

**Novák P., Willner W., Zukal D., Kollár J., Roleček J., Świerkosz K., Ewald J., Wohlgemuth T., Csiky J., Onyshchenko V. & Chytrý M. (2020) Oak-hornbeam forests in central Europe: a formalized classification and syntaxonomic revision. – Preslia 92: 1–34**

Electronic Appendix 1. Data sources.

### **Data obtained from the European Vegetation Archive**

EU-AT-001 Austrian Vegetation Database (688 plots)

Custodian: Wolfgang Willner, Deputy Custodian: Christian Berg

EU-CZ-001 Czech National Phytosociological Database (1,754 plots)

Custodian: Milan Chytrý, Deputy Custodian: Ilona Knollová

EU-CH-005 Swiss Forest Vegetation Database (250 plots)

Custodian: Thomas Wohlgemuth

EU-FR-003 SOPHY (83 plots)

Custodian: Henry Brisse, Deputy Custodian: Patrice de Ruffray

EU-FR-005 EcoPlant (3 plots)

Custodian: Jean-Claude Gégout, Deputy Custodian: Ingrid Seynave

EU-DE-001 VegMV (227 plots)

Custodian: Florian Jansen, Deputy Custodian: Christian Berg

EU-DE-013 VegetWeb (139 plots)

Custodian: Florian Jansen, Deputy Custodian: Jörg Ewald

EU-DE-014 GVRD Vegetation Reference Database Halle (746 plots)

Custodian: Ute Jandt, Deputy Custodian: Helge Bruelheide

EU-HU-003 CoenoDat Hungarian Phytosociological Database (215 plots)

Custodian: János Csiky, Deputy Custodian: Zoltán Botta-Dukát

EU-PL-001 Polish Vegetation Database (1,156 plots)

Custodian: Zygmunt Kącki, Deputy Custodian: Grzegorz Swacha

EU-SK-001 Slovak Vegetation Database (680 plots)

Custodian: Milan Valachovič, Deputy Custodian: Jozef Šibík

EU-UA-006 Vegetation database of Ukraine and adjacent parts of Russia (11 plots)

Custodian: Viktor Onyshchenko, Deputy Custodian: Vitaliy Kolomiychuk

### **Other sources**

Jan Roleček (225 original plots sampled in the field)

Novák et al. 2017 (35 plots digitized from the paper)

Numbers of relevés per country

<b>Country</b>	<b>Number of relevés</b>
Austria	692
Czech Republic	1,699
Germany	1,119
Hungary	438
Luxembourg	26
Poland	1,159
Slovakia	729
Switzerland	304
Ukraine	46
$\Sigma$	6,212

References

Novák P., Zukal D., Večeřa M. & Píšířková K. (2017) Vegetation of oak-hornbeam, scree and ravine forests at lower altitudes in Transcarpathia, Western Ukraine. – *Tuexenia* 37: 47–63.

## Electronic Appendix 2. GRIMP-based expert system.

Here we provide a brief description of the GRIMP procedure (Tichý et al. 2019) used to obtain the lists of diagnostic species of oak-hornbeam forest vegetation in the context of other seven major types of central European deciduous forest vegetation. The final version of the GRIMP-based expert system is also provided. All the analyses were performed using Juice 7.0 (Tichý 2002).

We used a dataset of 41,592 relevés obtained from the databases cited in Electronic Appendix 1. Nomenclature of vascular plants was generally unified according to the Euro+Med PlantBase ([www.emplantbase.org](http://www.emplantbase.org); accessed August 2018). Prior to the analyses, all the records of the same taxon in different vegetation layers were merged into a single layer. Only relevés with syntaxonomic classification on the association or alliance level provided in the original databases or publications were involved since the assignments to syntaxa were necessary for the next steps of the preparation of the GRIMP expert system. According to the authors' classification, we sorted relevés into eight principal deciduous forest vegetation types:

**F01 – Oak-hornbeam forests (*Carpinetalia betuli*)**

F02 – Scree and ravine forests (*Aceretalia*)

F03 – Beech forests (*Fagetalia + Luzulo-Fagetalia*)

F04 – Acidophytic oak forests (*Quercetea robori-petraeae*)

F05 – Thermophytic oak forests (*Quercetea pubescentis*)

F06 – Alluvial forests (*Alno-Fraxinetalia*)

F07 – Swamp forests (*Alnetea glutinosae*)

F08 – Willow riparian forests (*Salicetea purpureae*)

To avoid major misclassifications in the original sources, relevés had to fulfil conditions based on the total cover of groups of typical tree species recognized as important for certain forest vegetation types. For *Carpinetalia betuli*, relevés were included only if a total cover of *Acer campestre*, *A. platanoides*, *Carpinus betulus*, *Quercus petraea*, *Q. robur*, *Tilia cordata* and *Ulmus minor* was higher than 25%. Other relevés (n = 1,173) were excluded. At the same time, the total cover of other groups of tree species typical of the seven other vegetation types could not exceed 75%. After this step, the whole dataset contained 41,592 relevés. Then, for each vegetation type, we prepared a list of diagnostic species ( $\phi > 0.05$ , sizes of all groups were virtually standardized according to Tichý & Chytrý 2006). The number of diagnostic species ranged between 113–167 species per vegetation type. Some species were jointly diagnostic for more than one type.

Afterwards, the first classification cycle was performed. A relevé was classified into a vegetation type when the sum of square-rooted percentage cover of diagnostic species for this type was higher than the sum of square-rooted percentage cover of diagnostic species for the other seven types. As an additional condition, a relevé had to be dominated by tree species typical of this vegetation type.

This enabled to distinguish three types of classifications of a relevé:

1) **correct classification** – a relevé was classified to the same vegetation type as indicated by the original authors' classification.

2) **misclassification** – a relevé was classified to another vegetation type than indicated by the original authors' classification.

3) **no classification** – a relevé was not classified to any of the vegetation types. It was a frequent situation when a relevé fulfilled the first part of the definition (diagnostic species) but failed to fulfil the second part (dominant tree species).

After the first cycle, we obtained 82.4% of correctly classified relevés, 12.3% of misclassified relevés and 5.3% of unclassified relevés.

The GRIMP optimization process started afterwards. It was based on iterative removals of certain species from the lists of diagnostic species aiming at improving the number of correct classifications. After 10,000 cycles, the number of correctly classified relevés was not changing significantly. After this optimization of species groups, we had 87.8% of correctly classified relevés, 9.3% misclassified relevés and 3% of unclassified relevés. Based on these results, we prepared the following GRIMP-based expert system for classification of relevés into the eight main deciduous forest vegetation types of central Europe. The syntax used in the expert system is explained in Tichý et al. (2019). This expert system was used to select relevés of oak-hornbeam forests for subsequent analyses. It can be run in the Juice 7.0.210 program after being transformed into plain text (.txt) format.

#### GRIMP-based expert system

##### SECTION 1: Species aggregation

Achillea millefolium aggr.	-
0	
Achillea collina	0
Achillea millefolium	0
Achillea pannonica	0
Achillea setacea	0
Carex muricata aggr.	-
0	
Carex divulsa	0
Carex muricata	0
Carex spicata	0
Dryopteris affinis aggr.	-
0	
Dryopteris affinis	0
Dryopteris affinis × borreri	0
Dryopteris borreri	0
Molinia caerulea aggr.	-
0	
Molinia arundinacea	0
Molinia caerulea	0
Polypodium vulgare aggr.	-
0	
Polypodium interjectum	0
Polypodium vulgare	0

Pulmonaria officinalis aggr.	-
0	
Pulmonaria obscura	0
Pulmonaria officinalis	0
Quercus petraea aggr.	-
0	
Quercus dalechampii	0
Quercus petraea	0
Rubus fruticosus aggr.	-
0	
Rubus hirtus	0
Rubus serpens	0
Rubus sulcatus	0
Senecio nemorensis aggr. .	-
0	
Senecio hercynicus	0
Senecio nemorensis subsp. jacquinianus	0
Senecio ovatus	0
Stellaria media aggr.	-
0	
Stellaria media	0
Stellaria neglecta	0
Stellaria pallida	0
Sorbus aria aggr.	-
0	
Sorbus aria	0
Sorbus aria × torminalis	0
Sorbus bohemica	0
Sorbus graeca	0
Sorbus latifolia	0
Sorbus mougeotii	0
Sorbus semiincisa	0
Veratrum album aggr.	-
0	
Veratrum album	0
Veratrum lobelianum	0
Veronica hederifolia aggr.	-
0	
Veronica hederifolia	0
Veronica sublobata	0

SECTION 1: End

SECTION 2: Species groups

##Q +01 Alnglu

Agrostis canina  
Agrostis gigantea  
Agrostis stolonifera  
Alisma plantago-aquatica  
Alnus glutinosa  
Alopecurus geniculatus  
Angelica sylvestris  
Athyrium filix-femina  
Avenella flexuosa  
Betula pubescens  
Calamagrostis canescens  
Callitriche palustris  
Caltha palustris  
Cardamine amara  
Cardamine pratensis  
Carduus acanthoides  
Carex acuta  
Carex acutiformis  
Carex brizoides  
Carex canescens  
Carex cespitosa  
Carex disticha  
Carex echinata  
Carex elata  
Carex elongata  
Carex lasiocarpa  
Carex paniculata  
Carex remota  
Carex riparia  
Carex rostrata  
Carex vesicaria  
Circaea alpina  
Cirsium oleraceum  
Cirsium palustre  
Crepis paludosa  
Deschampsia cespitosa  
Dryopteris carthusiana  
Epilobium hirsutum  
Equisetum arvense  
Equisetum fluviatile  
Equisetum palustre  
Equisetum sylvaticum  
Equisetum x litorale  
Erechtites hieracifolius

Eriophorum angustifolium  
Eupatorium cannabinum  
Filipendula ulmaria  
Frangula alnus  
Galium palustre  
Galium uliginosum  
Geum rivale  
Glyceria fluitans  
Holcus lanatus  
Hottonia palustris  
Humulus lupulus  
Hydrocharis morsus-ranae  
Chrysosplenium alternifolium  
Chrysosplenium oppositifolium  
Juncus effusus  
Lemna minor  
Lycopus europaeus  
Lysimachia vulgaris  
Lythrum salicaria  
Mentha aquatica  
Menyanthes trifoliata  
Myosotis laxa  
Myosotis scorpioides  
Myosoton aquaticum  
Osmunda regalis  
Persicaria hydropiper  
Persicaria minor  
Peucedanum palustre  
Phragmites australis  
Poa trivialis  
Prunus padus  
Ranunculus flammula  
Ranunculus lingua  
Ranunculus repens  
Ribes nigrum  
Rumex hydrolapathum  
Salix aurita  
Salix cinerea  
Scirpus sylvaticus  
Silaum silaus  
Solanum dulcamara  
Sonchus arvensis  
Sparganium emersum  
Spirodela polyrhiza  
Stellaria alsine

Stellaria palustris  
Urtica dioica  
Valeriana dioica  
Valeriana excelsa  
Veronica beccabunga  
Viola palustris

##Q +01 Alninc

Aegopodium podagraria  
Ajuga reptans  
Alchemilla vulgaris  
Allium ursinum  
Alnus glutinosa  
Alnus incana  
Anemone nemorosa  
Angelica sylvestris  
Arabidopsis halleri  
Asarum europaeum  
Athyrium filix-femina  
Avenella flexuosa  
Bistorta officinalis  
Brachypodium sylvaticum  
Calamagrostis canescens  
Caltha palustris  
Cardamine amara  
Carduus personata  
Carex acutiformis  
Carex brizoides  
Carex pendula  
Carex remota  
Carex strigosa  
Carex sylvatica  
Circaea alpina  
Circaea lutetiana  
Circaea x intermedia  
Cirsium helenioides  
Cirsium oleraceum  
Cirsium palustre  
Cirsium rivulare  
Colchicum autumnale  
Crataegus x media  
Crepis paludosa  
Dactylorhiza fuchsii  
Dactylorhiza maculata  
Doronicum austriacum

Elymus caninus  
Equisetum hyemale  
Equisetum palustre  
Equisetum pratense  
Equisetum sylvaticum  
Euonymus europaeus  
Eupatorium cannabinum  
Ficaria verna  
Filipendula ulmaria  
Fraxinus angustifolia  
Fraxinus excelsior  
Gagea spathacea  
Galium aparine  
Geranium phaeum  
Geranium robertianum  
Geum rivale  
Geum urbanum  
Glechoma hederacea  
Glyceria fluitans  
Chaerophyllum aromaticum  
Chrysosplenium alternifolium  
Impatiens noli-tangere  
Jacobaea subalpina  
Juncus effusus  
Lamium maculatum  
Lycopus europaeus  
Lysimachia nemorum  
Lysimachia vulgaris  
Miliun effusum  
Myosotis nemorosa  
Myosotis scorpioides  
Neottia ovata  
Paris quadrifolia  
Petasites albus  
Petasites hybridus  
Petasites kablikianus  
Poa remota  
Poa trivialis  
Primula elatior  
Prunella vulgaris  
Prunus padus  
Ranunculus aconitifolius  
Ranunculus lanuginosus  
Ranunculus repens  
Ribes rubrum

Rubus caesius  
Rubus idaeus  
Rumex conglomeratus  
Rumex sanguineus  
Salix myrsinifolia  
Schedonorus giganteus  
Silene dioica  
Silene flos-cuculi  
Stachys sylvatica  
Stellaria nemorum  
Telekia speciosa  
Thalictrum alpinum  
Tussilago farfara

##Q +01 Carbet

Adoxa moschatellina  
Aegonychon purpurocaeruleum  
Aegopodium podagraria  
Ajuga reptans  
Anemone nemorosa  
Asarum europaeum  
Astragalus glycyphyllos  
Betula pendula  
Brachypodium sylvaticum  
Bromopsis benekenii  
Calamagrostis arundinacea  
Campanula persicifolia  
Campanula trachelium  
Carex digitata  
Carex muricata aggr.  
Carex pilosa  
Carpinus betulus  
Clinopodium vulgare  
Cornus sanguinea  
Corydalis solida  
Crataegus laevigata  
Crataegus monogyna  
Cruciata glabra  
Dactylis glomerata  
Daphne mezereum  
Epilobium lanceolatum  
Euonymus europaeus  
Euonymus verrucosus  
Euphorbia amygdaloides  
Euphorbia dulcis

Ficaria verna  
Fragaria moschata  
Fragaria vesca  
Gagea lutea  
Galanthus nivalis  
Galium intermedium  
Galium sylvaticum  
Geum urbanum  
Glechoma hirsuta  
Hepatica nobilis  
Hieracium murorum  
Hieracium racemosum  
Hypericum hirsutum  
Isopyrum thalictroides  
Knautia drymeia  
Lathyrus linifolius  
Lathyrus niger  
Lathyrus vernus  
Ligustrum vulgare  
Lilium martagon  
Maianthemum bifolium  
Melampyrum nemorosum  
Melica nutans  
Melica uniflora  
Melittis melissophyllum  
Miliium effusum  
Neottia nidus-avis  
Orchis pallens  
Platanthera bifolia  
Poa nemoralis  
Polygonatum multiflorum  
Populus tremula  
Potentilla sterilis  
Primula veris  
Prunus avium  
Pulmonaria obscura  
Pulmonaria officinalis  
Quercus petraea aggr.  
Quercus robur  
Ranunculus lanuginosus  
Sanicula europaea  
Sorbus torminalis  
Stellaria holostea  
Symphytum tuberosum  
Tilia cordata

Veronica hederifolia aggr.  
Veronica chamaedrys  
Vicia sepium  
Vinca minor  
Viola mirabilis  
Viola reichenbachiana  
Viola riviniana  
Waldsteinia geoides

##Q +01 Fagsyl

Abies alba  
Acer pseudoplatanus  
Actaea spicata  
Adenostyles alliariae  
Adenostyles alpina  
Anemone nemorosa  
Anemone trifolia  
Aquilegia vulgaris  
Athyrium filix-femina  
Atropa bella-donna  
Bellidiastrum michelii  
Calamagrostis varia  
Campanula scheuchzeri  
Cardamine bulbifera  
Cardamine enneaphyllos  
Cardamine glanduligera  
Cardamine heptaphylla  
Cardamine trifolia  
Carex alba  
Carex digitata  
Carex flacca  
Carex ornithopoda  
Carex pilulifera  
Carex sylvatica  
Cyanus montanus  
Cephalanthera damasonium  
Cephalanthera rubra  
Clematis alpina  
Corallorhiza trifida  
Cyclamen purpurascens  
Cypripedium calceolus  
Daphne laureola  
Daphne mezereum  
Drymochloa sylvatica  
Dryopteris filix-mas

Epilobium montanum  
Epipactis atrorubens  
Epipactis helleborine  
Euphorbia amygdaloides  
Fagus sylvatica  
Galium odoratum  
Hedera helix  
Helleborus niger  
Hieracium murorum  
Homogyne alpina  
Hordelymus europaeus  
Huperzia selago  
Ilex aquifolium  
Lactuca alpina  
Lactuca muralis  
Lamium galeobdolon  
Lilium martagon  
Lonicera alpigena  
Lonicera xylosteum  
Luzula luzulina  
Luzula luzuloides  
Luzula pilosa  
Maianthemum bifolium  
Melica uniflora  
Mercurialis perennis  
Miliium effusum  
Neottia nidus-avis  
Orthilia secunda  
Oxalis acetosella  
Paris quadrifolia  
Petasites albus  
Phyteuma spicatum  
Picea abies  
Polygala chamaebuxus  
Prenanthes purpurea  
Primula elatior  
Ranunculus montanus  
Ranunculus polyanthemos  
Rosa arvensis  
Rubus fruticosus aggr.  
Sambucus racemosa  
Sanicula europaea  
Saxifraga cuneifolia  
Senecio nemorensis aggr.  
Sesleria caerulea

Solidago virgaurea  
Sorbus aria aggr.  
Sorbus aucuparia  
Taxus baccata  
Thelypteris limbosperma  
Vaccinium myrtillus  
Valeriana tripteris  
Veratrum album aggr.  
Veronica montana  
Vicia sepium  
Vicia sylvatica  
Viola reichenbachiana

##Q +01 Quepub

Acer campestre  
Acer tataricum  
Adenophora liliifolia  
Aegonychon purpurocaeruleum  
Agropyron desertorum  
Agrostis capillaris  
Agrostis vinealis  
Achillea millefolium aggr.  
Achnatherum calamagrostis  
Ajuga genevensis  
Allium carinatum  
Allium ericetorum  
Allium lusitanicum  
Allium scorodoprasum  
Alyssum montanum  
Amelanchier ovalis  
Anthericum liliago  
Anthericum ramosum  
Anthoxanthum odoratum  
Arabidopsis arenosa  
Arabidopsis thaliana  
Arabis glabra  
Arrhenatherum elatius  
Artemisia pontica  
Asparagus officinalis  
Asperula aristata  
Asperula cynanchica  
Asplenium adiantum-nigrum  
Aurinia saxatilis  
Avenula pubescens  
Berberis vulgaris

Biscutella laevigata  
Bothriochloa ischaemum  
Brachypodium pinnatum  
Brachypodium sylvaticum  
Bromopsis erecta  
Bromopsis inermis  
Bromopsis pannonica  
Buphthalmum salicifolium  
Buxus sempervirens  
Campanula cervicaria  
Campanula cespitosa  
Campanula glomerata  
Campanula rapunculoides  
Campanula rotundifolia  
Campanula sibirica  
Campanula spicata  
Campanula trachelium  
Carex caryophyllea  
Carex filiformis  
Carex fritschii  
Carex humilis  
Carex montana  
Carex muricata aggr.  
Carlina vulgaris  
Centaurea stoebe  
Cirsium pannonicum  
Clematis recta  
Clinopodium nepeta  
Clinopodium vulgare  
Colutea arborescens  
Convallaria majalis  
Convolvulus arvensis  
Cornus mas  
Cornus sanguinea  
Cota tinctoria  
Cotoneaster tomentosus  
Crataegus laevigata  
Crataegus monogyna  
Cruciata glabra  
Cytisus ratisbonensis  
Dactylis glomerata  
Danthonia decumbens  
Daphne cneorum  
Dianthus carthusianorum  
Dianthus pontederiae

Dianthus seguieri  
Dianthus superbus  
Dictamnus albus  
Digitalis lutea  
Dorycnium pentaphyllum  
Echium vulgare  
Erica carnea  
Euonymus verrucosus  
Euphrasia cuspidata  
Festuca amethystina  
Festuca heterophylla  
Festuca pallens  
Fourraea alpina  
Fragaria moschata  
Fragaria vesca  
Fragaria viridis  
Fraxinus ornus  
Galeopsis ladanum  
Galium album  
Galium aristatum  
Galium boreale  
Galium glaucum  
Galium intermedium  
Galium lucidum  
Galium mollugo  
Galium pusillum  
Genista germanica  
Genista pilosa  
Genista sagittalis  
Genista tinctoria  
Geranium sanguineum  
Glechoma hirsuta  
Helianthemum nummularium  
Helictochloa pratensis  
Hieracium lachenalii  
Hieracium maculatum  
Hieracium murorum  
Hieracium porrifolium  
Hieracium racemosum  
Hieracium sabaudum  
Hieracium umbellatum  
Hierochloa australis  
Hypericum montanum  
Hypericum perforatum  
Hypochaeris maculata

Inula hirta  
Inula salicina  
Iris sibirica  
Jasione montana  
Jovibarba globifera  
Juniperus communis  
Knautia arvensis  
Koeleria macrantha  
Laburnum anagyroides  
Lactuca perennis  
Lactuca quercina  
Laser trilobum  
Laserpitium latifolium  
Lathyrus niger  
Lembotropis nigricans  
Ligustrum vulgare  
Lilium bulbiferum  
Limodorum abortivum  
Linaria genistifolia  
Linaria vulgaris  
Lithospermum officinale  
Loranthus europaeus  
Luzula campestris  
Luzula divulgata  
Malus sylvestris  
Medicago lupulina  
Medicago prostrata  
Melampyrum nemorosum  
Melampyrum pratense  
Melica ciliata  
Melica nutans  
Melica picta  
Melittis melissophyllum  
Muscari neglectum  
Myosotis ramosissima  
Myosotis stricta  
Noccaea perfoliata  
Ornithogalum orthophyllum  
Ostrya carpinifolia  
Petasites paradoxus  
Peucedanum alsaticum  
Peucedanum cervaria  
Peucedanum oreoselinum  
Phleum phleoides  
Pilosella cymosa

Pilosella officinarum  
Pimpinella saxifraga  
Pinus sylvestris  
Plantago media  
Poa angustifolia  
Poa nemoralis  
Poa pratensis  
Polygala amara  
Polygala major  
Potentilla alba  
Potentilla argentea  
Potentilla erecta  
Potentilla tabernaemontani  
Primula veris  
Prunella grandiflora  
Prunus avium  
Prunus mahaleb  
Prunus spinosa  
Pulmonaria angustifolia  
Pulmonaria dacica  
Pulmonaria officinalis aggr.  
Pulsatilla vulgaris  
Pyrus communis  
Quercus cerris  
Quercus petraea aggr.  
Quercus pubescens  
Ranunculus polyanthemus  
Reseda lutea  
Rhamnus alpina  
Rhamnus cathartica  
Robinia pseudoacacia  
Rosa canina  
Rosa gallica  
Rosa spinosissima  
Rubus saxatilis  
Rumex acetosella  
Salvia pratensis  
Salvia verticillata  
Sanguisorba minor  
Scabiosa canescens  
Scabiosa triandra  
Scleranthus perennis  
Scorzonera austriaca  
Scorzonera humilis  
Sedum acre

Sedum album  
Sedum rupestre  
Sedum sexangulare  
Selinum carvifolia  
Selinum dubium  
Sempervivum tectorum  
Serratula tinctoria  
Seseli osseum  
Silene nemoralis  
Silene nutans  
Silene viridiflora  
Silene viscaria  
Silene vulgaris  
Solidago virgaurea  
Stachys officinalis  
Stachys recta  
Stipa capillata  
Stipa pennata  
Succisa pratensis  
Symphytum tuberosum  
Teucrium chamaedrys  
Teucrium montanum  
Thalictrum minus  
Thymus praecox  
Thymus serpyllum  
Trientalis europaea  
Trifolium alpestre  
Trifolium arvense  
Trifolium campestre  
Vaccinium vitis-idaea  
Valeriana saxatilis  
Verbascum chaixii  
Verbascum phoeniceum  
Veronica austriaca  
Veronica dillenii  
Veronica chamaedrys  
Veronica officinalis  
Vicia cassubica  
Vicia hirsuta  
Vicia tenuifolia  
Vicia tetrasperma  
Vincetoxicum hirundinaria  
Viola canina  
Viola collina  
Viola hirta

Viola odorata  
Viola riviniana  
Viola rupestris  
Viola suavis  
Viola tricolor

##Q +01 Querop

Agrostis capillaris  
Anthericum liliago  
Anthoxanthum odoratum  
Asplenium septentrionale  
Avenella flexuosa  
Betula pendula  
Calamagrostis arundinacea  
Calamagrostis epigejos  
Calluna vulgaris  
Campanula rotundifolia  
Carex arenaria  
Carex pilulifera  
Ceratocarpus claviculata  
Convallaria majalis  
Cytisus scoparius  
Digitalis grandiflora  
Epilobium angustifolium  
Eriophorum vaginatum  
Festuca filiformis  
Festuca ovina  
Galium intermedium  
Galium pumilum  
Genista germanica  
Genista pilosa  
Genista tinctoria  
Hieracium glaucinum  
Hieracium laevigatum  
Hieracium lachenalii  
Hieracium murorum  
Hieracium sabaudum  
Hieracium schmidtii  
Hieracium umbellatum  
Holcus mollis  
Hylotelephium maximum  
Hypericum perforatum  
Hypericum pulchrum  
Jasione montana  
Lathyrus linifolius

Lembotropis nigricans  
Lonicera periclymenum  
Luzula campestris  
Luzula divulgata  
Luzula luzuloides  
Luzula pilosa  
Melampyrum pratense  
Molinia caerulea aggr.  
Pilosella officinarum  
Pinus sylvestris  
Poa nemoralis  
Polypodium vulgare aggr.  
Populus tremula  
Prunus cerasus  
Pteridium aquilinum  
Quercus petraea aggr.  
Quercus robur  
Rumex acetosella  
Senecio sylvaticus  
Silene nutans  
Silene viscaria  
Sorbus aucuparia  
Teucrium scorodonia  
Vaccinium myrtillus  
Vaccinium vitis-idaea  
Veronica officinalis  
Viscum album

##Q +01 Salice

Acer negundo  
Aegopodium podagraria  
Agrostis stolonifera  
Alisma lanceolatum  
Alliaria petiolata  
Alnus incana  
Alopecurus pratensis  
Angelica sylvestris  
Anthemis arvensis  
Arctium lappa  
Argentina anserina  
Atriplex prostrata  
Bidens tripartitus  
Callitriche cophocarpa  
Calystegia sepium  
Cardamine amara

Cardamine dentata  
Carex acutiformis  
Carex riparia  
Carex vulpina  
Chaiturus marrubiastrum  
Cirsium arvense  
Cirsium canum  
Cirsium oleraceum  
Conium maculatum  
Cornus sanguinea  
Cuscuta europaea  
Cuscuta lupuliformis  
Echinocystis lobata  
Elymus caninus  
Epilobium hirsutum  
Epilobium parviflorum  
Epilobium tetragonum  
Equisetum arvense  
Fallopia convolvulus  
Galeopsis ladanum  
Galeopsis tetrahit  
Galium aparine  
Galium palustre  
Glechoma hederacea  
Glyceria maxima  
Heracleum sphondylium  
Humulus lupulus  
Chaerophyllum aromaticum  
Chaerophyllum bulbosum  
Impatiens glandulifera  
Lamium album  
Lamium maculatum  
Leucanthemella serotina  
Leucojum aestivum  
Lycopus europaeus  
Lysimachia nummularia  
Lysimachia vulgaris  
Mentha arvensis  
Myosotis nemorosa  
Myosotis scorpioides  
Oenanthe aquatica  
Persicaria amphibia  
Persicaria dubia  
Petasites hybridus  
Phalaroides arundinacea

Phragmites australis  
Poa palustris  
Poa trivialis  
Populus alba  
Populus nigra  
Prunus cerasifera  
Prunus padus  
Ranunculus repens  
Reynoutria japonica  
Rorippa amphibia  
Rorippa sylvestris  
Rubus caesius  
Rumex aquaticus  
Rumex conglomeratus  
Rumex crispus  
Salix alba  
Salix euxina  
Salix purpurea  
Salix triandra  
Salix viminalis  
Sambucus nigra  
Schedonorus giganteus  
Scrophularia umbrosa  
Scutellaria hastifolia  
Silene baccifera  
Silene latifolia  
Sium latifolium  
Solanum dulcamara  
Stellaria media aggr.  
Stellaria nemorum  
Succisella inflexa  
Symphytum officinale  
Tanacetum vulgare  
Thalictrum flavum  
Typha angustifolia  
Ulmus minor  
Urtica dioica  
Utricularia vulgaris  
Veronica anagallis-aquatica

##Q +01 TilAce

Acer platanoides  
Acer pseudoplatanus  
Aconitum degenii  
Aconitum lycoctonum

Aconitum napellus  
Actaea spicata  
Adenostyles alliariae  
Adenostyles alpina  
Adoxa moschatellina  
Achillea macrophylla  
Alliaria petiolata  
Anemone ranunculoides  
Arabis alpina  
Arum cylindraceum  
Arum maculatum  
Aruncus dioicus  
Asarum europaeum  
Asperula taurina  
Asplenium scolopendrium  
Asplenium trichomanes  
Asplenium viride  
Athyrium filix-femina  
Bromopsis benekenii  
Campanula latifolia  
Campanula rhomboidalis  
Campanula trachelium  
Cardamine enneaphyllos  
Cardamine flexuosa  
Cardamine glanduligera  
Cardamine impatiens  
Cardamine raphanifolia  
Carduus personata  
Corydalis cava  
Corylus avellana  
Crepis pyrenaica  
Cyanus montanus  
Cyclamen purpurascens  
Cynoglossum germanicum  
Cystopteris fragilis  
Cystopteris montana  
Daphne laureola  
Dioscorea communis  
Drymochloa sylvatica  
Dryopteris affinis aggr.  
Dryopteris filix-mas  
Epilobium montanum  
Euonymus latifolius  
Euphorbia dulcis  
Fraxinus excelsior

Galanthus nivalis  
Galium odoratum  
Galium sylvaticum  
Gentiana lutea  
Geranium robertianum  
Geranium sylvaticum  
Gymnocarpium robertianum  
Helleborus foetidus  
Hepatica nobilis  
Heracleum sphondylium  
Hieracium prenanthoides  
Hordelymus europaeus  
Chaerophyllum aureum  
Chaerophyllum temulum  
Impatiens noli-tangere  
Knautia dipsacifolia  
Laburnum alpinum  
Lactuca alpina  
Lactuca muralis  
Lactuca plumieri  
Lamium galeobdolon  
Lamium maculatum  
Laserpitium latifolium  
Lathyrus laevigatus  
Lilium martagon  
Lonicera alpigena  
Lonicera nigra  
Lonicera xylosteum  
Lunaria rediviva  
Mercurialis perennis  
Moehringia muscosa  
Myosotis sylvatica  
Petasites albus  
Peucedanum ostruthium  
Poa hybrida  
Polygonatum multiflorum  
Polygonatum verticillatum  
Polypodium vulgare aggr.  
Polystichum aculeatum  
Polystichum braunii  
Polystichum lonchitis  
Polystichum setiferum  
Pseudoturritis turrita  
Ribes alpinum  
Ribes petraeum

Rosa pendulina  
Rumex arifolius  
Salvia glutinosa  
Sambucus racemosa  
Saxifraga rotundifolia  
Senecio nemorensis aggr.  
Silene dioica  
Stachys sylvatica  
Staphylea pinnata  
Stellaria nemorum  
Taxus baccata  
Thalictrum alpinum  
Tilia cordata  
Tilia platyphyllos  
Ulmus glabra  
Urtica dioica  
Valeriana officinalis  
Valeriana tripteris  
Veronica urticifolia  
Vicia sylvatica  
Viola biflora

#TC Alninc-woody

Acer campestre  
Alnus incana  
Alnus glutinosa  
Fraxinus excelsior  
Fraxinus angustifolia  
Prunus padus  
Ulmus laevis

#TC Carbet-woody

Acer campestre  
Carpinus betulus  
Quercus robur  
Quercus petraea aggr.  
Tilia cordata

#TC Quepub-woody

Fraxinus ornus  
Ostrya carpinifolia  
Quercus cerris  
Quercus frainetto  
Quercus petraea aggr.  
Quercus pubescens  
Quercus robur

#TC Querop-woody

Betula pendula  
Quercus petraea aggr.  
Quercus robur  
Sorbus aucuparia

#TC Salice-woody  
Populus alba  
Populus nigra  
Salix alba  
Salix eleagnos  
Salix euxina  
Salix purpurea  
Salix triandra  
Salix viminalis

#TC TilAce-woody  
Acer platanoides  
Acer pseudoplatanus  
Fraxinus excelsior  
Tilia cordata  
Tilia platyphyllos  
Ulmus glabra

#TC Alnglu-woody  
Alnus glutinosa  
Betula pubescens  
Salix aurita  
Salix cinerea  
Salix pentandra

SECTION 2: End  
SECTION 3: Group definitions

6                   F01    Carbet  
<#TC Carbet-woody GR25> AND <##Q +01 Carbet>

6                   F02    TilAce  
<#TC TilAce-woody GR25> AND <##Q +01 TilAce>

6                   F03    Fagsyl  
<Fagus sylvatica GR25> AND <##Q +01 Fagsyl>

6                   F04    Querop  
<#TC Querop-woody GR25> AND <##Q +01 Querop>

6                   F05    Quepub  
<#TC Quepub-woody GR25> AND <##Q +01 Quepub>

6                   F06    Alninc  
<#TC Alninc-woody GR25> AND <##Q +01 Alninc>

6                    F07    Alnglu  
<#TC Alnglu-woody GR25> AND <##Q +01 Alnglu>

6                    F08    Salice  
<#TC Salice-woody GR25> AND <##Q +01 Salice>

SECTION 3: End

SECTION 4: Similarity

SECTION 4: End

#### References

Tichý L. (2002) JUICE, software for vegetation classification. – *Journal of Vegetation Science* 13: 451–453.

Tichý L. & Chytrý M. (2006) Statistical determination of diagnostic species for site groups of unequal size. – *Journal of Vegetation Science* 17: 809–818.

Tichý L., Chytrý M. & Landucci F. (2019) GRIMP: A machine-learning method for improving groups of discriminating species in expert systems for vegetation classification. – *Journal of Vegetation Science* 30: 5–17.

Electronic Appendix 3. A list of aggregated species in the final dataset.

Species concepts and nomenclature follow the Euro+Med PlantBase ([www.emplantbase.org](http://www.emplantbase.org); accessed August 2018).

*Achillea millefolium* aggr.: *Achillea collina*, *Achillea millefolium*, *Achillea pannonica*,  
*Achillea setacea*  
*Bromopsis ramosa* aggr.: *Bromopsis benekenii*, *Bromopsis ramosa*  
*Cardamine pratensis* aggr.: *Cardamine dentata*, *Cardamine matthioli*, *Cardamine pratensis*,  
*Carex muricata* aggr.: *Carex divulsa*, *Carex muricata*, *Carex spicata*  
*Dryopteris affinis* aggr.: *Dryopteris affinis*, *Dryopteris affinis* × *borreri*, *Dryopteris borrieri*  
*Dryopteris carthusiana* aggr.: *Dryopteris carthusiana*, *Dryopteris carthusiana* × *dilatata*,  
*Dryopteris dilatata*  
*Galium palustre* aggr.: *Galium elongatum*, *Galium palustre*  
*Galium pumilum* aggr.: *Galium pumilum*, *Galium pusillum*, *Galium valdepilosum*  
*Luzula campestris* aggr.: *Luzula campestris*, *Luzula divulgata*, *Luzula multiflora*, *Luzula*  
*pallescens*, *Luzula sudetica*  
*Molinia caerulea* aggr.: *Molinia arundinacea*, *Molinia caerulea*  
*Polypodium vulgare* aggr.: *Polypodium interjectum*, *Polypodium vulgare*  
*Pulmonaria officinalis* aggr.: *Pulmonaria obscura*, *Pulmonaria officinalis*  
*Pyrus communis* aggr.: *Pyrus communis*, *Pyrus nivalis*  
*Quercus petraea* aggr.: *Quercus dalechampii*, *Quercus petraea*  
*Rubus fruticosus* aggr.: *Rubus hirtus*, *Rubus serpens*, *Rubus sulcatus*, *Rubus fruticosus* aggr.  
sensu Ehrendorfer 1973  
*Senecio nemorensis* aggr.: *Senecio hercynicus*, *Senecio nemorensis* subsp. *jacquinianus*,  
*Senecio ovatus*  
*Sorbus aria* aggr.: *Sorbus aria*, *Sorbus aria* × *torminalis*, *Sorbus bohemica*, *Sorbus graeca*,  
*Sorbus latifolia*, *Sorbus mougeotii*, *Sorbus semiincisa*  
*Stellaria media* aggr.: *Stellaria media*, *Stellaria neglecta*, *Stellaria pallida*  
*Veratrum album* aggr.: *Veratrum album*, *Veratrum lobelianum*  
*Veronica hederifolia* aggr.: *Veronica hederifolia*, *Veronica sublobata*  
*Viola odorata* aggr.: *Viola odorata*, *Viola suavis*  
*Viola reichenbachiana* aggr.: *Viola reichenbachiana*, *Viola reichenbachiana* × *riviniana*,  
*Viola riviniana*

#### References

Ehrendorfer (1973) Liste der Gefäßpflanzen Mitteleuropas. – Fischer, Stuttgart.

Electronic Appendix 5: Expert system for classification of central European oak-hornbeam forests (*Carpinetalia*) to associations.

This expert system can be run in the Juice 7 program after being transformed into plain text (.txt) format. It is expected that the analysed data will use species names following the Euro+Med PlantBase with modifications listed in Electronic Appendix 3. Species groups are provided followed by formulas of all the accepted associations. In the formulas, the number of species of a sociological group required for its presence is given by a two-digit number after "#". Sociological species groups are connected by logical operators AND, OR and NOT.

SECTION 1: Species aggregation

SECTION 1: End

SECTION 2: Species groups

### Boreal

Equisetum pratense  
Trientalis europaea  
Lycopodium annotinum  
Vaccinium vitis-idaea

### Carinthia

Anemone trifolia  
Galium laevigatum  
Vicia oroboides

### CE\_sstr

Galium sylvaticum  
Potentilla sterilis  
Rosa arvensis  
Phyteuma nigrum  
Cyclamen purpurascens

### CE\_thermo

Aegonychon purpureocaeruleum  
Anthericum ramosum  
Carex michelii  
Cornus mas  
Dictamnus albus  
Festuca heterophylla  
Ligustrum vulgare  
Melittis melissophyllum  
Primula veris  
Quercus cerris  
Quercus pubescens  
Sorbus torminalis  
Tanacetum corymbosum  
Trifolium alpestre  
Vincetoxicum hirundinaria  
Viola hirta

### CE\_thermo\_bas

Aegonychon purpureocaeruleum

Carex michelii  
Cornus mas  
Dictamnus albus  
Ligustrum vulgare  
Primula veris  
Quercus pubescens  
Viola hirta

### CE\_thermo\_neu  
Anthericum ramosum  
Festuca heterophylla  
Melittis melissophyllum  
Quercus cerris  
Sorbus torminalis  
Tanacetum corymbosum  
Trifolium alpestre  
Vincetoxicum hirundinaria

### Cont\_nem  
Carex pilosa  
Cruciata glabra  
Euonymus verrucosus  
Galium intermedium  
Isopyrum thalictroides  
Viola mirabilis

### CWE\_thermo  
Acer opalus  
Carex flacca  
Dioscorea communis  
Hippocrepis emerus  
Helleborus foetidus  
Ilex aquifolium  
Primula acaulis  
Rosa arvensis  
Sorbus aria aggr.  
Viburnum lantana

### E\_C\_mesic  
Anemone trifolia  
Asparagus tenuifolius  
Asperula taurina  
Dioscorea communis  
Doronicum orientale  
Erythronium dens-canis  
Galium aristatum  
Geranium nodosum  
Helleborus dumetorum  
Helleborus odorus  
Lamium orvala  
Luzula forsteri

Luzula nivea  
Ostrya carpinifolia  
Phyteuma betonicifolium  
Polystichum setiferum  
Pulmonaria australis  
Pulmonaria stiriaca  
Ruscus aculeatus  
Ruscus hypoglossum  
Tilia tomentosa  
Veronica urticifolia  
Vicia oroboides

### Fagus\_species  
Abies alba  
Fagus sylvatica  
Aruncus dioicus  
Veratrum album aggr.  
Prenanthes purpurea

### Galium\_s\_i  
Galium sylvaticum  
Galium intermedium

### Illyr\_EA\_Boh  
Knautia drymeia  
Cyclamen purpurascens

### Illyr\_EA\_Boh\_vs\_WC  
Galium sylvaticum  
Hepatica nobilis  
Hippocrepis emerus  
Knautia drymeia  
Cyclamen purpurascens  
Veratrum nigrum

### Mecsek  
Helleborus odoratus  
Doronicum orientale  
Tilia tomentosa  
Fraxinus ornus  
Luzula forsteri  
Ruscus hypoglossum

### Oceanic  
Ilex aquifolium  
Luzula sylvatica  
Lonicera periclymenum  
Poa chaixii  
Pulmonaria montana  
Teucrium scorodonia

### Pannonia\_thermo  
     Acer tataricum  
     Polygonatum hirtum  
     Physalis alkekengi  
     Viola mirabilis

### Pannonia\_thermo\_Qcerr  
     Quercus cerris

### Pannonian\_wet  
     Fraxinus angustifolia  
     Acer tataricum  
     Aristolochia clematitidis  
     Carex strigosa  
     Oenanthe banatica

### Styria  
     Cardamine waldsteinii  
     Crocus vernus  
     Erythronium dens-canis  
     Gentiana asclepiadea  
     Pseudostellaria europaea  
     Pulmonaria stiriaca

### Styria\_sstr  
     Cardamine waldsteinii  
     Crocus vernus  
     Erythronium dens-canis  
     Pseudostellaria europaea  
     Pulmonaria stiriaca

### Subboreal  
     Dryopteris carthusiana aggr.  
     Frangula alnus  
     Luzula pilosa  
     Maianthemum bifolium  
     Oxalis acetosella  
     Populus tremula  
     Pteridium aquilinum  
     Rubus saxatilis  
     Sorbus aucuparia  
     Vaccinium myrtillus

### Ticino  
     Castanea sativa  
     Geranium nodosum  
     Veronica urticifolia  
     Phyteuma betonicifolium  
     Ostrya carpinifolia  
     Luzula nivea  
     Asplenium adiantum-nigrum

### Thermo\_acido  
Calamagrostis arundinacea  
Carex montana  
Convallaria majalis  
Festuca ovina  
Genista tinctoria  
Hylotelephium maximum  
Hieracium lachenalii  
Hieracium murorum  
Hieracium sabaudum  
Hypericum montanum  
Lembotropis nigricans  
Luzula luzuloides  
Melampyrum pratense  
Veronica officinalis  
Avenella flexuosa  
Luzula campestris aggr.  
Solidago virgaurea  
Silene nutans  
Vaccinium myrtillus

### WCarp\_only  
Aremonia agrimonioides  
Cardamine glanduligera  
Carex brevicollis  
Hacquetia epipactis  
Waldsteinia geoides  
Aconitum moldavicum  
Symphytum cordatum

### WCarp\_typical  
Aposeris foetida  
Arum cylindraceum  
Carex alba  
Drymochloa drymeja  
Euphorbia amygdaloides  
Pulmonaria mollis  
Salvia glutinosa  
Stachys alpina  
Staphylea pinnata  
Symphytum tuberosum

### Wet\_coll  
Aegopodium podagraria  
Anthriscus sylvestris  
Carex remota  
Carex sylvatica  
Circaea lutetiana  
Ficaria verna  
Lamium maculatum

Prunus padus  
Stachys sylvatica  
Stellaria nemorum  
Urtica dioica  
Viburnum opulus

### Wet\_low

Adoxa moschatellina  
Alliaria petiolata  
Galium aparine  
Geranium robertianum  
Geum urbanum  
Glechoma hederacea  
Chaerophyllum temulum  
Sambucus nigra  
Urtica dioica  
Veronica hederifolia aggr.

#TC Carbet-woody

Acer campestre  
Carpinus betulus  
Quercus robur  
Quercus petraea aggr.  
Tilia cordata

SECTION 2: End

SECTION 3: Group definitions

5 01ShC Stellario-Carpinetum

(<#TC Carbet-woody GR25> AND (<#03 Wet\_coll> OR <#03  
Wet\_low>)) NOT ((((((((((<#01 Boreal> OR <#02 Cont\_nem>) OR  
<#01 CE\_sstr>) OR <#01 E\_C\_mesic>) OR <#02 Oceanic>) OR <#03  
CWE\_thermo>) OR <#01 WCarp\_only>) OR <#04 CE\_thermo>) OR <#02  
Pannonia\_thermo>) OR <#01 Pannonian\_wet>) OR <#01  
Styria\_sstr>) OR <#01 Pannonia\_thermo\_Qcerr>) OR <#01  
WCarp\_typical>)

5 02CoC Convallario-Carpinetum

(<#TC Carbet-woody GR25> AND (<#02 Pannonian\_wet> OR (<#01  
Pannonian\_wet> AND <#03 Wet\_low>))) NOT ((((((((((<#01 Boreal>  
OR <#02 Cont\_nem>) OR <#01 CE\_sstr>) OR <#01 E\_C\_mesic>) OR  
<#02 Oceanic>) OR <#03 CWE\_thermo>) OR <#01 WCarp\_only>) OR  
<#04 CE\_thermo>) OR <#02 Pannonia\_thermo>)

5 03PeC Pseudostellario-Carpinetum

(<#TC Carbet-woody GR25> AND (<#02 Styria> OR (<#01  
Styria\_sstr> AND (<#01 WCarp\_typical> OR <#01  
Illyr\_EA\_Boh>)))) NOT (<#01 WCarp\_only> OR <#01  
Pannonian\_wet>)

5           04PcC Poo-Carpinetum  
(<#TC Carbet-woody GR25> AND <#02 Oceanic>) NOT ((<#03  
CWE\_thermo> OR <#04 CE\_thermo>) OR <#01 E\_C\_mesic>)

5           05GsC Galio-Carpinetum  
(<#TC Carbet-woody GR25> AND <#01 CE\_sstr>) NOT (<#03  
Subboreal> OR (((((((<#04 CE\_thermo> OR <#01 Ticino>) OR  
<#01 E\_C\_mesic>) OR <#02 WCarp\_typical >) OR <#02 Cont\_nem>)  
OR <#02 Oceanic>) OR <#03 CWE\_thermo>) OR <#02 Galium\_s\_i>)  
OR <#01 Pannonian\_wet>) OR <#01 WCarp\_only>)

5           06TcC Tilio-Carpinetum  
(<#TC Carbet-woody GR25> AND ((<#01 Cont\_nem> AND <#03  
Subboreal>) OR <#01 Boreal>)) NOT ((((<#01 WCarp\_typical> OR  
<#01 WCarp\_only>) OR <#01 Fagus\_species>) OR <#01 CE\_sstr>) OR  
<#01 Oceanic>)

5           07CpC Carici-Carpinetum  
(<#TC Carbet-woody GR25> AND ((<#02 Cont\_nem> AND <#01  
WCarp\_typical>) OR <#01 WCarp\_only>)) NOT ((((((<#01  
E\_C\_mesic> OR <#04 CE\_thermo>) OR <#01 CE\_sstr>) OR <#02  
Pannonia\_thermo>) OR <  
#01 Boreal>) OR <#01 Pannonian\_wet>) OR <#01  
Illyr\_EA\_Boh\_vs\_WC>)

5           08EaC Epimedio-Carpinetum  
<#TC Carbet-woody GR25> AND (<#02 Carinthia> OR (<#01  
Carinthia> AND (<#01 WCarp\_typical> OR <#01 Illyr\_EA\_Boh>)))

5           09CgQ Cruciato-Quercetum  
<#TC Carbet-woody GR25> AND <#02 Ticino>

5           10LpC Lithospermo-Carpinetum  
(<#TC Carbet-woody GR25> AND <#03 CWE\_thermo>) NOT (((<#02  
Cont\_nem> OR <#01 Mecsek>) OR <#01 Ticino>) OR <#01  
Illyr\_EA\_Boh>)

5           11PvC Primulo-Carpinetum  
(<#TC Carbet-woody GR25> AND (<#04 CE\_thermo> OR (<#03  
CE\_thermo\_bas> OR (<#02 Pannonia\_thermo> AND <#04  
Thermo\_acido>)))) NOT (<#01 E\_C\_mesic> OR (<#03 CWE\_thermo> OR  
(<#02 Pannonia\_thermo> NOT <#04 Thermo\_acido>)))

5           12PlC Polygonato-Carpinetum  
(<#TC Carbet-woody GR25> AND <#02 Pannonia\_thermo>) NOT (<#01  
E\_C\_mesic> OR (<#04 Thermo\_acido> AND <#02 Pannonia\_thermo>))

5           13HoC Helleboro-Carpinetum  
<#TC Carbet-woody GR25> AND <#02 Mecsek>

SECTION 3: End

SECTION 4: Similarity  
SECTION 4: End