerio-Corynephoretea*																												
Polytrichum piliferum	?	?	?	.	.	5	30	48	27	16	67	73	36	67	100	?	?	?	?	8	?	14	?	?	?	?	?	?
Ceratodon purpureus	?	?	?	.	.	47	60	38	60	47	67	7	45	.	100	?	?	?	?	.	?	.	?	?	?	?	?	?
Tortula ruralis	?	?	?	58	17	32	.	5	7	21	.	7	.	.	50	?	?	?	?	.	?	.	?	?	?	?	?	?
Cladonia pyxidata	?	?	?	.	.	11	.	5	7	5	67	.	.	.	10	?	?	?	?	.	?	57	?	?	?	.	?	?
Cladonia foliacea	?	?	?	.	.	.	.	.	.	.	67	.	.	.	90	?	?	?	?	8	?	14	?	?	?	?	?	?
Cladonia arbuscula	?	?	?	.	.	.	.	29	7	.	33	.	.	.	50	?	?	?	?	.	?	.	?	?	?	?	?	?
Cladonia rangiformis	?	?	?	.	.	.	.	14	.	.	67	.	.	.	40	?	?	?	?	.	?	14	?	?	?	?	?	?
Cladonia furcata	?	?	?	.	.	5	.	5	7	.	.	.	.	.	.	?	?	?	?	.	?	86	?	?	?	?	?	?
Pleurozium schreberi	?	?	?	.	.	.	.	10	.	.	7	.	.	.	.	?	?	?	?	.	?	86	?	?	?	?	?	?
Cladonia mitis	?	?	?	.	.	.	.	.	.	.	2	.	.	.	.	?	?	?	?	.	?	100	?	?	?	?	?	?
Cladonia phyllophora	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	?	?	?	?	8	?	86	?	?	?	?	?	?
Cladonia fimbriata	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	?	?	?	?	.	?	86	?	?	?	?	?	?
Polytrichum commune	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	?	?	?	?	.	?	71	?	?	?	?	?	?
Racomitrium canescens	?	?	?	.	.	.	.	.	.	.	33	.	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Peltigera praetextata	?	?	?	.	.	25	.	.	.	.	.	.	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Other species																					?		?	?				
Cladonia coccifera	?	?	?	.	.	.	.	.	.	.	.	27	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Cladonia rangiferina	?	?	?	.	.	.	.	.	.	.	.	53	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Dicranum scoparium	?	?	?	.	.	5	.	10	.	.	.	.	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Grimmia ovalis	?	?	?	.	.	.	20	.	.	11	.	.	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Homalothecium sericeum	?	?	?	25	.	.	.	.	7	32	.	.	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?
Polytrichum juniperinum	?	?	?	.	.	16	.	.	.	5	.	7	.	.	.	?	?	?	?	.	?	.	?	?	?	?	?	?

Species which present only in one column with low constancy (Designation of original syntaxa/percentage constancy).

Vascular plants: *Acer tataricum* (SS10/11), *Adonis vernalis* (SS1/10), *Allium paczoskianum* (FV1a/10), *Allium scorodoprasum* (FV1a/10), *Alnus glutinosa* (j.) (KC1/7), *Alyssum calycinum* (SS4/8), *Alyssum gmelinii* (SS1/10), *Amorpha fruticosa* (j) (AV3/7), *Anchusa officinalis* (AV2/5), *Anemonastrum narcissiflorum* (SS2/10), *Anemone sylvestris* (SS1/10), *Angelica sylvestris* (AV3/4), *Antennaria dioica* (KC1/7), *Anthemis arvensis* (SS11/9), *Anthyllis schwereckii* (SS5/17), *Arenaria serpyllifolia* (SS6/5), *Artemisia abrotanum* (AV1/8), *Artemisia scoparia* (KC1/7), *Aruncus vulgaris* (KC1/7), *Asparagus polyphyllus* (FV1a/10), *Asparagus tenuifolius* (FV5/25), *Astragalus austriacus* (SS1/10), *Astragalus cicer* (AV2/5), *Athyrium filix-femina* (SS8/5), *Atriplex sagittata* (SS4/8), *Bidens tripartita* (AV3/11), *Bromopsis riparia* (SS1/10), *Bromus arvensis* (FV1a/20), *Calluna vulgaris* (KC1/2), *Campanula cervicaria* (AV2/5), *Campanula glomerata* (KC1/7), *Campanula patula* (SS8/5), *Capsella bursa-pastoris* (AV3/4), *Carduus crispus* (SS4/8), *Carex buxbaumii* (AV1/2), *Carex melanostachya* (SS9/7), *Carex michelii* (AV3/4), *Carex muricata* (AV2/18), *Carex panicea* (AV3/7), *Carex vulpina* (AV3/4), *Carlina biebersteinii* (SS2/10), *Centaurea biebersteinii* (FV1a/10), *Centaurea orientalis* (SS1/10), *Centaurium erythraea* (AV2/5), *Cerastium glomeratum* (AV2/14), *Cerasus fruticosa* (SS1/30), *Chamaecytisus blockianus* (SS1/10), *Chamaecytisus borysthenicus* (FV2a/20), *Chamaecytisus podolicus* (SS1/10), *Chrysaspis dubia* (SS11/9), *Cirsium arvense* (AV3/11), *Cirsium palustre* (AV3/4), *Cirsium vulgare* (AV2/5), *Clematis integrifolia* (SS4/8), *Kadenia dubia* (AV1/5), *Cornus mas* (SS3/10), *Crataegus leiomonogyna* (SS4/8), *Cynoglossum officinale* (SS9/7), *Dactylorhiza incarnata* (AV1/2), *Dactylorhiza majalis* (AV2/5), *Dianthus armeria* (AV3/4) , *Dianthus campestris* (AV3/4), *Dianthus carthusianorum* (SS8/19), *Dianthus membranaceus* (SS6/11), *Digitalis grandiflora* (SS6/16), *Digitaria sanguinalis* (FV6/14), *Dryopteris filix-mas* (FV6/29), *Epilobium montanum* (AV2/5), *Eragrostis minor* (SS12/33), *Eremogone saxatilis* (FV4/8), *Erysimum hieracifolium* (SS11/9), *Erysimum pannonicum* (SS4/17), *Euonymus verrucosa* (SS9/7), *Euphrasia stricta* (AV2/5), *Festuca polesica* (KC1/13), *Galium album* (SS2/30), *Galium palustre* (AV3/4), *Galium rubioides* (AV1/2), *Geranium pratense* (AV3/4), *Geranium purpureum* (SS9/7), *Geranium sanguineum* (FV4/8), *Glechoma hirsuta* (AV3/4), *Filaginella uliginosa* (AV3/4), *Heracleum sibiricum* (AV3/4), *Hierochloe repens* (FV5/13), *Pilosella cespitosa* (AV3/4), *Holcus lanatus* (KC1/7), *Holcus mollis* (KC1/7), *Hordeum murinum* (SS10/5), *Hypericum montanum* (FV4/8), *Inula salicina* (AV3/11), *Juncus compressus* (AV3/4), *Juniperus communis* (SS4/17), *Jurinea pachysperma* (SS5/17), *Jurinea thyrsiflora* (FV1a/10), *Lactuca chaixii* (FV6/57), *Lactuca serriola* (SS4/8), *Lappula squarrosa* (SS1/10), *Lavatera thuringiaca* (SS3/10), *Leontodon danubialis* (SS8/10), *Leonurus quinquelobatus* (SS4/8), *Lepidium campestre* (KC3/9), *Linum catharticum* (SS4/17), *Linum flavum* (SS1/10), *Lithospermum officinale* (SS6/5), *Lolium perenne* (AV2/5), *Luzula campestris* (SS7/10), *Luzula multiflora* (AV2/9), *Luzula pilosa* (KC3/9), *Lycium barbatum* (SS10/5), *Lysimachia nummularia* (AV1/5), *Lysimachia vulgaris* (AV3/4), *Lythrum virgatum* (AV3/11), *Malva sylvestris* (KC2/11), *Medicago minima* (SS3/10), *Melampyrum arvense* (SS4/17), *Melampyrum nemorosum* (KC3/18), *Melampyrum polonicum* (FV4/8), *Melampyrum pratense* (KC17), *Melica nutans* (FV4/8), *Milium effusum* (AV3/7), *Mycelis muralis* (FV6/57), *Myosotis arvensis* (AV1/2), *Myosotis cespitosa* (AV1/2), *Nepeta cataria* (SS8/5), *Onopordum acanthium* (FV5/13), *Oxytropis pilosa* (SS4/8), *Petasites hybridus* (AV3/11), *Phalaroides arundinacea* (AV3/4), *Polygala podolica* (AV2/5), *Persicaria minor* (AV3/4), *Populus tremula* (KC1/7), *Potentilla heptaphylla* (AV3/4), *Potentilla obscura* (SS6/11), *Ptarmica cartilaginea* (AV3/14), *Pulsatilla patens* (FV4/8), *Ranunculus auricomus* (AV1/3), *Ranunculus flammula* (AV3/7), *Rhinanthus minor* (AV1/2), *Rorippa austriaca* (AV2/9), *Rorippa sylvestris* (AV3/4), *Rosa porrectidens* (SS4/8), *Rubus caesius* (AV3/4), *Sagina procumbens* (KC1/7), *Salix triandra* (j) (AV3/4), *Salvia nutans* (SS2/10), *Sambucus ebulus* (AV2/5), *Saxifraga tridactylites* (SS5/17), *Scirpoides holoschoenus* (SS11/9), *Schivereckia podolica* (SS4/17), *Scolochloa festucacea* (AV3/4), *Scrophularia nodosa* (AV1/2), *Senecio vulgaris* (FV6/29), *Seseli campestre* (FV5/25), *Sesleria heufleriana* (SS1/10), *Silene chlorantha* (SS3/10), *Silene lithuanica* (SS9/13), *Silene viscosa* (SS4/8), *Solanum dulcamara* (FV6/14), *Sorbus aucuparia* (FV6/14), *Spergula morisonii* (FV8/7), *Stachys officinalis* (AV1/3), *Stellaria media* (AV2/5), *Stipa borysthenica* (FV4/23), *Succisa pratensis* (SS10/5), *Swida sanguinea* (SS1/10), *Taeniopetalum arenarium* (FV4/15), *Teucrium pannonicum* (SS1/10), *Thalictrum flavum* (AV2/5), *Thalictrum lucidum* (AV1/2), *Thalictrum simplex* (AV1/2), *Thesium arvense* (FV4/8), *Thesium ebracteatum* (FV4/15), *Thesium linophyllon* (SS1/10), *Tragopogon orientalis* (KC1/7), *Tribulus terrestris* (FV1a/10), *Trisetum sibiricum* (AV3/4), *Turritis glabra* (FV4/15), *Ulmus minor* (SS10/5), *Urtica dioica* (SS4/25), *Valerianella coronata* (FV5/13), *Verbascum phlomoides* (SS12/67), *Veronica arvensis* (KC1/7), *Veronica jacquinii* (SS3/10), *Veronica prostrata* (SS4/8), *Veronica scutellata* (AV3/7), *Veronica teucrium* (AV2/5), *Veronica triphyllos* (SS8/14), *Vicia villosa* (FV2a/20), *Viola canina* (AV1/5), *Viola hirta* (SS2/10), *Viola reichenbachiana* (KC1/7), *Viola rupestris* (SS4/8), *Xanthium strumarium* (AV1/2), **Non-vascular plants:** *Bryum subelegans* (SS4/8), *Cetraria islandica* (KC1/7), *Cladonia alpina* (KC1/4), *Cladonia degenerans* (FV8/27), *Cladonia polydactyla* (KC1/2), *Climacium dendroides* (KC1/7), *Diploschistes scruposus* (SS6/11), *Encalypta rhaptocarpa* (SS4/8), *Funaria hygrometrica* (KC1/7), *Hypnum vaucheri* (SS5/17), *Leucodon sciuroides* (SS4/8), *Orthotrichum anomalum* (SS4/8), *Peltigera canina* (SS6/5), *Pogonatum urnigerum* (SS6/5), *Porella platyphylla* (SS4/17), *Pseudoleskeella tectorum* (SS5/17), *Ramalina pollinaria* (SS10/5), *Schistidium trichodon* (SS4/8), *Tortula subulata* (SS10/5), *Trinia multicaulis* (SS4/8).

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Zeitschrift/Journal: Tuexenia - Mitteilungen der Floristisch-soziologischen Arbeitsgemeinschaft

Jahr/Year: 2009

Band/Volume: NS_29

Autor(en)/Author(s): Kuzemko Anna

Artikel/Article: Dry grasslands on sandy soils in the forest and forest-steppe zones of the plains region of Ukraine: present state of syntaxonomy 369-390