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The vegetation with *Stipellula capensis* (Thunb.) Röser & Hamasha in the Abruzzo region (Central Italy)

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Abstract
This paper describes the vegetation with *Stipellula capensis* in the Abruzzo region (Central Italy). The species is a terophyte with a strictly Mediterranean distribution and it is generally present in sub-nitrophilous pastures of small annual plants, on thin soils often rich in small clasts. The area investigated is an inter-mountain basin that is characterized by a meso-Mediterranean sub-humid climate with a high level of continentality. For the investigated plant communities, the new association *Euphorbio exiguae-Stipelluletum capensis* is described, within the syntaxa *Hypochaeridenion achyrophori/ Hypochaeridion achyrophori/ Brachypodietalia distachyae/Tuberarietea guttatae*. The association is the last regressive stage of the brush-tree vegetation within the climatophilous and thermophilous series of *Quercus pubescens* s.l. (*Roso sempervirentis-Querco vigilianae* sigmetum).

Key words: Abruzzo, central Italy, phytosociology, *Stipellula capensis*, vegetation.

Introduction

Study area

Stipa capensis Thunb., recently moved to the new genus *Stipellula* Röser & Hamasha (Röser, 2012), is a terophyte with a strictly Mediterranean distribution (Pignatti, 1982) that is present in Italy in Liguria, in the central and southern regions, and in Sicily and Sardinia (Conti *et al*., 2005). The Abruzzo region is the northern distribution limit along the Adriatic side.

The species is a component of sub-nitrophilous pastures with a winter-spring cycle dominated by small annual plants, on thin soils often rich in small clasts. It is also part of merely nitrophilous annual vegetation.

This paper describes the vegetation with *Stipellula capensis* investigated in the Abruzzo region. Within the region the species is known only for a few sites in the Capestrano and Sulmona basins (Guarrera *et al*., 1995; Tammaro, 1995; Conti *et al*., 1999; Pirone *et al*., 1997). These two basins are contiguous and similar in geo-morphological and climatic features, in a altitudinal range between 350 and 700 m a.s.l. (Fig. 1).

The investigated sites are located in the carbonate Apennine belt, on soils mostly deriving from calcarenite and massive limestones dating from the Miocene to the Cretaceous eras (Vezzani & Ghisetti, 1998).

As regards climatic framing, the thermo-pluviometric diagrams of Popoli and Sulmona (Figs. 2 and 3), that are close to the survey sites, show a Mediterranean regime with the presence of a two-month period of aridity and average annual precipitation between 622 and 675 mm. In the pluviometric station of Capestrano (497 m a.s.l.) the average annual precipitation does not even exceed 550 mm, that is the minimum value among the all pluviometric stations in the Abruzzo region. On the basis of the bio-climatic indexes and classification by Rivas-Martínez (2011), the two thermo-pluviometric stations fall within the Oceanic pluvio-seasonal Mediterranean climate with a meso-Mediterranean thermotype and a sub-Humid ombrotype. The level of continentality of these inter-mountain basins is considerable (Ic = 18.19 at Sulmona) and it is also demonstrated by the presence of para-steppic species and vegetation.

Materials and methods

The study of the vegetation was made with the phytosociological method of the school of Zurich-Montpellier (Braun-Blanquet, 1931), integrated with the more recent acquisitions (Géhu & Rivas-Martínez, 1981; Theurillat, 1992; Biondi, 2011). The original relevés were made on the southern slopes of the Capestrano basin in April 2016.

For the syntaxonomic references of the upper units (suballiance, alliance, order and class) the scheme adopted here follows that of the Vegetation Prodrome of Italy (Biondi *et al*., 2014).

The life-forms and the choro-types are taken from Pignatti (1982). The related spectra were calculated, both normal and on the basis of the frequencies. To make this easier to understand, the choro-types were grouped in the following way: Endemics; Steno-Mediterranean (Steno-Medit., E-Steno-Medit., S-Medit);

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Fig. 1 - Study area.

Euri-Mediterranean (Euri-Medit., Eurimedit.-Pontic, Euri-Medit.-W-Asiat., Euri-Medit.-Turan., Euri-Medit., C and W-Medit, NE-Medit.); Eurasiatic (SE-Europ., SW-Europ., S-Europ., Eurasiat. temp., S-Siber.-S-Europ., European-W-Asiat.); Paleotemperate; Wide distribution (Subcosmop., Cosmopol.).

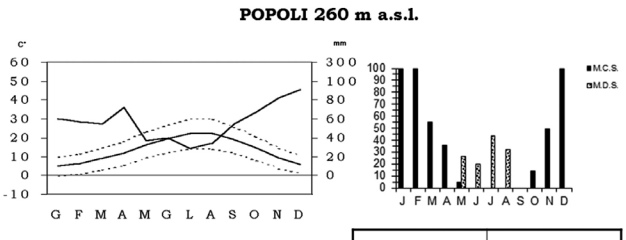
Results and discussion

Generally, the associations with dominance of *Stipellula capensis* are divided into two distinct groups: the first groups the sub-nitrophilous communities of terophytic pastures belonging to the *Tuberarietea guttatae* class; the second refers to the more nitrophilous coenoses such as those at the edges of roads, abandoned crops, etc. of the *Stellarietea mediae* class.

A single survey with dominant *Stipellula capensis* was published for the Abruzzo region, in the "Sorgenti del Pescara" Natural Reserve at the southern and eastern edge of the Sulmona basin and was attributed to the association *Bromo tectori-Stipetum capensis* Rivas-Martínez & Izco 1977 (*Taeniathero-Aegilopion geniculatae*, *Thero-Brometalia*, *Stellarietea mediae*), whose floristic composition highlights an organic-rich substrate (Pirone *et al.*, 1997).

Instead, the surveys carried out in the Capestrano basin (Tab. 1) refer to sub-nitrophilous communities which spread over few nitrified substrata. These pastures are included in a vegetation mosaic also comprising hemicryptophytic and xerophytic pastures, camephyte-dominated garrigues, brushes of xerophilous species belonging to the genera *Juniperus*, *Cytisus*, *Rhamnus*, *Pistacia*, etc.

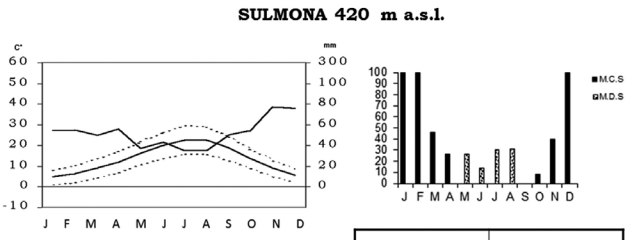
The examination of the known vegetations with dominance of *Stipellula capensis* in Italy shows the *Hypochaerido achyrophori-Stipetum capensis* association, described by Scoppola (1999) for the travertines of the Viterbo province (Lazio, Italia) to be the one with evident floristic and ecological affinities with those of Abruzzo. That association was included by the Author in the *Echio-Galactition tomentosae* alliance (*Brometalia rubenti-tectorum*, *Stellarietea mediae*) and was later moved by Biondi and Guerra (2008), in a revision of the terophytic grasslands of the *Brachypodietalia distachyae* order of the European Central Mediterranean, into the *Hypochaeridion achyrophori* alliance (*Brachypodietalia distachyae*, *Tuberarietea guttatae*) which is the vicariant of the Western Mediterranean *Trachynion distachyae* alliance and of which *Hypochaeris achyrophorus*, *Ononis reclinata*, *Lotus ornithopodioides* and *Coronilla scorpioides* were indicated as characteristic species. The



INDEXES	BIO-CLIMATIC CLASSIFICATION
Ios_2= 1.73	MACRO-BIOCLIMATE: MEDITERRANEAN
Ic= 17.44	BIOCLIMATE: PLUVIOSEASONAL OCEANIC MEDITERRANEAN
It= 231.72	THERMOTYPE: UPPER MESO-MEDITERRANEAN
Io= 4.18	OMBROTYPE: LOWER SUB-HUMID

T max YEAR	19.79 C°
T med YEAR	13.43 C°
T min YEAR	7.10 C°
P YEAR	674.76 mm
N° months T min <0 C°	1
N° months T med <10 C°	5

Fig. 2 - Climatic diagrams and bioclimate of the thermo-pluviometric station of Popoli.



INDEXES	BIO-CLIMATIC CLASSIFICATION
Ios_4= 1.83	MACRO-BIOCLIMATE: MEDITERRANEAN
Ic= 18.19	BIOCLIMATE: PLUVIOSEASONAL OCEANIC MEDITERRANEAN
It= 224.27	THERMOTYPE: UPPER MESO-MEDITERRANEAN
Io= 3.89	OMBROTYPE: LOWER SUB-HUMID

T max YEAR	18.40 C°
T med YEAR	13.33 C°
T min YEAR	8.27 C°
P YEAR	622.16 mm
N° months T min <0 C°	-
N° months T med <10 C°	5

Fig. 3 - Climatic diagrams and bioclimate of the thermo-pluviometric station of Sulmona.

Authors highlight two suballiances within the alliance: *Hypochaeridenion achyrophori*, northwards, differentiated by Euri-Mediterranean species (*Arenaria leptoclados*, *Trifolium scabrum* subsp. *scabrum*, *Cerastium semidecandrum* and *Galium parisiense*), and *Ononidenion ornithopodioides*, more thermophilous and widespread in the south, differentiated by thermo-Mediterranean species (*Ononis ornithopodioides*, *Trifolium lucanicum*, *Bromus fasciculatus*, *Odontites lutea*, *Ammoides pusilla*, *Romulea bulbocodium* and *Convolvulus elegantissimus*). The association *Hypochaerido achyrophori-Stipetum capensis* was included in the first suballiance.

Here, we propose to move some species indicated for the suballiance *Ononidenion* to the alliance because of their geographic distribution: *Odontites lutea*, *Convolvulus elegantissimus*, *Ammoides pusilla* and *Romulea bulbocodium*.

A further but less significant similarity is between the communities of Abruzzo with those of *Plantago afrae-Stipetum capensis*, an association proposed by Foggi *et al*. (2008) for the Island of Pianosa in the Tuscan archipelago and placed by the Authors in the *Stipion capensis*, *Stipo-Bupleuretalia semicompositi* and *Tuberarietea guttatae* syntaxa. We believe that it would be more appropriate to place this association in the *Hypochaeridion/Hypochaeridenion achyrophori* units, and we suggest that *Parentucellia viscosa, Pallenis spinosa*, *Medicago polymorpha* and *Asphodelus fistulosus* should be identified as differential species.

For the Abruzzo communities that show a substantial floristic autonomy, we propose the new association *Euphorbio exiguae-Stipelluletum capensis* (*holotypus* Tab. 1, rel. 5), within the *Hypochaeridion achyrophori* alliance and the *Hypochaeridenion achyrophori* suballiance. The species *Euphorbia exigua* subsp. *exigua*, *Ammoides pusilla*, *Hippocrepis ciliata* and *Valerianella pumila* are proposed as diagnostic with a preeminent differential character.

The association describes the sub-nitrophilous terophytic spring vegetation, on shallow soils, dominated by *Stipellula capensis*, which spreads along the southern slopes of the Capestrano basin, on carbonatic litho-types, in a meso-Mediterranean sub-Humid climate with high levels of continentality.

The life-form spectrum (Fig. 4) shows an obvious prevalence of the terophytes (respectively 59.3% and 60.6% in the normal spectrum and in the spectrum calculated on the basis of the frequencies. They are followed by the hemicryptophytes. (27.1% and 30.5%) while the values of the other life forms are clearly lower.

The chorological spectrum (Fig. 5) shows the predominance of the Mediterranean species, particularly Euri-Mediterranean (33.9% and 36.1% respectively in the normal spectrum and in the spectrum calculated on the basis of the frequencies) and Steno-Mediterranean

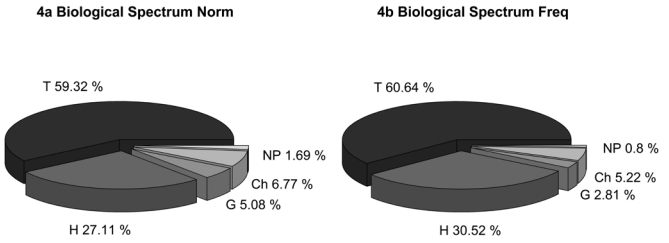


Fig. 4 - a) Life-form spectrum normal; b) life-form spectrum frequence.

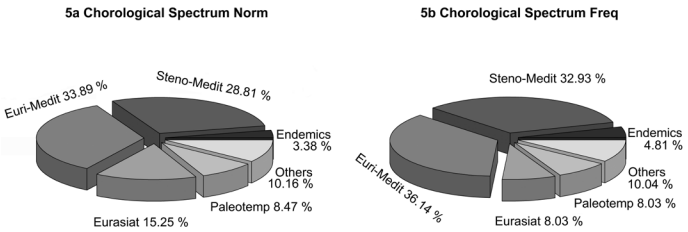


Fig. 5 - a) Chorological spectrum normal; b) chorological spectrum frequence

(28.8% and 32.9%).

The Eurasiatic species are relatively well represented (15.3% and 8%), while lower values are shown by the Endemics (3.4% and 4.8%).

The association represents the last regressive stage of the brush-tree vegetation within the climatophilous and thermophilous series of *Quercus pubescens* s.l. (*Roso sempervirentis-Querco virgilianae* sigmetum) of the Central Apennines and is in contact with the xerophilous hemicryptophytic pasture of the *Lino tommasinii-Stipetum apenninicolae* association described for the Capestrano basin (Pirone *et al*., 2001, Frattaroli *et al*., 2014).

The other stages of the series are: garrigue of the *Osyrido albae-Cystetum cretici* association which was described for the inter-montane basins of the Abruzzo Apennines (Pirone & Tammaro, 1997); brush of the *Cytiso spinescentis-Juniperetum oxycedri* association, described for the same territory (Pirone & Cutini, 2002); pre-wood of the *Lonicero etruscae-Carpinetum orientalis* association, established for the Latium territory (Blasi *et al*., 2001) and found also in the Capestrano basin (Pirone *et al*., 2001).

The synoptic table n. 2, in which the three associations dominated by *Stipellula capensis* and belonging to the *Hypochaeridion/Hypochaeridenion achyrophori* units are compared, shows the relative floristic differences.

The appendix II reports a list of the associations dominated by *Stipellula capensis* in Italy, together with the syntaxonomic frame as reported by the Authors and corrected on the basis of the Vegetation Prodrome of Italy (Biondi *et al*., 2014).

Tab. 1 - *Euphorbio exiguae-Stipelluletum capensis* ass. nova.

life-forms	choro-types	Relevé (n°)	1	2	3	4	5*	6	7	8	9	Presences
		Altitude (m a.s.l.)	370	370	350	380	390	390	460	450	430	
		Exposure	SSW	SSW	SSW	SSW	WSW	WSW	SE	SSE	SW	
		Slope (°)	15	20	25	15	5	10	20	20	10	
		Total cover (%)	75	70	90	75	85	90	80	80	70	
		Stones cover (%)	80	80	80	75	15	20	70	85	70	
		Solid rock cover (%)	-	-	-	-	-	5	-	-	-	
		Area (m²)	5	8	6	16	10	10	12	14	5	
		Charact. and diff. species of the ass.										
T	Steno-Medit.	Stipellula capensis (Thunb.) Röser & Hamasha	4	4	4	4	3	3	3	4	1	V
T	Euri-Medit.	Euphorbia exigua L. ssp. exigua	.	+	+	1	.	+	1	+	+	IV
T	Steno-Medit.	Hippocrepis ciliata Willd.	1	.	2	+	+	.	+	2	.	III
T	Steno-Medit.	Ammoides pusilla (Brot.) Breistr.	1	.	.	.	1	1	.	+	.	III
T	Steno-Medit.	Valerianella pumila (L.) DC.	.	.	.	1	+	+	.	.	+	II
		Hypochaeridion/Hypochaeridenion achyrophori										
T	Steno-Medit.	Hypochaeris achyrophorus L.	1	1	2	2	2	2	2	2	1	V
T	Euri-Medit.	Trifolium scabrum L. ssp. scabrum	+	2	2	+	.	.	1	1	2	IV
T	Steno-Medit.	Medicago truncatula Gaertn.	.	.	.	+	2	2	1	1	1	IV
T	Paleotemp.	Minuartia hybrida (Vill.) Shischk. ssp. hybrida	+	+	+	.	+	+	+	.	.	III
T	Steno-Medit.	Plantago afra L. ssp. afra	.	.	1	.	2	1	2	1	4	III
T	Cosmopol.	Cerastium semidecandrum L.	.	.	+	+	+	+	+	.	.	III
T	Paleotemp.	Arenaria leptoclados (Rchb.) Guss.	.	.	.	1	1	1	.	+	1	III
T	S-Europ.	Viola hymettia Boiss. & Heldr.	.	.	+	.	.	.	.	.	+	I
		Brachypodietalia distachyi/Tuberarietea guttatae										
T	Euri-Medit.	Helianthemum salicifolium (L.) Mill.	2	2	2	2	2	2	1	1	1	V
T	Steno-Medit.	Asterolinon linum-stellatum (L.) Duby	+	1	1	+	+	.	1	1	+	IV
T	Euri-Medit.	Trifolium stellatum L.	.	+	1	+	+	+	.	+	+	IV
T	Euri-Medit.	Crupina vulgaris Cass.	+	+	+	+	.	.	+	+	.	III
T	Euri-Medit.	Crepis sancta (L.) Babc. ssp.sancta	.	.	1	.	+	.	+	1	2	III
T	Euri-Medit.	Lagurus ovatus L. ssp. ovatus	.	.	1	+	.	.	+	1	+	III
T	Steno-Medit.	Linum corymbulosum Rchb.	+	+	.	1	.	.	+	.	.	II
T	Subcosmop.	Erodium cicutarium (L.) L'Hér.	1	+	.	.	+	.	.	+	.	II
T	Euri-Medit.	Alyssum alyssoides (L.) L.	.	.	.	.	+	+	.	.	+	II
T	Paleotemp.	Silene conica L.	.	.	+	+	.	+	.	.	.	II
T	Steno-Medit.	Clypeola jothlaspi L. ssp jonthlaspi	+	+	.	.	.	.	.	.	.	I
T	Euri-Medit.	Linaria simplex (Willd.) DC.	.	.	.	1	.	+	.	.	.	I
T	S-Siber.-S-Europ.	Xeranthemum cylindraceum Sm.	.	.	.	.	+	.	.	.	+	I
T	Steno-Medit.	Polygala monspeliaca L.	.	.	.	.	.	.	1	+	.	I
T	Euri-Medit.	Buglossoides arvensis (L.) I.M. Johnst.	.	+	.	.	.	.	.	.	.	I
T	Europeo-W-Asiat.	Geranium pusillum L.	.	.	+	.	.	.	.	.	.	I
T	Steno-Medit.	Onobrychis caput-galli (L.) Lam.	.	.	.	.	.	1	.	.	.	I
T	Steno-Medit.	Astragalus sesameus L.	.	.	.	.	.	+	.	.	.	I
G	s-Medit.	Gagea granatellii (Parl.) Parl.	.	.	.	.	.	.	+	.	.	I
T	Euri-Medit.	Saxifraga tridactylites L.	.	.	.	.	.	.	.	.	+	I
		Other species										
H	Steno-Medit.-Or.	Convolvulus elegantissimus Mill.	2	1	2	.	1	1	1	1	1	V
H	Euri-Medit.	Convolvulus cantabrica L.	.	2	1	2	2	1	1	2	1	V
H	Steno-Medit.	Reichardia picroides (L.) Roth	+	1	.	1	+	1	+	+	.	IV
H	Endem.	Centaurea ambigua Guss. ssp. ambigua	.	1	+	1	1	1	+	+	.	IV
H	Euri-Medit.-Centro-Occid.	Urospermum dalechampii (L.) F.W. Schmidt	2	+	1	1	.	.	1	2	.	IV
H	Subcosmop.	Hypericum perforatum L.	.	+	.	+	+	1	1	.	1	III
H	S-Europ.	Leontodon crispus Vill. ssp. crispus	+	1	.	.	+	+	+	.	.	III
H	NE-Medit.	Eryngium amethystinum L.	+	+	+	.	.	.	+	.	+	III
H	Endem.	Stipa dasyvaginata Martinovsky ssp. apenninicola Martinovsky & Moraldo	+	+	+	.	.	.	1	+	.	III
H	Euri-Medit.	Ononis pusilla L. ssp. pusilla	.	1	1	1	.	.	+	1	.	III
Ch	Eurimedit.-Pontica	Fumana procumbens (Dunal) Gren. & Godr.	.	.	.	+	1	2	2	2	.	III
H	Subcosmop.	Sanguisorba minor Scop. ssp. minor	+	+	.	.	+	.	.	.	+	III
T	Cosmopol.	Euphorbia helioscopia L. ssp. helioscopia	1	.	.	+	.	.	+	+	.	II
G	Paleotemp.	Allium sphaerocephalon L.	1	+	.	.	.	.	+	+	.	II
Ch	Steno-Medit.	Teucrium capitatum L. ssp. capitatum	.	+	+	+	.	.	+	.	.	II
H	Euri-Medit.-W-Asiat.	Lactuca viminea (L.) J. & C. Presl. ssp. viminea	1	+	.	.	.	.	.	.	.	II
H	SE-Europ.	Seseli tommasinii Rchb. f.	+	1	.	.	.	.	.	.	.	I
NP	Euri-Medit.	Osyris alba L.	.	+	.	.	.	.	.	1	.	I
G	Euri-Medit.	Muscari neglectum Guss. ex Ten.	.	+	.	.	.	.	.	.	+	I
H	SE-Europ.	Linum tommasinii (Rchb.) Nyman	.	.	+	.	.	.	1	.	.	I
Ch	SW-Europ.	Helianthemum apenninum (L.) Mill. ssp. apenninum	.	.	+	.	.	.	+	.	.	I
H	Eurasiat.-temp.	Stipa capillata L.	.	.	.	.	+	+	.	.	.	I
T	Subcosmop.	Sherardia arvensis L.	.	.	.	.	+	.	1	.	.	I
T	Euri-Medit.-Turan.	Avena barbata Pott ex Link	.	.	.	.	1	.	.	.	1	II
H	Paleotemp.	Poa bulbosa L.	.	.	.	.	+	.	.	.	+	I
Ch	S-Europ.	Helichrysum italicum (Roth) G. Don ssp. italicum	.	.	.	.	.	.	+	+	.	I
		Sporadic species	1	0	1	7	2	0	0	1	4	

Tab. 2 - Synoptic table: 1) *Hypochaerido achyrophori-Stipetum capensis* Scoppola 1999; 2) *Plantago afrae-Stipetum capensis* Foggi, Cartei & Pignotti 2008; 3) *Euphorbio exiguae-Stipelluletum capensis* ass. nova.

	1	2	3
Stipellula capensis	V	V	V
Hypochaerido achyrophori-Stipetum capensis			
Aegilops geniculata Roth	V	.	.
Tordylium apulum L.	IV	.	.
Carthamus lanatus L.	III	.	.
Lotus ornithopodioides L.	III	.	.
Plantago afrae-Stipetum capensis			
Parentucellia viscosa (L.) Caruel	.	IV	.
Pallenis spinosa (L.) Cass. ssp. spinosa	.	III	.
Medicago polymorpha L.	.	II	.
Asphodelus fistulosus L.	.	II	.
Euphorbio exiguae-Stipelluletum capensis			
Euphorbia exigua L. ssp. exigua	.	.	IV
Ammoides pusilla (Brot.) Breistr.	.	.	III
Hippocrepis ciliata Willd.	.	.	III
Valerianella pumila (L.) DC.	.	.	II
Hypochaeridion/Hypochaeridenion achyrophori			
Hypochaeris achyrophorus L.	V	II	V
Trifolium scabrum L. ssp. scabrum	III	V	IV
Plantago afra L. ssp. afra	IV	V	III
Medicago truncatula Gaertn.	I	.	IV
Arenaria leptoclados (Rchb.) Guss.	II	.	III
Minuartia hybrida (Vill.) Shischk. ssp. hybrida	.	.	III
Cerastium semidecandrum L.	.	.	III
Viola hymettia Boiss. & Heldr.	.	.	I
Brachypodietalia distachyi			
Linum corymbulosum Rchb.	IV	I	II
Asterolinon linum-stellatum (L.) Duby	I	.	IV
Sideritis romana L. ssp. romana	IV	.	.
Filago pyramidata L.	II	.	.
Catapodium rigidum (L.) C.E. Hubb. Ex Dony	III	.	.
Alyssum simplex Rudolphi	II	.	.
Euphorbia falcata L. ssp. falcata	I	.	.
Trachynia distachya (L.) Link	.	I	.
Clypeola jothlaspi L. ssp. jonthlaspi	.	.	I
Tuberarietea guttatae			
Trifolium stellatum L.	II	IV	IV
Medicago minima (L.) L.	IV	III	.
Helianthemum salicifolium (L.) Mill.	V	.	V
Erodium cicutarium (L.) L'Hér.	I	.	II
Polygala monspeliaca L.	II	.	I
Onobrychis caput-galli (L.) Lam.	I	.	I
Lagurus ovatus L. ssp. ovatus	.	IV	III
Campanula erinus L.	III	.	.
Scorpiurus muricatus L.	II	.	.
Vulpia myuros (L.) C.C. Gmel.	I	.	.
Trifolium cherleri L.	I	.	.
Trifolium campestre Schreb.	I	.	.
Petroragia saxifraga (L.) Link ssp. saxifraga	.	I	.
Crupina vulgaris Cass.	.	.	III
Crepis sancta (L.) Babc. ssp.sancta	.	.	III
Alyssum alyssoides (L.) L.	.	.	II
Silene conica L.	.	.	II
Linaria simplex (Willd.) DC.	.	.	I
Xeranthemum cylindraceum Sm.	.	.	I
Buglossoides arvensis (L.) I.M. Johnst.	.	.	I
Geranium pusillum L.	.	.	I
Astragalus sesameus L.	.	.	I
Gagea granatellii (Parl.) Parl.	.	.	I
Saxifraga tridactylites L.	.	.	I
Other species			
Avena barbata Pott ex Link	V	V	II
Bromus hordeaceus L. sl.l.	I	I	.
Urospermum dalechampii (L.) F.W. Schmidt	IV	.	IV
Euphorbia helioscopia L. ssp. helioscopia	II	.	II
Sherardia arvensis L.	II	.	I
Dasypirum villosum (L.) P. Candargy	IV	.	.
Nigella damascena L.	III	.	.
Plantago lagopus L.	III	.	.
Tyrimnus leucographus (L.) Cass.	III	.	.
Geranium molle L.	III	.	.
Bromus madritensis L.	II	.	.
Loncomelos narbonensis (L.) Raf.	II	.	.
Anthemis arvensis L.	II	.	.
Vulpia ciliata Dumort	II	.	.
Reseda phyteuma L. ssp. phyteuma	II	.	.
Papaver rhoeas L. ssp. rhoeas	II	.	.
Galactites tomentosus Moench	II	.	.
Avena sterilis L.	II	.	.
Convolvulus arvensis L.	.	III	.
Bromus rubens L.	.	II	.
Convolvulus althaeoides L.	.	II	.
Convolvulus elegantissimus Mill.	.	.	V
Convolvulus cantabrica L.	.	.	V
Reichardia picroides (L.) Roth	.	.	IV
Centaurea ambigua Guss. ssp. ambigua	.	.	IV
Hypericum perforatum L.	.	.	III
Leontodon crispus Vill. ssp. crispus	.	.	III
Ononis pusilla L. ssp. pusilla	.	.	III
Eryngium amethystinum L.	.	.	III
Stipa dasyvaginata Martinovsky ssp. apenninicola Martinovsky & Moraldo	.	.	III
Sanguisorba minor Scop. ssp. minor	.	.	III
Fumana procumbens (Dunal) Gren. & Godr.	.	.	III
Allium sphaerocephalon L.	.	.	II
Teucrium capitatum L. ssp. capitatum	.	.	II
Lactuca viminea (L.) J. & C. Presl. ssp. viminea	.	.	II

Syntaxonomic scheme

(Italian associations belonging to the *Hypochaeridion achyrophori* alliance and the *Hypochaeridenion achyrophori* suballiance)

TUBERARIETEA GUTTATAE (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas-Goday & Rivas-Martínez 1963 *nom. mut. propos*. Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002
BRACHYPODIETALIA DISTACHYAE Rivas-Martínez 1978
Hypochaeridion achyrophori Biondi & Guerra 2008
Hypochaeridenion achyrophori Biondi & Guerra 2008
Hypochaerido achyrophori-Stipetum capensis Scoppola 1999
Plantago afrae-Stipetum capensis Foggi, Cartei & Pignotti 2008
Euphorbio exiguae-Stipelluletum capensis ass. nova *hoc loco*

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Appendix I: Accidental species

Tab. 1 - Rel. 1: Medicago lupulina L. (+); rel. 3: Satureja montana L. subsp. montana (+); rel. 4: Cytisus spinescens C. Presl. (+), Hippocrepis comosa L. subsp. comosa (+), Medicago prostrata Jacq. subsp. prostrata (1), Matthiola fruticulosa (L.) Maire subsp. fruticulosa (+), Pistacia terebinthus L. subsp. terebinthus (+), Plantago lanceolata L. (+), Silene otites Wibel subsp. otites (+); rel 5: Linaria purpurea (L.) Mill. (+), Sedum hispanicum L. (+); rel. 8: Vicia sativa L. s.l.(+); rel. 9: Cirsium vulgare (Savi) Ten. (1), Geranium rotundifolium L. (+), Lathyrus cicera L. (+), Vicia peregrina L. (1).

Appendix II: List of the association with dominant *Stipellula capensis* in Italy.

Tuscan Archipelago: *Plantago afrae-Stipetum capensis* Foggi, Cartei & Pignotti 2008 (Foggi *et al*., 2008) [*Stipion capensis* Br.-Bl. in Br.-Bl. & Bolós em. Izco 1974, *Stipo-Bupleuretalia semicompositi* Brullo in Brullo, Scelsi & Spampinato 2001, *Tuberarietea guttatae* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas Goday & Rivas-Martínez 1963 *nom. mut. propos*. Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002].

Latium: *Hypochaerido achyrophori-Stipetum capensis* Scoppola 1999 (Scoppola, 1999; Facioni, 2011-2012) [*Echio plantaginei-Galactition tomentosae* O. Bolòs & Molinier 1969, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae* Tüxen, Lohmeyer & Preising ex Von Rochow 1951].

Abruzzo: *Bromo tectori-Stipetum capensis* Rivas-Martinez & Izco 1977 (Pirone *et al*., 1997) [*Taeniathero-Aegilopion geniculatae* Rivas-Martinez & Izco 1977, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae* Tüxen, Lohmeyer & Preising ex Von Rochow 1951].

Apulia: *Onobrychido aequidentatae-Stipetum capensis* Biondi & Guerra 2008 (Biondi & Guerra, 2008) [*Hypochaeridion achyrophori* Biondi & Guerra 2008, *Brachypodietalia distachyae* Rivas-Martinez 1978, *Tuberatietea guttatae* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas Goday & Rivas-Martínez 1963 nom. mut. propos. Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002]; *Aveno sterilis-Stipetum capensis* Biondi & Mossa 1992 (Fanelli *et al*., 2001)) [*Stipion capensis* Br.-Bl. in Br.-Bl. & Bolós em. Izco 1974, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae* Tüxen, Lohmeyer & Preising ex Von Rochow 1951].

Calabria: *Plantagini bellardi-Stipetum capensis* Brullo, Scelsi & Spampinato 2001 (Brullo *et al*., 2001) [*Onobrychido-Ptilostemion stellati* Brullo, Scelsi & Spampinato 2001, *Stipo-Bupleuretalia semicompositi* Brullo in Brullo, Scelsi & Spampinato 2001, *Tuberarietea guttatae* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas Goday & Rivas-Martínez 1963 nom. mut. propos. Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002]; *Hypochaerido achyrophori-Stipetum capensis* Scoppola 1999 (Maiorca *et al*., 2013) [*Hypochaeridion achyrophori* Biondi & Guerra 2008, *Brachypodietalia distachyae* Rivas-Martinez 1978, *Tuberatietea guttatae* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas Goday & Rivas-Martínez 1963 *nom. mut. propos*. Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002].

Sicily: *Ononido brevifoliae-Stipetum capensis* Brullo, Guarino & Ronsisvalle 2000 (Brullo *et al*., 2000) [*Plantagini-Catapodion marini*, *Stipo-Bupleuretalia semicompositi*, *Tuberarietea guttatae*]; *Trigonello monspeliacae-Stipetum capensis* Tomaselli 1999 (Tomaselli, 1999) [*Plantagini-Catapodion marini* Brullo 1985, *Stipo-Bupleuretalia semicompositi* Brullo in Brullo, Scelsi & Spampinato 2001, *Tuberatietea guttatae*]; *Loto halophili-Stipetum capensis* Minissale & Sciandrello 2005 (Minissale & Sciandrello, 2005) and *Reichardio picroidis-Stipetum capensis* Gianguzzi, Ilardi & Raimondo 1996 (Gianguzzi *et al*., 1996) [*Echio plantaginei-Galactition tomentosae* O. Bolòs & Molinier 1969, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae* Tüxen, Lohmeyer & Preising ex Von Rochow 1951].

Sardinia: A*veno sterilis-Stipetum capensis* Biondi & Mossa 1992 (Biondi & Mossa, 1992) [*Stipion capensis* Br.-Bl. in Br.-Bl. & Bolós em. Izco 1974, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae* Tüxen, Lohmeyer & Preising ex Von Rochow 1951]; *Bromo tectori-Stipetum capensis* Rivas-Martinez & Izco 1977 (Biondi & Bagella, 2005) [*Taeniathero-Aegilopion geniculatae* Rivas-Martinez & Izco 1977, *Thero-Brometalia* (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975, *Stellarietea mediae*

Tüxen, Lohmeyer & Preising ex Von Rochow 1951]; *Onobrychido aequidentatae-Stipetum capensis* Biondi & Guerra 2008 (Biondi & Guerra, 2008) [*Ononidenion ornithopodioides* Biondi & Guerra 2008, *Hypochaeridion achyrophori* Biondi & Guerra 2008, *Brachypodietalia distachyae* Rivas-Martinez 1978, *Tuberatietea guttatae* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas Goday & Rivas-Martínez 1963 *nom. mut. propos.* Rivas-Martínez, Diaz, Fernández-González, Izco, Loidi, Lousa & Penas 2002].