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Rediscovery of the plant community *Loto tenuis-Potentilletum anserinae* Vicherek 1973 in Slovakia after 50 years

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Abstract: The association *Loto tenuis-Potentilletum anserinae* was described by Vicherek in 1973 based on phytosociological data from south-eastern Moravia (Czech Republic) and south-western Slovakia. In Slovakia, the community was documented only by seven relevés from the 1970s and has not been recorded since. We recorded stands of this community in the Poiplie region (south-central Slovakia) in 2025 based on three phytosociological relevés. A comparison of species composition with the original description revealed some differences, mainly the presence of marsh species and the absence of typical halophytic plants. However, the newly recorded relevés are similar to the "typical" subassociation described by Vicherek.

Keywords: Central Europe, flooded grassland, plant community.

Introduction

The association *Loto tenuis-Potentilletum anserinae* was described by Vicherek (1973; as *Loto-Potentilletum anserinae*) based on phytosociological material from south-eastern Moravia (Czech Republic) and south-western Slovakia. According to the author, the community occupies a transitional position between ruderal vegetation (*Polygono-Coronopodion* Sissingh 1969 and *Bidention tripartitae* Nordhagen ex Klika et Hadač 1944) and halophytic vegetation (*Juncion gerardii* Wendelberger 1943 and *Puccinellion limosae* Soó 1933) as a result of strong

anthropozoogenic impact. This “goose pasture” community is characterized by the dominance of *Potentilla anserina* and *Lotus tenuis* and the constant presence of a set of grassland, ruderal, halophytic, and wetland species, such as *Agrostis stolonifera*, *Leontodon autumnalis*, *Lolium perenne*, *Medicago lupulina*, *Mentha pulegium*, *Odontites vulgaris*, *Plantago uliginosa*, *Poa annua*, *Pulicaria vulgaris*, *Ranunculus repens*, and *Trifolium repens*. The stands occurred on wet, loamy-clay, nitrogen-rich, and slightly saline soils with a neutral to slightly alkaline reaction, typically in the surroundings of small ponds (Vicherek 1973). The author suggested that the community is distributed in the lowlands of the Euro-Siberian region, with its optimum in south-eastern Europe. Currently, the association is known from the Pannonian part of Central Europe (Eliáš et al. 2021), including Austria (Mucina in Mucina et al. 1993), the Czech Republic (Novák & Šumberová in Chytrý 2007), Hungary (Borhidi et al. 2012), and Slovakia (Zaliberová & Škodová in Hegedüšová Vantarová & Škodová 2014). In addition, isolated localities of the association are known from north-western Czech Republic (Novák & Šumberová in Chytrý 2007). In these countries, the association is classified differently within higher syntaxonomical units, either within *Juncion gerardii* (class *Festuco-Puccinellietea* Soó ex Vicherek 1973) or within *Potentillion anserinae* Tx. 1947 (class *Molinio-Arrhenatheretea* Tx. 1937). However, inclusion in *Potentillion anserinae* was reported only by Zaliberová & Škodová in Hegedüšová Vantarová & Škodová (2014), whereas Eliáš et al. (2021) subsequently placed the association in *Juncion gerardii*; in both cases referring to records from Slovakia.

The stands of this association were known from south-western Slovakia (Vicherek 1973; Eliáš 1977) and south-eastern Slovakia based on one unpublished relevé recorded by Hejný in 1953. However, this record probably belongs to the association *Pulicario vulgaris–Menthetum pulegii* Slavnić 1951 (class *Isoëto-Nanojuncetea* Br.-Bl. et Tx. in Br.-Bl. et al. 1952) due to numerous diagnostic species of the class such as *Cyperus fuscus*, *Eleocharis acicularis*, *Gnaphalium uliginosum*, *Lythrum hyssopifolium* and *Potentilla supina*. All the above-mentioned relevés are more than 50 years old, and until now, the community has not been confirmed (Zaliberová & Škodová in Hegedüšová Vantarová & Škodová 2014). Therefore, the community could be considered Extinct in the Wild (EW) according to the IUCN criteria (IUCN 2024).

During field research conducted in the southern part of Central Slovakia in 2025, stands of this community were recorded in the Poiplie region, near the villages of Malé Dálovce and Vrbovka (Fig. 1). The area of the stands was relatively small, fragmented, occurring among wetland communities from the *Molinio-Arhhenatheretea* and *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941 classes. The stands were flooded in spring; subsequently, the water level declined below the soil surface in summer, and the localities were grazed by sheep or cattle. The species composition was dominated by *Potentilla anserina*, while *P. reptans* was frequently a co-dominant species; more rarely, *Agrostis stolonifera* or *Trifolium hybridum* also occurred as co-dominants. Constant species included those diagnostic for the association, such as *Inula britannica*, *Lotus tenuis*, *Mentha pulegium*, and

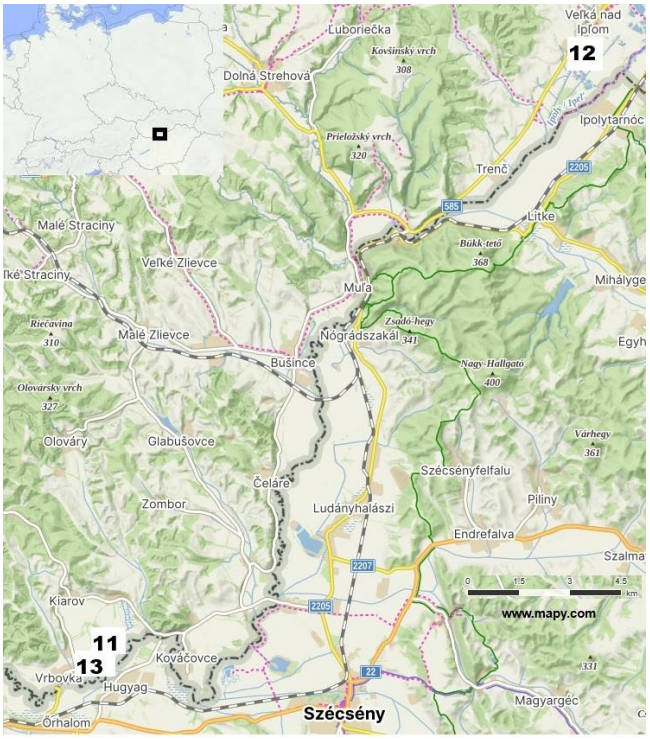

Fig. 1 Map of the newly recorded localities of the *Loto tenuis–Potentilletum anserinae* in the Poiplie region (relevés 11–13 in Tab. 1).

Fig. 2 *Loto tenuis–Potentilletum anserinae* in the Poiplie region, near the Veľké Dálovce settlement (upper photographs) and near the Vrbovka village (lower photographs).

Pulicaria vulgaris, as well as other wetland species such as *Lythrum virgatum*, *Ranunculus repens*, and *Stachys palustris*, together with ruderal species and plants of trampled habitats (e.g. *Elymus repens*, *Juncus compressus*, *Plantago major* agg., *Polygonum aviculare* agg., *Trifolium repens*). The stands were relatively species-rich, with 25 to 31 taxa per relevé (Tab. 1, rels 11–13; Fig. 2).

Comparison of the newly recorded relevés from the Poiplie region (hereafter new records; group 2 in Tab. 1) with the original description of the association by Vicherek (1973) showed partial similarity to the "typical" subassociation (group 3 in Tab. 1), but also some differences in species composition (Tab. 1). Cluster analysis first separated the relevés assigned by Vicherek (1973) to the "*taraxacetosum bessarabicum*" subassociation (group 1 in Tab. 1) from both the new relevés and the remaining relevés reported by Vicherek (1973). In the subsequent steps, the new records and the relevés of the "typical" together with "*pulicarietosum dysentericae*" subassociations (group 4 in Tab. 1) were separated in this order. The groups distinguished in our analysis corresponded to the original delimitation of the subassociations by Vicherek (1973). The new records differed mainly by a diagnostic species group composed of marshy and ruderal plants, including the native but intensively spreading clonal grass *Calamagrostis epigejos* (group 2 in Tab. 1). All four groups were also clearly separated in the ordination space (Fig. 3).

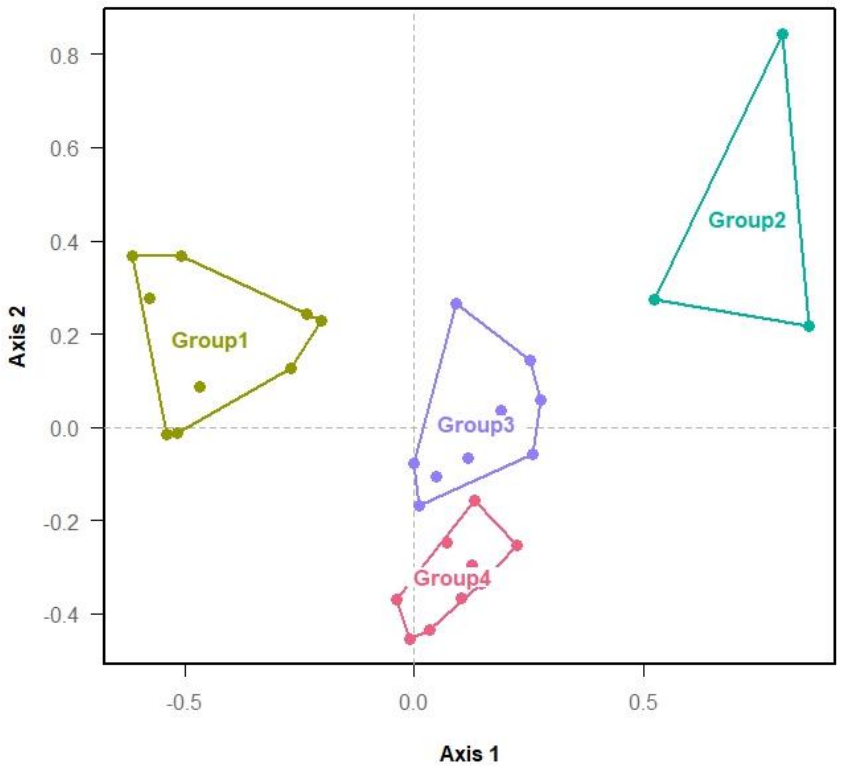

Fig. 3 NMDS of relevés from Slovakia (newly recorded relevés from Poiplie region, group 2 in ordination graph and Tab. 1) Slovakia and Czech Republic (relevés published by Vicherek (1973), groups 1, 3 and 4 in graph and Tab. 1).

The syntaxonomical position of the association within higher syntaxa is partially unclear. Vicherek (1973) and a substantial part of the literature dealing with *Loto tenuis-Potentilletum anserinae* (e.g. Novák & Šumberová in Chytrý 2007; Eliáš et al. 2013, 2021) placed it in the *Juncion gerardii* alliance (class *Festuco-Puccinellietea*) based on the presence of typical halophytic plant species. However, these plants (obligate halophytes sensu Dítě et al. 2023) are present only in the „*taraxacetosum bessarabicum*" subassociation, whereas their proportion decreases towards other subassociations and in newly recorded stands, or they are completely absent (cf. Vicherek 1973; Tab. 1). The new records and relevés of the "typical" subassociation contain mainly accessory species of saline habitats, only a few facultative halophytes, and no obligate halophytes (sensu Dítě et al. 2023; see Tab. 1). In contrast, several plants of saline habitats occurring in almost all relevés of *Loto tenuis-Potentilletum anserinae* such as *Inula britannica*, *Lotus tenuis*, *Mentha pulegium*, *Pulicaria vulgaris*, and *Trifolium fragiferum* occur relatively rarely in the vegetation of the *Potentillion anserinae* alliance in Central Europe (e.g., Borhidi et al. 2012; Hegedüšová Vantarová & Škodová 2014), although they have been frequently reported in surveys from some other European countries (e.g. Sýkora 1982a,b).

We assume that stands of the association still persist in Slovakia, but with a partially altered species composition, mainly due to fragmentation of the stands within marshy or wet-meadow communities and insufficient management, particularly the absence of goose herding, which has been replaced by extensive grazing by sheep and cattle.

Methodological notes

The relevés were recorded using the traditional Zürich-Montpellier approach with the modified Braun–Blanquet scale (Dengler et al. 2008). All relevés were stored in the Turboveg database (Hennekens & Schaminée 2001) and subsequently processed using the JUICE program (Tichý 2002), version JUICE.NET. The original relevés used in the description of the association (Vicherek 1973) were obtained from the Czech National Phytosociological Database (Chytrý & Rafajová 2003). Numerical classification was performed using hierarchical cluster analysis with the flexible beta method ($\beta = -0.25$) as the group linkage method and the Bray-Curtis index as the dissimilarity measure; species cover values were log-transformed. Differential species for each group were identified based on frequency and fidelity thresholds (Φ – phi coefficient; Chytrý et al. 2002), set at frequency ≥ 40%, phi coefficient ≥ 0.30, and a difference in frequency between groups of ≥ 20%. Species that were constant (frequency ≥ 50%) in two or more groups were not considered differential. To display groups in the ordination space, non-metric multidimensional scaling (NMDS; Bray–Curtis distance, log-transformed species cover) was used. All analyses were performed in JUICE.NET using R scripts implemented in the program. The name of plant species and higher syntaxa than association are according to FloraVeg.Eu (Chytrý et al. 2024).

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Tab. 1 Shortened phytosociological table of relevés of the *Loto tenuis–Potentilletum anserinae* association in Slovakia and the Czech Republic (for comparison with the original description by Vicherek 1973).

	group1									group2					group3																	group4				
Taxon / Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Diagnostis taxa of the first group																																	
Spergularia marina	+	+	1	+	+	+	1	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Taraxacum besarabicum	2	2	2	+	+	1	1	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Puccinellia limosa	+	+	+	1	1	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Glaux maritima	.	.	.	2	1	2	3	3	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tripolium pannonicum	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus bufonius agg.	.	.	.	.	1	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diagnostic taxa of the second, third and fourth groups																																	
Juncus compressus	1	+	1	.	.	.	.	.	.	1	.	+	.	.	+	+	+	.	+	.	+	+	+	+	+	1	1	1	.	1	+
Potentilla reptans	.	.	.	.	.	.	.	.	.	b	3	a	+	.	.	.	+	.	+	+	+	.	+	.	.	+	+	.	+	+	+	+
Rorippa sylvestris	.	.	+	.	+	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	+	+	.	.	+	+	+	.	.	+
Trifolium repens	.	.	.	.	.	.	.	.	.	+	+	+	+	1	1	1	1	2	+	1	2	2	.	.	.	.	.	.	.	.	.	.	.
Carex cuprina	.	.	.	.	.	.	.	.	.	1	.	1	+	.	+	.	.	.	.	.	.	.	+	.	+	.	+	+	.	+	+	+	+
Taraxacum sp.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	+	+	.	+	.	.	.	+	+	+	+	.	.	.	.	.	.
Achillea millefolium	.	.	.	1	.	.	.	.	.	.	.	.	+	+	.	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Diagnostis species of the second group																																	
Stachys palustris	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lythrum virgatum	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calamagrostis epigejos	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris pseudacorus	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ambrosia artemisiifolia	.	.	.	.	.	.	.	.	.	r	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium hybridum	.	.	.	.	.	.	.	.	.	.	a	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus sardous	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lythrum salicaria	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Althaea officinalis	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+

Elytrigia repens	.	.	.	+	.	.	.	.	.	.	.	**1**	**+**	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diagnostis species of the third and fourth groups																																						
Scorzoneroides autumnalis	.	.	+	.	.	.	+	.	.	.	.	.	.	**+**	**1**	**+**	**+**	**1**	**1**	**1**	**+**	**+**	**+**	**+**	**+**	**+**	**1**	**+**	.	**+**	.	**+**	.
Matricaria discoidea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**1**	**+**	**+**	**1**	**+**	.	**+**	**+**	**+**	**+**	.	.	**+**	.	.	.	**+**	**+**	.
Medicago lupulina	.	.	.	.	.	.	.	.	.	.	.	.	.	**+**	**1**	**+**	**+**	**+**	**+**	.	**+**	**+**	**+**	.	.	.	**+**	**+**	.	**+**	.	.	.
Carex distans	+	+	+	.	.	.	.	.	.	.	.	.	.	.	**+**	.	**+**	**+**	**+**	.	**+**	.	**+**	**+**	**+**	.	**+**	**+**	**+**	**+**	.	**+**	**+**
Lotus maritimus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**+**	**+**	.	**+**	.	.	**+**	.	**+**	**+**	**+**	.	.	.	.	.
Pastinaca sativa	.	.	.	+	.	.	.	.	.	.	.	.	.	**+**	**+**	**+**	.	.	.	.	**+**	**+**	**+**	.	**+**	.	.	**+**	**+**	.	.	.	.
Verbena officinalis	+	.	.	.	.	.	.	.	.	.	.	.	.	**+**	**+**	**+**	.	.	.	.	.	.	.	**+**	**+**	**+**	**+**	**+**	.	.	.	.	.
Diagnostic species of the fourth group																																						
Jacobaea erratica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**+**	**1**	**2**	**1**	**+**	**1**	**1**	**1**	**+**	**1**
Pulicaria dysenterica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**4**	**2**	**3**	**4**	**2**	**3**	**3**	**3**	**3**	**3**
Other species with occurrence at least three relevés																																						
Potentilla anserina	5	5	5	4	5	4	3	3	3	5	4	3	4	5	5	5	5	5	5	4	4	4	5	3	3	3	3	2	2	3	2	2	2
Lotus tenuis	1	1	1	2	2	2	2	1	+	1	1	1	1	3	2	2	2	1	1	1	2	1	1	2	1	3	3	2	2	2	3	3	2
Lolium perenne	1	1	+	3	+	1	+	+	+	1	.	+	+	2	1	1	1	1	2	1	1	+	1	1	+	2	+	+	1	+	1	+	1
Agrostis stolonifera	1	1	+	1	1	1	+	+	1	+	a	.	3	+	1	1	1	1	1	1	+	1	1	1	+	+	1	1	+	1	1	1	1
Plantago major agg.	1	+	+	.	+	1	+	+	1	+	1	+	+	+	1	1	1	1	+	1	+	1	+	1	2	+	+	+	1	1	1	1	1
Poa annua	1	1	1	1	2	2	2	+	+	1	.	.	.	1	1	1	+	1	+	+	+	1	1	1	1	+	+	+	1	+	+	+	+
Mentha pulegium	+	.	.	.	.	+	+	1	+	+	+	a	+	+	1	1	1	1	+	+	+	1	1	2	2	2	2	1	1	1	1	1	1
Pulicaria vulgaris	+	+	+	.	1	+	.	.	.	.	.	r	+	1	+	+	+	+	+	+	+	1	+	1	+	+	1	1	1	+	1	+	1
Trifolium fragiferum subsp. *fragiferum*	2	1	1	2	2	2	1	1	1	1	.	.	1	1	.	2	2	.	1	1	.	.	.	1	1	2	+	2	1	1	2	1	1
Odontites vernus agg.	+	.	.	+	+	+	.	+	.	.	.	.	.	+	+	1	+	1	+	+	1	1	+	+	.	1	1	1	1	1	+	+	+
Bidens tripartita	+	+	.	1	.	+	+	.	.	.	.	.	.	.	+	+	+	+	+	.	+	+	+	+	+	+	+	1	1	+	+	+	+
Inula britannica	.	+	+	+	.	.	+	.	.	.	+	+	+	.	+	+	.	+	+	.	+	+	+	.	+	.	+	+	.	+	+	+	+
Ranunculus repens	.	.	.	.	.	.	.	.	.	.	+	.	+	1	+	+	+	1	+	+	1	1	1	+	1	+	+	+	.	+	1	1	+
Polygonum aviculare agg.	+	+	.	+	+	.	.	.	.	.	+	+	.	+	+	+	.	.	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.
Tripleurospermum inodorum	.	.	.	+	+	.	+	.	.	.	.	.	+	+	+	+	+	.	+	.	.	.	+	.	.	+	.	+	+	+	+	+	+
Rumex crispus	.	+	+	+	+	.	.	.	.	.	1	.	+	.	.	.	.	+	.	+	.	.	+	.	+	.	+	.	+	.	+	+	.
Centaurium pulchellum	.	+	+	.	+	.	.	+	.	.	.	.	.	.	+	+	+	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.
Juncus gerardii	.	.	.	.	.	1	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.
Carex hirta	.	+	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.
Centaurea jacea subsp. *angustifolia*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex maritimus	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	+	+	.

Cichorium intybus	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium fragiferum subsp. *bonannii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.	1	2	2	.	.	.	.	.	.	.	.	.	.
Teucrium scordium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	.	.	.	+
Galega officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.
Ononis spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.