

The vegetation of the river bed and the first alluvial terraces of the River Trigno (Abruzzo-Molise)

G. Pirone¹, G. Ciaschetti & A. R. Frattaroli

¹*Department of Environmental Sciences, University of L'Aquila, Via Vetoio, Località Coppito, I-67100 L'Aquila; e-mail: gianfranco.pirone@univaq.it*

Abstract

We here present a study of the vegetation of the alluvial deposits of the River Trigno that runs between the regions of Abruzzo and Molise, Italy, the morphology of which resembles that of the seasonal, gravel-bed “*fiumare*”, or river, of southern Italy. On the bed of the river, there is the association *Artemisia variabilis-Helichrysetum italicum*, which has been described for the Lucano-Calabrian *fiumare*. This has particular aspects that have been formally described in the subassociation *arundinetosum plinii*. There is also the pioneering hygro-nitrophilous vegetation of the association *Polygonum lapatifolium-Xanthium italicum*. On the first alluvial terrace, the communities seen are: the garrigue with *Lomelosia crenata* subsp. *pseudisetensis*, for which we propose the new association *Artemisia variabilis-Lomelosietum pseudisetensis*; *Hyparrhenia hirta* subsp. *hirta* thermo-xerophilous grasslands of the association *Onosmo echinoidis-Hyparrhenietum hirtae*, which are here in the new subassociation *imperatetosum cylindricae*; a *Tamarix africana* wood; and the weakly alo-hygrophilous grasslands of the associations *Imperato cylindricae-Juncetum tommasinii* and *Schoeno nigricantis-Erianthetum ravennae*.

Key words: River Trigno, vegetation, phytosociology, river bed, alluvial terraces, Abruzzo-Molise.

Riassunto

Viene presentato uno studio sulla vegetazione dei depositi alluvionali del fiume Trigno, tra le Regioni Abruzzo e Molise, la cui morfologia ricorda le “*fiumare*” dell'Italia meridionale. Sul greto del fiume è stata rilevata l'associazione *Artemisia variabilis-Helichrysetum italicum*, descritta per le *fiumare* lucano-calabresi, con aspetti peculiari formalizzati nella subassociazione *arundinetosum plinii*, oltre alla vegetazione pioniera igro-nitrofila dell'associazione *Polygonum lapatifolium-Xanthium italicum*. Sul primo terrazzo le comunità rilevate sono: gariga a *Lomelosia crenata* subsp. *pseudisetensis*, di cui si propone la nuova associazione *Artemisia variabilis-Lomelosietum pseudisetensis*; prateria termo-xerica ad *Hyparrhenia hirta* subsp. *hirta* dell'associazione *Onosmo echinoidis-Hyparrhenietum hirtae*, qui presente nella nuova subassociazione *imperatetosum cylindricae*; boscaglia a *Tamarix africana*; praterie debolmente alo-igrofile delle associazioni *Imperato cylindricae-Juncetum tommasinii* ed *Schoeno nigricantis-Erianthetum ravennae*.

Parole chiave: fitosociologia, greto, terrazzi alluvionali, fiume Trigno, Abruzzo-Molise.

Introduction

The aim of the present study was a phytosociological investigation of the vegetation of the alluvial deposits of the River Trigno, which marks the administrative border between the Regions of Abruzzo (Chieti Province) and Molise (Campobasso Province). With its wide gravelly and stony river bed and considering its hydrology, the River Trigno resembles the seasonal, gravel-bed “*fiumare*” of southern Italy. This morphological-functional similarity is also supported by some of the vegetation types that are fully comparable to those of the *fiumare*. The present study has therefore allowed an extension of the considerations and syntaxonomic references of the more southern areas to the territories of the Adriatic side of central Italy, although with some predictable floristic-ecological differences.

The study area

The study area includes the medium to low tract of the River Trigno (Fig. 1) that flows within a wide valley cut through the modest heights of the Frentani Mountains. The sector studied is characterised by a

wide river bed and it lies between the confluence of River Treste (about 100 m) near Lentella, about 10 km from the Adriatic Sea, and the San Giovanni Valley (about 220 m) at the level of San Giovanni Lipioni.

The lithologies outcropping in the valley area are referred to the units of the Molise basin: layered clays, flysch, marl limestone with clay marl, and conglomerate deposits with chalk arenites and silt (Vezzani & Ghisetti, 1998). The bed of the river and the lower alluvial terraces are composed of fluvial deposits that are mainly gravelly sand. The presence of lithotypes from evaporitic sequences and of multicoloured clays explains the establishing of weakly alophilous vegetal communities, as detailed in the following paragraphs. For the description of the climatic aspects, the data from the thermopluviometric stations of Vasto and Trivento were analysed, along with those from the pluviometric stations of San Salvo, Lentella and Montemitro, for the thirty-year period of 1967-1996. The analysis of the data shows a mainly Mediterranean climate that is characterised by hot summers with little precipitation, and mild winters, with a tendency for transition to a temperate microclimate only in the higher aspects along the valley slopes (Fig. 2). However, the monthly dry stress index (Mitrakos, 1980) does not reach high

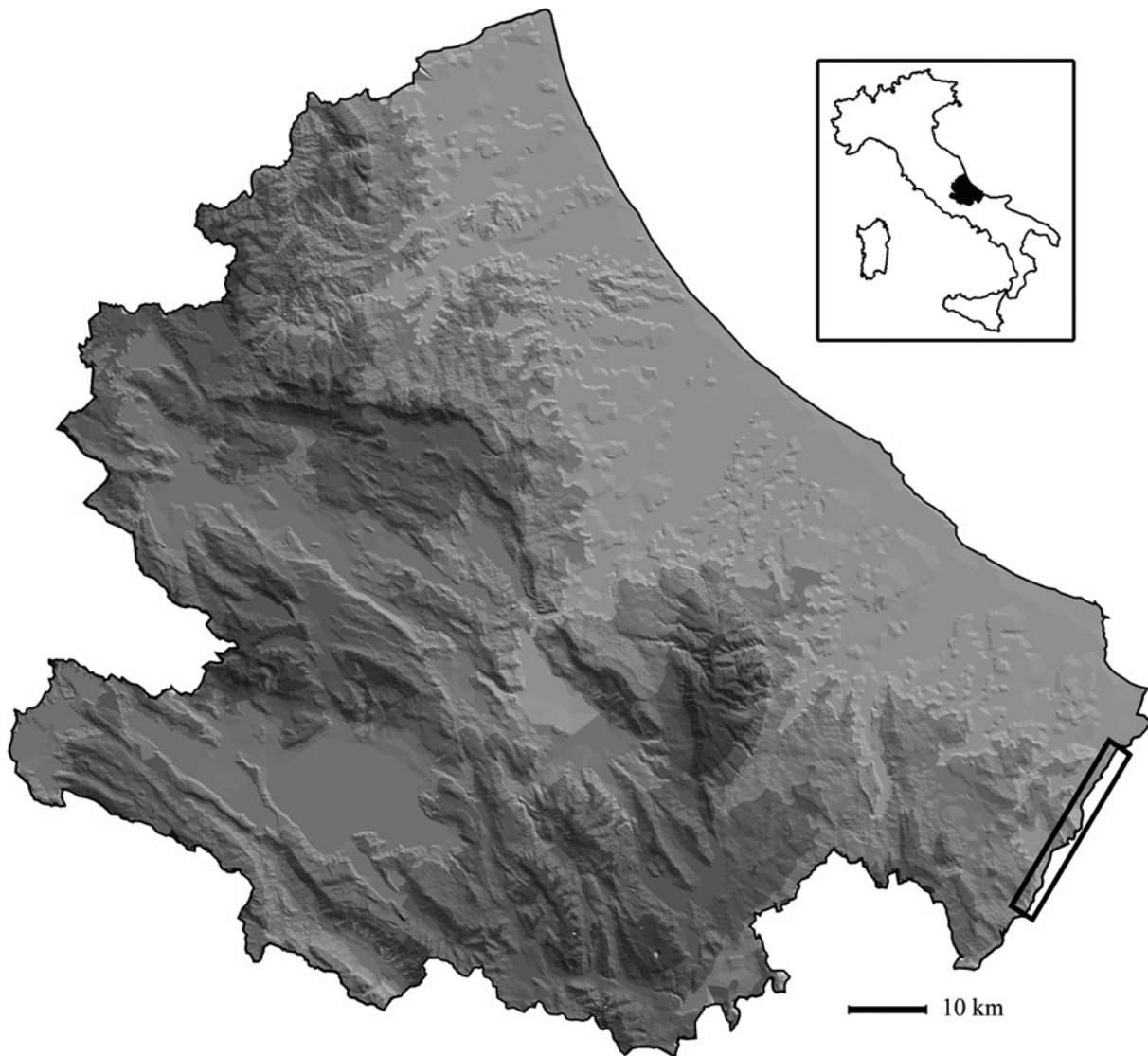


Fig. 1 - Study area

values, even in the hottest months; the monthly cold stress (Mitrakos, 1982) is very weak. According to the bioclimatic classification by Rivas-Martínez (1996, 2002), the study area can be included in a transition belt between the low-Mesomediterranean and low-mesotemperate thermotypes, and the upper-dry and low-subhumid ombrotypes.

Materials and methods

This vegetational study was carried out according to the phytosociological method, using the abundance-dominance scale proposed by Braun-Blanquet (1964). The samplings were subdivided into Tables according to physiognomic-structural categories, whereby it was not considered necessary to subject these

to multivariate analyses considering the extensive homogeneity of the individual aspects. The form of growth and the chorotypes were assessed according to Pignatti (1982). For the newly described associations and subassociations, calculations were carried out for the normal and weighted biological and chorological spectra, according to frequencies, were calculated. With the aim of simplifying their interpretation, the chorotypes were grouped as follows: Endemic, Stenomediterranean, Eurimediterranean, Orophytic, Turanian, Pontic, Eurasiatic s.l., Paleotemperate, Nordic (Circumboreal and Euro-Siberian), and Cosmopolitan. The nomenclature of the species conforms to that reported in Conti *et al.* (2005). Figure 3 shows a schematic transect of the vegetation sampled.

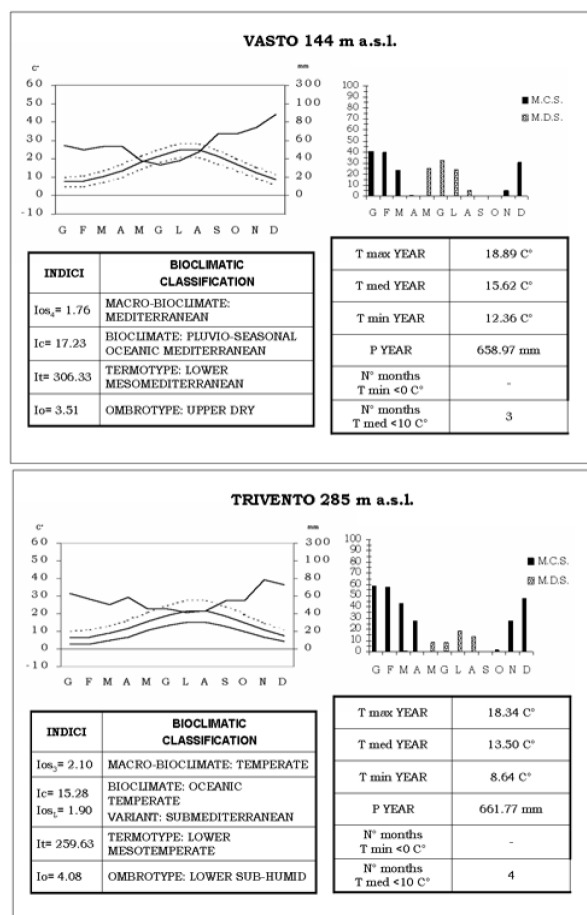


Fig. 2 – Bioclimatic classification

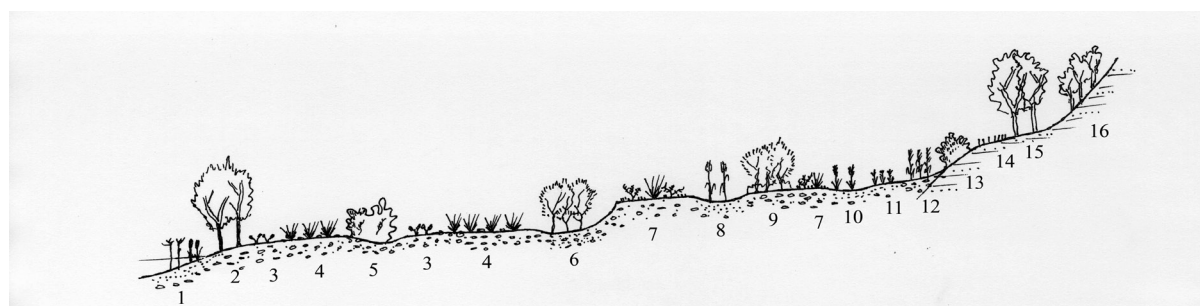


Fig. 3 – Vegetation transect

1. Helophytic vegetation
2. *Salicetum albae*
3. *Polygono lapatifolii-Xanthietum italici*
4. *Artemisia variabilis-Helichrysetum italici arundinetosum plinii*
5. *Saponario-Salicetum purpureae*
6. *Tamarix africana* and *Pyracantha coccinea* community *Erianthus ravennae* variant
7. *Artemisia variabilis-Lomelosietum pseudisetensis* and *Trifolium campestre* community
8. *Schoeno nigricantis-Erianthetum ravennae*
9. *Tamarix africana* and *Pyracantha coccinea* community *Juniperus oxycedrus* subsp. *oxycedrus* variant
10. *Imperato cylindricae-Juncetum tommasinii*
11. *Onosmo echiodis-Hypparrietum hirtae imperatetosum cylindricae*
12. *Arundinetum plinianae*
13. *Prunetalia spinosae*
14. Cropland
15. *Rosa sempervirentis-Quercetum pubescentis*
16. *Cyclamino hederifolii-Quercetum ilicis*

Results and discussion

The river-bed vegetation

The sandy-stony bed of the river, and of some of its affluents, is periodically totally flooded, and it has been colonised by a discontinuous vegetation dominated by *Artemisia campestris* subsp. *variabilis*, which is not known for many locations in Abruzzo (Conti, 1998), and *Dittrichia viscosa*. This is seen as a vegetal community that has already been described for the seasonal, gravel-bed *fumare* of Calabria by Brullo & Spampinato (1990), who described the association *Artemisia variabilis-Helichrysetum italici*, later reported by Brullo *et al.* (2001). This association has also been reported for the Ionic *fumare* of Basilicata (Biondi *et al.*, 1994), and we refer the River Trigno population to this association, with its own autonomy at the level of subassociation.

The pioneering terophytic vegetation of the association *Polygono lapatifolii-Xanthietum italici* is also found for this river bed.

ARTEMISIO VARIABILIS-HELICHRYSSETUM ITALICI BRULLO & SPAMPINATO 1990 *ARUNDINETOSUM PLINII* SUBASS. NOVA (TABLE 1; *HOLOTYPE*: RIL. 1)

Physiognomy and structure: this vegetation is structurally characterised by the dominance of

Tab. 1 - *Artemisia variabilis-Helichrysetum italicum* Brullo & Spampinato 1990 *arundinetosum plinii* subass. nova

Rel. n.			1*	2	3	4	5
Coverage (%)			40	50	60	60	40
Surface (m ²)			100	100	40	40	70
Charact. sp. of the ass. <i>Artemisia variabilis-Helichrysetum italicum</i> and of the upper units							
Ch frut	Endem	<i>Artemisia campestris</i> L. ssp. <i>variabilis</i> (Ten.) Greuter	3	2	3	3	3
H scap	Euri-Medit	<i>Dittrichia viscosa</i> (L.) Greuter	2	2	2	3	2
Ch suffr	S-Europ	<i>Helichrysum italicum</i> (Roth) G. Don ssp. <i>italicum</i>	+	1	1	1	1
H bienn	Euri-Medit	<i>Verbascum sinuatum</i> L.	+	+	.	.	.
H scap	Subpont	<i>Chondrilla juncea</i> L.	.	.	+	.	.
H scap	Euri-Medit	<i>Scrophularia canina</i> L. ssp. <i>bicolor</i> (Sm.) Greuter	.	.	.	+	.
Diff. sp. of the subass. <i>arundinetosum plinii</i>							
G rhiz	Steno-Medit	<i>Arundo plinii</i> Turra	1	1	+	.	+
H scap	Euri-Medit	<i>Pulicaria dysenterica</i> (L.) Bernh.	1	+	.	+	+
H scap	W-Medit	<i>Sulla coronaria</i> (L.) Medik.	1	+	+	.	.
H scap	Euri-Medit	<i>Lolium multiflorum</i> Lam.	1	.	.	1	1
H rept	Circumbor	<i>Agrostis stolonifera</i> L.	+	.	.	1	.
H scap	Eurasiat	<i>Senecio erucifolius</i> L. ssp. <i>erucifolius</i>	+	.	.	+	.
H scap	Eurosiber	<i>Saponaria officinalis</i> L.	+	.	.	.	+
Other species							
H scap	Eurosiber	<i>Picris hieracioides</i> L.	1	1	+	1	1
H scap	S-Medit	<i>Foeniculum vulgare</i> Mill.	+	1	.	+	+
H scap	S-Europ-Pont	<i>Dorycnium herbaceum</i> Vill.	+	+	1	+	.
T scap	Eurasiat	<i>Sonchus oleraceus</i> L.	1	1	.	+	+
T scap	S-Europ	<i>Xanthium orientale</i> L. ssp. <i>italicum</i> (Moretti) Greuter	1	+	.	+	1
H bienn	Paleotemp	<i>Daucus carota</i> L.	+	1	.	1	1
H scap	Paleotemp	<i>Sanguisorba minor</i> Scop. s. l.	+	1	.	+	+
T scap	Cosmopol	<i>Erigeron canadensis</i> L.	+	.	+	2	1
T scap	S-Medit	<i>Melilotus sulcatus</i> Desf.	1	.	+	+	+
T scap	Euri-Medit	<i>Crepis sancta</i> (L.) Bab. ssp. <i>sancta</i>	+	.	+	+	+
T scap	Euri-Medit	<i>Bromus diandrus</i> Roth	+	.	+	+	+
H scap	W-Eurasiat	<i>Galium mollugo</i> L. ssp. <i>erectum</i> Syme	+	+	.	+	.
T scap	Euri-Medit	<i>Catapodium rigidum</i> (L.) C. E. Hubb. ex Dony ssp. <i>rigidum</i>	+	1	+	.	.
H bienn	Centro-Europ-Pontica	<i>Cota tinctoria</i> (L.) J. Gay	1	1	.	+	.
H caesp	Paleotemp	<i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	+	.	1	1	.
H bienn	Europ	<i>Echium vulgare</i> L.	+	.	.	+	+
G rhiz	Medit	<i>Elymus athericus</i> (Link) Kerguélen	.	.	1	+	+
T scap	Euri-Medit-Turan	<i>Avena barbata</i> Pott ex Link	.	.	+	+	+
G rhiz	Paleotemp	<i>Convolvulus arvensis</i> L.	+	+	.	.	.
P caesp	Nordamer	<i>Robinia pseudacacia</i> L.	+	+	.	.	.
H scap	NE-Medit	<i>Stachys germanica</i> L. ssp. <i>salviifolia</i> (Ten.) Gams	+	+	.	.	.
P caesp	Orof-S-Europ	<i>Salix eleagnos</i> Scop.	+	.	+	.	.
T scap	Euri-Medit	<i>Filago pyramidata</i> L.	1	.	.	+	.
P scap	Paleotemp	<i>Populus nigra</i> L.	1	.	.	.	+
H ros	Euri-Medit	<i>Astragalus monspessulanus</i> L.	+	.	.	.	+
P caesp	Eurasiat	<i>Salix purpurea</i> L. ssp. <i>purpurea</i>	1	.	.	.	+
T scap	Steno-Medit-Turan	<i>Trachynia distachya</i> (L.) Link	+	.	.	.	+
Tcaesp	Euri-Medit	<i>Vulpia ciliata</i> Dumort.	.	+	+	.	.
H scap	Steno-Medit-Turan	<i>Reichardia picroides</i> (L.) Roth	.	+	.	+	.
T scap	Euri-Medit	<i>Helminthotheca echioides</i> (L.) Holub	.	+	.	+	.
H scap	Eurasiat	<i>Centaurea jacea</i> L. subsp. <i>jacea</i>	.	+	.	+	.
T scap	Euri-Medit	<i>Petrorhagia prolifera</i> (L.) P. W. Ball & Heywood	.	+	.	+	.
H ros	Eurasiat	<i>Plantago lanceolata</i> L.	.	+	.	+	.
H scap	Paleotemp	<i>Hypericum perforatum</i> L.	.	+	.	+	.
T scap	Euri-Medit	<i>Euphorbia exigua</i> L. ssp. <i>exigua</i>	.	+	.	1	.
Ch suffr	Medit-Mont	<i>Asperula aristata</i> L. f. ssp. <i>longiflora</i> (Waldst. & Kit.) Hayek	.	.	+	1	.
G rhiz	Cosmop	<i>Cynodon dactylon</i> (L.) Pers.	.	.	1	.	+
H scap	Eurasiat	<i>Reseda luteola</i> L.	.	.	.	+	+
Sporadic species			14	5	9	8	5

chamaephytes and hemicryptophytes (Fig. 4), and its physiognomy is determined to a large extent by *Artemisia campestris* subsp. *variabilis*, an endemic chamaephyte of central-southern Italy, Sicily and Sardinia, and *Dittrichia viscosa*, a striking hemicryptophyte with a Eurimediterranean distribution.

Characteristic species of the association: *Artemisia campestris* subsp. *variabilis*.

Differential species of the subassociation: *Arundo plinii*, *Sulla coronaria*, *Pulicaria dysenterica*, *Galium mollugo* subsp. *erectum*, *Lolium multiflorum*, *Agrostis stolonifera*, *Senecio erucifolius* subsp. *erucifolius*, and *Saponaria officinalis*.

Syntaxonomy: Brullo & Spampinato (1990) include the vegetation of the bed of the Sicilian and southern Italy *fumare* in the class *Thlaspietea rotundifolii*, indicating that there are floristic and ecological-

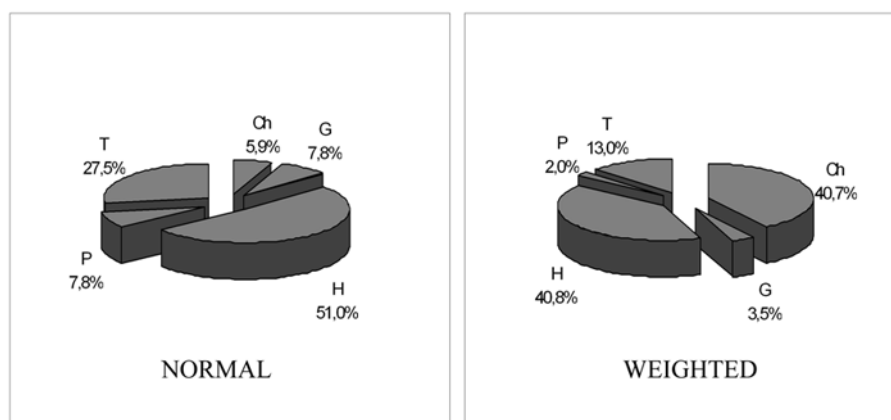


Fig. 4 – Biological spectrum *Artemisia variabilis-Helichrysetum italicum arundinetosum plinii*

structural analogies between the talus-slope vegetation of the *fumare* and that of the scree slopes of the mountainous areas of Sicily. In this setting, the association *Artemisia variabilis-Helichrysetum italicum* is referred to the order *Scrophulario-Helichrysetalia* and the alliance *Euphorbion rigidae*, this last of which unites the vegetation of the river beds of the Sicilian and Calabrian *fumare* (Brullo & Spampinato, 1990). Later, the order was put into an autonomous class, *Scrophulario-Helichrysetea*, a geographical vicariant of the class *Thlaspietea rotundifoliae* with a central-Mediterranean distribution (Brullo *et al.*, 1998).

Biondi *et al.* (1994) indicated that it was more appropriate to include the association found in the *fumare* of the Lucano-Calabrian Ionic aspects in the class *Pegano harmalae-Salsoletea vermiculatae* and the order *Helichryso-Santolinetalia*. This class had been set up with the aim of uniting the shrubby nitrophilous and alophilous vegetation of the regions with dry and semi-dry climates of the Iberian Peninsula. It was then enlarged with the description of the order *Helichryso-Santolinetalia*, to include the enduring subnitrophilous chamaephytic communities that in the Meso-supramediterranean belt colonise the detritus material from the erosion of the montane slopes as it stabilises (Peinado & Martínez-Parras, 1984; Peinado *et al.*, 1988).

Within this context, the Authors propose a new alliance, *Artemision variabilis*, which is the vicariant in southern Italy of the alliance *Artemisio-Santolinion rosmarinifoliae* of the siliceous substrates of the Iberian Peninsula. They believe that the association *Loto commutati-Artemisietum variabilis* can also be included in this, which has been described for the Molise-Puglia dunes (Taffetani & Biondi, 1992) and has also been seen in central-western Calabria (Maiorca *et al.*, 2002). On the basis of the above-mentioned considerations, we believe that the

classification proposed by Biondi *et al.* (1994) better corresponds to the floristic-ecological aspects of the *Artemisia campestris* subsp. *variabilis* populations.

Description of the association: for the populations of the Trigno basin it appears best to describe an autonomous subassociation: *Artemisia variabilis-Helichrysetum italicum arundinetosum plinii*. In floristic-coenological terms, this is differentiated by some species (*Arundo plinii*, *Sulla coronaria*, *Pulicaria dysenterica*, *Galium mollugo* subsp. *erectum*, *Lolium multiflorum*, *Agrostis stolonifera*, *Senecio erucifolius*, and *Saponaria officinalis*) that show a greater edaphic humidity with respect to the Lucano-Calabrian populations. Indeed, almost all of these species are characteristic or differential of the alliance *Inulo viscosae-Agropyrion repentis*, which describes the vegetation of the meso-hygrophilous grasslands of the pre-Apennine hilly territories on heavy soils, and which represents the Submediterranean vicariant of the alliance *Convolvulo-Agropyrion repentis* of the territories with a definitely more temperate bioclimate (Biondi & Allegrezza, 1996). With respect to the Lucano-Calabrian phytocoenoses, moreover, those of the Trigno are characterised by a much more modest coverage of *Helichrysum italicum*.

Syndynamics: enduring vegetation within the geosyngnetum of the alluvial plains of the River Trigno.

Synecology: association of the river beds with alluvial material that is mainly gravel-pebbles with a carbonatic nature. With sand and lime, in a Mesomediterranean climate environment, the subassociation has an ecology with a more marked meso-hygrophilous character, in circumstances where the river bed is subjected to periods of flooding that are longer than those of the typical association.

Synchorology: endemic community of central-southern Italy, at present known for Calabria, the Ionic aspects of Basilicata, and the basin of the River Trigno

between Abruzzo and Molise.

The chorological spectrum of the subassociation (Fig. 5) reveals the prevalence of Eurimediterranean species (36.3% in the normal spectrum, 33.5% with weighting), which are followed by those Eurasiatic (19.9% and 8.3%, respectively) and Paleotemperate (11.6% and 5.8%, respectively), together with the endemic species that especially considering their coverage values, can even be dominant. The dominance of *Artemisia campestris* subsp. *variabilis* is responsible for the prevalence in the weighted spectrum of the endemic species, that are seen as 37.1% (while they only reach 3.4% in the normal spectrum).

POLYGONO LAPATIFOLII-XANTHIETUM ITALICI PIROLA & ROSSETTI 1974 (TABLE 2)

Physiognomy and structure: low coverage pioneer vegetation with a dominance of terophytes with their greatest growth in the autumn. The physiognomy is provided by *Persicaria lapathifolia* (= *Polygonum lapathifolium*), *Xanthium italicum* and *Bidens tripartita*.

Characteristic species: *Xanthium italicum*, *Bidens tripartita*, and *Amaranthus retroflexus*.

Syntaxonomy: this association described by Pirola & Rossetti (1974) for the River Reno in Emilia-Romagna is included in the syntaxa *Bidentetalia/Bidentetea tripartitae*, in the alliance *Chenopodion fluviatile* (Biondi & Baldoni, 1994), which describes the pioneering vegetation on eutrophic gravelly substrata. Among the accompanying species, there are various nitrophilous terophytes of the class *Stellarietea*

mediae, which arise from the adjacent cultivated and ruderal areas.

Syndynamics: evolution of these populations is blocked by the dynamics of the river; the association has chain connections with *Artemisia variabilis-Helichrysetum italicum*.

Synecology: mesohydrophilous community that develops during the summer to autumn season, is established on the lime-pebbly river beds that are temporarily dry. It is affected both by the fluvial regime, which deposits new materials at each flood, and by the human disturbance that eutrifies the substrate.

Synchorology: known for various river courses and other wet zones, such as: Reno, Saline, Marecchia, Taro, Stirone, and Lago di Serranella (Pirola & Rossetti, 1974; Pirone, 1991; Biondi & Baldoni, 1994; Biondi *et al.*, 1997; Biondi *et al.*, 1999; Pirone *et al.*, 2003).

Vegetation of the first alluvial terrace

On the lower terrace, which is rarely reached by the high waters due to its 1-2 m elevation over that of the bed of the river, the vegetation is represented by some communities of which the most frequent is the garrigue with *Lomelosia crenata* subsp. *pseudisetensis*. The other vegetation types are: woods of *Tamarix africana*, weakly hygro-alophilous grasslands with *Erianthus ravennae* and *Imperata cylindrica*, and steppes-type grasslands with *Hyparrhenia hirta*.

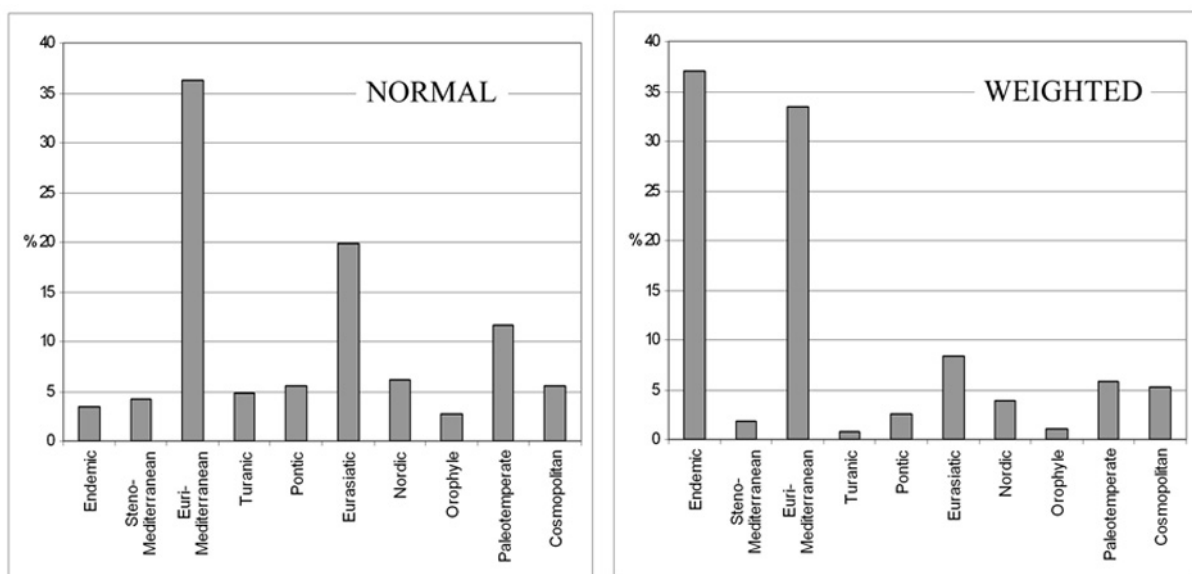


Fig. 5 – Chorological spectrum *Artemisia variabilis-Helichrysetum italicum arundinetosum plinii*

Tab. 2 - *Polygono lapatifolii-Xanthietum italicum* Pirola & Rossetti 1974

Rel. n.	1	2	3
Coverage (%)	50	40	50
Surface (m ²)	30	8	15

Charat. sp. of the ass. <i>Polygono lapatifolii-Xanthietum italicum</i> and upper units			
<i>Persicaria lapathifolia</i> (L.) Delarbre	3	1	2
<i>Xanthium orientale</i> L. ssp. <i>italicum</i> (Moretti) Greuter	+	2	1
<i>Bidens tripartita</i> L. ssp. <i>tripartita</i>	2	2	1
<i>Echinochloa crus-galli</i> (L.) P. Beauv.	1	+	1
<i>Polypogon viridis</i> (Gouan) Breistr.	1	+	+
<i>Amaranthus retroflexus</i> L.	+	.	+
<i>Symphytotrichum squamatum</i> (Spreng.) G. L. Nesom	.	+	+
Other species			
<i>Dittrichia viscosa</i> (L.) Greuter	2	+	+
<i>Daucus carota</i> L.	+	+	+
<i>Sonchus oleraceus</i> L.	1	+	+
<i>Pulicaria dysenterica</i> (L.) Bernh.	+	+	+
<i>Verbena officinalis</i> L.	+	+	+
<i>Agrostis stolonifera</i> L.	+	1	+
<i>Helminthotheca echioides</i> (L.) Holub	+	+	.
<i>Polygonum aviculare</i> L.	+	+	.
<i>Lolium perenne</i> L.	+	+	.
<i>Senecio vulgaris</i> L.	+	+	.
Sporadic species			
	9	4	2

ARTEMISIO VARIABILIS-LOMELOSIIETUM PSEUDISETENSIS ASS. NOVA (TABLE 3; HOLOTYPE: RIL. 3)

Physiognomy and structure: garrigue with a dominance of *Lomelosia crenata* subsp. *pseudisetensis*, *Helichrysum italicum*, *Artemisia variabilis*, *Micromeria graeca* subsp. *tenuifolia* and *Fumana thymifolia*. Its biological spectrum (Fig. 6) shows a prevalence of chamaephytes (30.9% for the normal spectrum; 71.1% for the weighted), followed by the terophytes (29.1% and 10.4%, respectively) and the hemicryptophytes (29.1% and 6.7%, respectively). Characteristic and differential species: characteristic species: *Lomelosia crenata* subsp. *pseudisetensis*, endemic of central-southern Italy (Conti *et al.*, 2005), but not common in Abruzzo (Conti, 1998). The role of the differential species is taken on by *Artemisia variabilis*, *Astragalus monspessulanus* and *Arundo plinii*.

Syntaxonomy: the association is included in the alliance *Cisto eriocephali-Ericion multiflorae* (*Rosmarinetales/Rosmarinetea officinalis*), which describes the garrigue of the Thermomediterranean and Mesomediterranean belts in central-southern Italy (Biondi, 2000), and of the islands and along the coasts. The vegetal communities with a physiognomy dominated by *Lomelosia crenata* subsp. *pseudisetensis*, the only subspecies of *L. crenata* in Abruzzo (Conti, 1998; Conti *et al.*, 2005), have been described for various territories of central Italy. These are: the thermophilous pastures of the association *Onosmo echioidis-Cymbopogonetum hirti*, in the valley of the River Sangro, included

in the alliance *Cymbopogo-Brachypodion ramosi* (*Thero-Brachypodietalia*, *Thero-Brachypodietea*) (Biondi *et al.*, 1988); the chamaephytic pastures of the association *Centaureo rupestris-Scabiosetum crenatae*, in the National Park of Abruzzo, Lazio and Molise, referred to the suballiance *Sideridenion italicum* (*Phleo ambigu-Bromion erecti*, *Artemisio albae-Bromenalia erecti*, *Brometalia erecti* and *Festuco-Brometea*) (Biondi *et al.*, 1992a); the garrigue of *Sideritido italicum-Globularietum meridionalis scabiosetosum crenatae* in Abruzzo, included in the alliance *Cytiso spinoscentis-Satureion montanae* (*Cisto cretici-Ericetalia manipuliflorae*, *Cisto cretici-Micromerietea julianae*) (Pirone & Tammaro, 1997); and the garrigue of *Asperulo aristatae-Fumanetum thymifoliae scabiosetosum crenatae* in the Province of Ascoli Piceno, of the alliance *Cisto eriocephali-Ericion multiflorae* (*Rosmarinetales/Rosmarinetea officinalis*) (Taffetani, 2000). Not considered here are the garrigue with *Lomelosia crenata* of southern Italy (Corbetta & Pirone, 1981; Biondi *et al.*, 1992b; Cutini *et al.*, 2007) both because the floristic combination, and generally also the ecology, are very different, and because of the difficulty of establishing which subspecies this corresponds to (*Lomelosia crenata* subsp. *crenata* or *L. crenata* subsp. *pseudisetensis*).

The association shows some similarities to *Sideritido italicum-Globularietum meridionalis scabiosetosum crenatae*, which is still part of the hill and montane temperate bioclimate, while *Artemisio-Lomelosietum* is linked to a Mesomediterranean bioclimate; moreover, the first of these associations is found on carbonatous rocks, while the second colonises the river alluvia. From a floristic point of view, the differences are great, as the species characteristic of the alliance *Cytiso spinoscentis-Satureion montanae* are totally absent in the populations of the Trigno.

Greater similarities are seen with a comparison with *Asperulo aristatae-Fumanetum thymifoliae scabiosetosum crenatae*. Nevertheless, the pedoclimatic characteristics and the floristic peculiarities of the populations of the Trigno do not allow them to be referred to this syntaxon. Indeed, while the Marche populations develop on banks of calcareous conglomerate of the Monte dell'Ascensione, those of the Trigno colonise the lime-sandy-pebbly alluvia. Moreover, in the first case, the altitude belt is between about 700 and 900 m, with a climate of the Submediterranean type, and in the second case it is between 100 and 200 m, with a Mesomediterranean climate. The differences from a floristic point of view reflect particularly

Tab. 3 - *Artemisia variabilis-Lomelosietum pseudisetensis* ass. nova

Rel. n.			1	2	3*	4	5	6	7
Coverage (%)			65	60	70	85	70	85	80
Surface (m ²)			40	40	50	40	30	30	25
Charact. and diff. sp. (*) of the ass. <i>Artemisia variabilis-Lomelosietum pseudisetensis</i>									
Ch suffr	Endem	Lomelosia crenata (Cirillo) Greuter & Burdet ssp. pseudisetensis (Lacaita) Greuter & Burdet	2	1	2	1	3	4	2
Ch frut	Endem	Artemisia campestris L. ssp. variabilis (Ten.) Greuter (*)	1	1	1	1	1	+	1
H ros	Euri-Medit	Astragalus monspessulanus L. ssp. Monspessulanus (*)	+	.	+	+	.	1	.
G rhiz	Steno-Medit	Arundo plinii Turra (*)	.	.	+	.	+	1	+
Charact. sp. of <i>Cisto eriocephali-Ericion multiflorae/Rosmarinetalia/Rosmarinetea</i>									
Ch suffr	Endem	Micromeria graeca (L.) Benth. ex Rchb. ssp. tenuifolia (Ten.) Nyman	.	1	+	2	+	2	2
NP	Steno-Medit	Cistus salviifolius L.	.	1	2	+	1	+	2
Ch suffr	Steno-Medit	Fumana thymifolia (L.) Spach ex Webb	2	3	2	3	.	.	2
NP	Steno-Medit	Cistus creticus L. ssp. eriocephalus (Viv.) Greuter & Burdet	1	2	1	.	+	2	.
Ch suffr	Steno-Medit	Teucrium capitatum L. ssp. capitatum	+	1	.	2	.	2	1
T scap	Euri-Medit	Odontites luteus (L.) Clairv.	+	.	1	+	1	1	.
Ch suffr	Euri-Medit	Dorycnium hirsutum (L.) Ser.	+	+	.	.	1	+	.
H scap	Euri-Medit	Ononis pusilla L. ssp. pusilla	+	.	+	.	+	1	.
Ch suffr	Submedit-Pontico	Linum tenuifolium L.	+	.	.	+	.	1	+
Ch suffr	Euri-Medit-Pontica	Fumana procumbens (Dunal) Gren. & Godr.	.	.	+	.	.	+	.
Ch suffr	Medit-Mont	Asperula aristata L. f. ssp. longiflora (Waldst. & Kit.) Hayek	.	.	.	1	.	.	1
Diff. sp. of the variant									
G rhiz	Medit	Elymus athericus (Link) Kerguelen	.	.	.	.	.	.	2
H caesp	Medit-Turan	Erianthus ravennae (L.) P. Beauv.	.	.	.	.	.	.	1
T scap	Paleotemp	Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch s. l.	.	.	.	.	.	.	+
Other species									
Ch suffr	S-Europ	Helichrysum italicum (Roth) G. Don ssp. italicum	3	2	3	3	2	2	2
T scap	Euri-Medit	Euphorbia exigua L. ssp. exigua	+	+	+	+	+	1	+
T scap	Steno-Medit	Linum strictum L. ssp. strictum	1	2	1	.	1	1	+
H scap	Paleotemp	Sanguisorba minor Scop. s. l.	1	+	1	+	.	+	.
H caesp	Paleotemp	Dactylis glomerata L. ssp. glomerata	+	.	+	.	+	+	+
H caesp	Euri-Medit	Petrorhagia saxifraga (L.) Link ssp. saxifraga	1	.	.	+	+	1	+
T scap	Euri-Medit	Crepis sancta (L.) Babç. ssp. sancta	1	+	1	.	.	.	1
T scap	Steno-Medit-Turan	Trachynia distachya (L.) Link	.	1	.	+	.	1	+
H caesp	Paleotemp	Bromus erectus Huds. ssp. erectus	1	+	1	.	.	.	.
T scap	Paleo-subrop	Briza maxima L.	+	+	+	.	.	.	.
Ch suffr	Euri-Medit	Thesium humifusum DC.	+	.	.	+	.	+	.
P caesp	Euri-Medit	Spartium junceum L.	.	+	+	.	+	.	.
T scap	Steno-Medit-Turan	Triticum ovatum (L.) Raspail	.	+	.	1	.	.	+
T scap	Euri-Medit	Filago pyramidata L.	.	+	.	1	.	.	1
H caesp	Paleotrop	Hyparrhenia hirta (L.) Stapf ssp. hirta	.	.	.	+	1	+	.
H bienn	Centro-Europ-Pontica	Cota tinctoria (L.) J. Gay	.	.	.	+	.	+	+
H ros	Euras	Silene otites (L.) Wibel ssp. otites	.	.	.	.	+	+	+
T scap	Euri-Medit	Catapodium rigidum (L.) C.E. Hubb. ex Dony ssp. rigidum	.	.	.	.	+	+	+
T scap	Euri-Medit	Coronilla scorpioides (L.) W.D.J. Koch	+	.	+	.	.	.	.
T scap	W-Paleotemp	Trifolium campestre Schreb.	+	.	.	.	+	.	.
H caesp	Euri-Medit-Turan	Melica ciliata L.	+	.	.	.	.	.	1
H bienn	Steno-Medit	Galactites elegans (All.) Soldano	.	+	+	.	.	.	.
H caesp	Euri-Medit	Festuca circummediterranea Patzke	.	+	.	+	.	.	.
T scap	Euri-Medit	Scorpiurus muricatus L.	.	1	.	.	+	.	.
H scap	W-Medit	Sulla coronaria (L.) Medik.	.	+	.	.	+	.	.
Tcaesp	Euri-Medit	Vulpia ciliata Dumort.	.	.	+	.	+	.	.
T rept	Euri-Medit	Anagallis arvensis L. ssp. arvensis	.	.	.	.	.	+	.
H bienn	Euri-Medit	Verbascum sinuatum L.	.	.	.	+	.	.	+
Ch suffr	Euri-Medit	Teucrium chamaedrys L. ssp. chamaedrys	.	.	.	+	.	.	+
H scap	Medit-Mont	Calamintha nepeta (L.) Savi ssp. nepeta	.	Savi	.	+	.	.	+
H scap	Eurasiat	Carex caryophylla Latourr.	.	.	.	+	.	.	+
T scap	Cosmopol	Erigeron canadensis L.	.	.	.	.	+	+	.
H scap	S-Medit	Foeniculum vulgare Mill.	.	.	.	.	+	+	.
T scap	Paleotemp	Minuartia hybrida (Vill.) Shischk. ssp. hybrida	.	.	.	.	.	+	+
Sporadic species			12	6	3	13	7	4	7

the substratum conditions: the coenoses of Trigno are characterised by the presence of a contingent of species linked to the alternation of periods of edaphic dryness and humidity. Among these species the most significant, to which the role of the differential species of the association is given, are *Artemisia variabilis*, *Astragalus monspessulanus* and *Arundo plinii*.

The first of these shows contact with the river-bed association *Artemisia variabilis-Helichrysetum italicum*; the second is linked to the heavy soils under erosion and is a species that is characteristic of the pasture associations, and specifically of *Coronilla minimae-Astragaletum monspessulani* (Biondi *et al.*, 1985) and *Astragalo monspessulani-Scabiosetum crenatae*

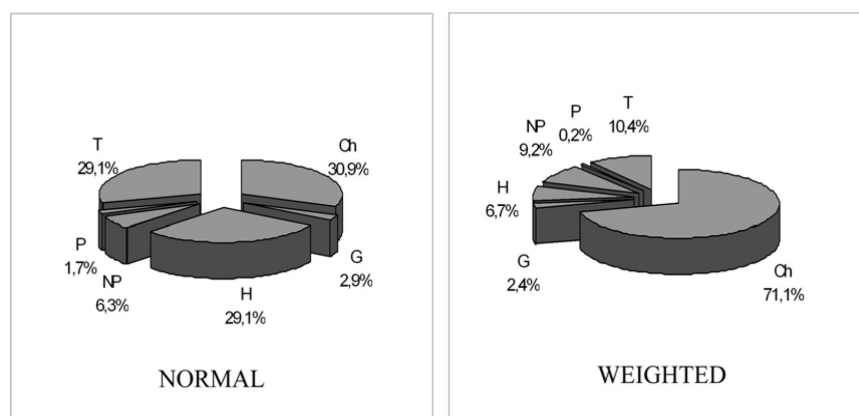


Fig. 6 – Biological spectrum *Artemisio variabilis-Lomelosietum pseudisetensis*

(Biondi *et al.*, 1992a); the third species is of the alliance *Inulo viscosae-Agropyron repentis*, relative to the vegetation of the mesohygrophilous grasslands of the pre-Apennine hilly territories on heavy soils (Biondi & Allegrezza, 1996). On the Trigno, *Artemisio-Lomelosietum* takes on the same ecological space that in the Calabrian *fumare* corresponds to the association *Helichryso italici-Sarcopoterietum spinosi* (*Hyperico-Micromerion graecae, Cisto-Micromerietalia*) (Biondi *et al.*, 1994). From a comparison with the terraces of the rivers further north, there is an analogy with the situation of the River Taro in Emilia-Romagna, for which the first terraces are colonised by a garrigue of the association *Astragalo onobrychidis-Artemisietum albae* (*Artemisio albae-Saturejion montanae, Rosmarinetalia officinalis*) (Biondi *et al.*, 1997).

Relevée number 7 of Table 3 relates to a lightly alophilous edaphic variant that is differentiated by *Elymus athericus*, *Erianthus ravennae* and *Centaureum tenuiflorum*. The development of this variant probably arises from the salt coming from the rocks of the evaporitic sequences and from the multicoloured clays of the Trigno valley.

Syndynamics: the association is in serial contact with the woods of *Tamarix Africana* in the variante with *Juniperus oxycedrus* subsp. *oxycedrus* and with the grasslands of *Onosmo echiodis-Hyparrhenietum hirtae imperatetosum cylindrica*. The chain contacts are formed by the river-bed community of *Artemisio variabilis-Helichrysetum italici* and with the vegetation of the higher terraces and of the slopes within the series of *Roso sempervirentis-Quercetum pubescentis* and of *Cyclamino hederifolii-Quercetum ilicis*.

As a mosaic with the garrigue of *Artemisio-Lomelosietum*, there are rare terophytic communities attributable to the syntaxa *Trachynetalia distachyae* and *Helianthemetea guttati*, with *Trifolium campestre*, *Coronilla scorpioides*, *Crepis sancta*, *Onobrychis*

caput-galli, *Linum strictum* ssp. *strictum*, *Euphorbia exigua* ssp. *exigua*, and *Ammoides pusilla*, etc. The rarity and the ephemeral character of these populations have not allowed the collection of a sufficient dataset for its precise phytosociological characterisation.

Synecology: association of the lowest terraces on lime-sandy-pebbly alluvia of a carbonaceous nature, with gravel, in a Mesomediterranean bioclimate.

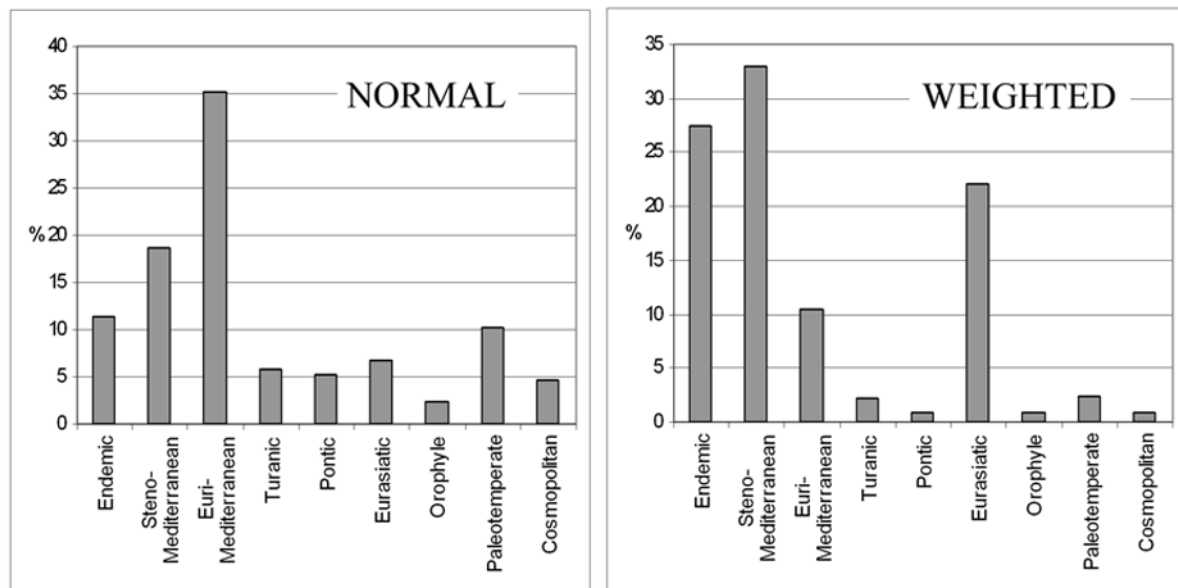
Synchorology: community known for the River Trigno basin, which is probably present also in other river basins of central-southern Italy. The normal and weighted chorological spectra (Fig. 7) show results that are slightly in disagreement. Even so, from the analysis of the data, a presence of Mediterranean species can be seen: Stenomediterranean (18.8% in the normal spectrum, 33.0% in the weighted) and Eurimediterranean (35.2% and 10.4%, respectively), followed by endemic (11.4% and 27.4%, respectively), Eurasiatic (6.8% and 22.0%, respectively) and Paletotemperate (10.2% and 2.4%, respectively).

ONOSMO ECHIODIS-HYPARRHENIETUM HIRTAE BIONDI, ALLEGREZZA & MANZI 1988 *IMPERATETOSUM CYLINDRICA* SUBASS. NOVA (TABLE 4; *HOLOTYPUS* RIL. 1)

Physiognomy and structure: grasslands that are structurally dominated by bushy hemicryptophytes, with the physiognomy given by *Hyparrhenia hirta* subsp. *hirta*. The biological spectrum (Fig. 8) shows a prevalence of hemicryptophytes (36.8% in the normal spectrum, 60.0% in the weighted) and of terophytes (40.4% and 18.9% respectively), followed by chamaephytes (12.3% and 4.2%, respectively) and nanophanerophytes (5.3% and 15.0%, respectively).

Characteristic species: *Hyparrhenia hirta* subsp. *hirta*, *Micromeria graeca* subsp. *tenuifolia*, *Onosma echiodes*, and *Lomelosia crenata* subsp. *pseudisetensis*.

Syntaxonomy: the association was described by

Fig. 7 – Chorological spectrum *Artemisia variabilis-Lomelosietum pseudisetensis*Tab. 4 - *Onosmo echiodis-Hyparrhenietum hirtae* Biondi, Allegrezza & Manzi 1988 subass. *imperatosum cylindricae* subass. nova

Rel. n.	1*	2
Coverage (%)	85	70
Surface (m ²)	30	25

		Charact. sp. of the ass. <i>Onosmo echiodis-Hyparrhenietum hirtae</i>		
H caesp	Paleotrop	Hyparrhenia hirta (L.) Stapf ssp. hirta	4	3
Ch suffr	Endem	Micromeria graeca (L.) Benth. ex Rechb. ssp. tenuifolia (Ten.) Nyman	1	+
Ch suffr	Endem	Lomelosia crenata (Cirillo) Greuter & Burdet ssp. pseudisetensis (Lacaita) Greuter & Burdet	+	+
Ch suffr	Endem	Onosma echiodes (L.) L.	+	.
		Diff. sp. of the subass. <i>imperatosum cylindricae</i>		
G rhiz	Cosmop	Imperata cylindrica (L.) P. Beauv.	1	+
Ch frut	Endem	Artemisia campestris L. ssp. variabilis (Ten.) Greuter	1	+
		Charact. sp. of <i>Lygeo-Stipetea/Hyparrhenietalia</i>		
H caesp	Steno-Medit	Dactylis glomerata L. ssp. hispanica (Roth) Nyman	1	+
H scap	Medit-Mont	Calamintha nepeta (L.) Savi ssp. nepeta	1	+
H bienn	Euri-Medit	Verbascum sinuatum L.	+	1
H bienn	Steno-Medit	Sixalis atropurpurea (L.) Greuter & Burdet ssp. grandiflora (Scop.) Soldano & F. Conti	+	1
H scap	Steno-Medit	Carlina coymbosa L.	+	+
H caesp	Euri-Medit-Turan	Melica ciliata L.	+	+
H scap	SW-Medit	Anthyllis vulneraria L. ssp. maura (Beck) Maire	1	.
H scap	S-Medit	Foeniculum vulgare Mill.	+	.
H scap	Steno-Medit-Turan	Reichardia picroides (L.) Roth	+	.
		Charact. sp. of the class <i>Tuberarietea guttatae</i>		
T scap	Steno-Medit	Linum strictum L. ssp. strictum	1	1
T scap	Steno-Medit	Onobrychis caput-galli (L.) Lam.	1	+
T scap	Euri-Medit	Filago pyramidata L.	+	+
T scap	Medit-Turan	Astragalus hamosus L.	+	+
T rept	Euri-Medit	Trifolium scabrum L. ssp. scabrum	+	.
T scap	Euri-Medit	Catapodium rigidum (L.) C.E. Hubb. ex Dony ssp. rigidum	.	+
T scap	W-Paleotemp	Trifolium campestre Schreb.	.	1
		Other species		
T scap	Medit-Atl	Parapholis incurva (L.) C.E. Hubb.	2	+
T scap	Steno-Medit-Turan	Triticum ovatum (L.) Raspail	1	+
NP	Steno-Medit	Cistus creticus L. ssp. eriocephalus (Viv.) Greuter & Burdet	+	2
H scap	Euri-Medit	Ononis pusilla L. ssp. pusilla	+	+
T scap	Euri-Medit-Turan	Avena barbata Pott ex Link	+	+
T scap	Euri-Medit	Ajuga chamaeypytis (L.) Schreb. s. l.	+	+
		Sporadic species	6	2

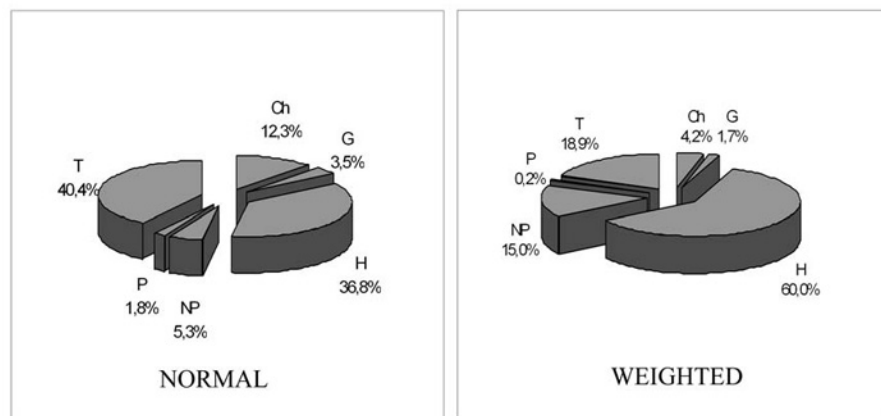


Fig. 8 – Biological spectrum *Onosmo echioidis-Hyparrenietum hirtae imperatetosum cylindricaе*

Biondi *et al.* (1988) for the hydrographic basin of the Sangro River, a little north of the Trigno basin. For inclusion in the higher syntaxa, the authors refer to the units *Thero-Brachypodietea*, *Thero-Brachypodietalia* Br.-Bl. and *Cymbopogo-Brachypodium ramosi*. As a consequence of the separation of the annual aspects from those perennial, and the setting up of the class *Lygeo-Stipetea* (Rivas-Martínez, 1978), it would appear more opportune to refer the association to this last syntaxon and to the order *Hyparrenietalia*, which better expresses the structural and floristic-ecological characteristics of the phytocoenosis. At the alliance level, one possible reference would be to *Saturejo-Hyparrenion hirtae*, of the drier territories of the central and western Mediterranean, although this hypothesis remains to be confirmed by further data.

While in the Sangro Valley the association has been found on rocky substrata and on rubble, for the Trigno it is linked to the sandy-pebbly alluvia. Moreover, as indicated above, the alluvial deposits are occasionally enriched in salts that derive from the evaporatic sediments of the surrounding territory. These also reflect on the floristic composition: indeed, on the Trigno, *Onosmo-Hyparrenietum* is present with a combination of species, among which there are *Imperata cylindrica*, *Artemisia campestris* subsp. *variabilis* and *Parapholis incurva*. These are indicated as the differential species of the new subassociation *Onosmo echioidis-Hyparrenietum hirtae imperatetosum cylindricaе*, with a slightly alophilous character, in contact with the association *Imperato cylindricaе-Juncetum littoralis*.

Syndynamics: this community is in serial contact with the garrigue of *Artemisia variabilis-Lomelosietum pseudisetensis* and with the woods of *Tamarix africana* var. with *Juniperus oxycedrus* subsp. *oxycedrus*, and has chain links with the grasslands of *Imperato cylindricaе-Juncetum littoralis*.

Synecology: thermoxerophilous steppes grasslands that are found on the lower alluvial terraces, on sandy-pebbly substrata. The subassociation is characterised by a weak alo-agrophilia.

Synchorology: the association is known for the Sangro and Trigno Valleys. The chorological spectrum (Fig. 9) shows also in this vegetal community a prevalence of Mediterranean species, more or less equally divided between Stenomediterranean (26.3% in the normal spectrum; 24.1% in the weighted) and Eurimediterranean (26.3% and 13.3%, respectively). The Turanic species are also rather abundant (17.5% and 3.7%, respectively), while the dominance in terms of the physiognomy of *Hyparrenia hirta* subsp. *hirta* determines an overall prevalence in the weighted spectrum of the cosmopolitan species, which are seen as 50.9%.

TAMARIX AFRICANA AND PYRACANTHA COCCINEA GROUPMENT (TABLE 5)

Physiognomy and structure: woods with a dominance of *Tamarix africana* and *Pyracantha coccinea*.

Syntaxonomy: through a consideration of the floristic composition and of its ecological peculiarity, this community that is here generically referred to as a groupment, is attributed to the class *Rhamno-Prunetea* and to the alliance *Pruno-Rubion*, since, as already described by Biondi *et al.*, (2009) it lacks elements that would put it into the class *Nerio-Tamaricetea*. The communities that are a part of this last syntaxon, which has a Mediterranean distribution, substitute the hygrophilous woods of *Salici purpureae-Populetea nigrae* under drier conditions. Within the groupment, two variants are distinguishable: one of an aridophilous character, of the first alluvial terraces, differentiated by *Juniperus oxycedrus* subsp. *oxycedrus*, *Pistacia lentiscus*, *Spartium junceum*, and *Crataegus monogyna*; the other linked to more humid soils,

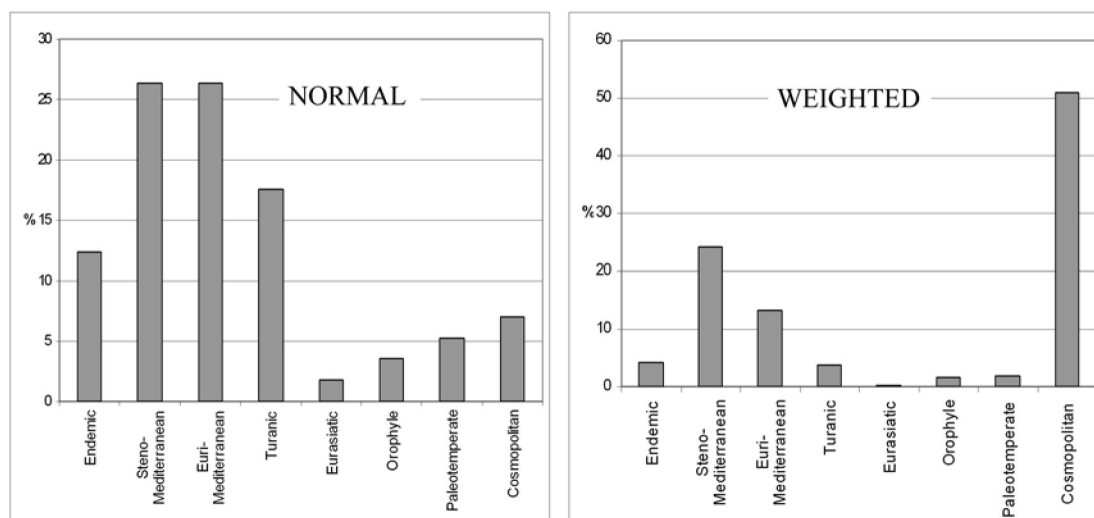


Fig. 9 – Chorological spectrum *Onosmo echioidis-Hyparrhenietum hirtae imperatosum cylindricae*

Tab. 5 - *Tamarix africana* and *Pyracantha coccinea* community

Rel. n.	1	2	3
Veg. coverage layer A (%)	25	45	50
Veg. coverage layer B (%)	60	65	35
Veg. coverage layer C (%)	40	50	70
Surface (m ²)	30	40	40
<hr/>			
<i>Tamarix africana</i> Poir.	2	3	3
<i>Pyracantha coccinea</i> M. Roem.	2	2	2
<i>Rubus ulmifolius</i> Schott	.	+	1
<i>Juniperus oxycedrus</i> L. ssp. <i>oxycedrus</i> variant			
<i>Juniperus oxycedrus</i> L. ssp. <i>oxycedrus</i>	3	3	.
<i>Pistacia lentiscus</i> L.	1	1	.
<i>Elymus athericus</i> (Link) Kerguélen	2	3	.
<i>Spartium junceum</i> L.	+	.	.
<i>Helichrysum italicum</i> (Roth) G. Don ssp. <i>italicum</i>	+	.	.
<i>Crataegus monogyna</i> Jacq.	.	+	.
<i>Cistus salvifolius</i> L.	.	+	.
<i>Erianthus ravennae</i> variant			
<i>Erianthus ravennae</i> (L.) P. Beauv.	.	.	2
<i>Arundo plinii</i> Turra	.	.	2
<i>Agrostis stolonifera</i> L.	.	.	2
<i>Dittrichia viscosa</i> (L.) Greuter	.	.	2
<i>Centaurium tenuiflorum</i> (Hoffmanns. & Link) Fritsch s. l.	.	.	2
<i>Imperata cylindrica</i> (L.) P. Beauv.	.	.	2
<i>Populus nigra</i> L.	.	.	1
<i>Populus alba</i> L.	.	.	1
<i>Ulmus minor</i> Mill. ssp. <i>minor</i>	.	.	+
<i>Pulicaria dysenterica</i> (L.) Bernh.	.	.	+
Other species			
<i>Scirpoides holoschoenus</i> (L.) Soják	2	2	1
<i>Salix purpurea</i> L. ssp. <i>purpurea</i>	+	1	1
<i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	1	1	.
Sporadic species	4	1	10

generally of the river beds, with *Erianthus ravennae*, *Imperata cylindrica*, *Agrostis stolonifera*, and *Populus alba*, among others.

Syndynamics: the wood constitutes the most mature vegetation of the lower fluvial terraces. In the variant with *Juniperus oxycedrus* subspecies *oxycedrus* it

enters into chain contact with the vegetation of the higher terraces and of the slopes within the series of *Roso sempervirentis-Quercetum pubescentis* and of *Cyclamino hederifolii-Quercetum ilicis*.

Synecology: these are found on the river bed and on the first alluvial terrace, which is only exceptionally subjected to flooding, on sandy-pebble deposits, and in the Mesomediterranean bioclimate.

Synchorology: for this groupment, no other locations have been described, other than the Trigno basin.

IMPERATO CYLINDRICAЕ-JUNCETUM TOMMASINII BRULLO & FURNARI 1976 (TABLE 6)

On the lower terrace, there are localised and not extensive populations of the *Imperata cylindrica* vegetation. In Abruzzo this species is rare: it has been reported in the past for Pescara (Villani, 1921), for the coast from Tronto to Vomano, and for the valley of Mavone (Crugnola, 1900; Zodda, 1953, 1976), in which location it has not been further confirmed. More recently it was found at Vasto Marina, along the banks of River Tronto at Ancarano, and in the areas that are the object of the present study (Conti *et al.*, 2002); it is also present along the coast at San Salvo Marina (pers. obs.).

Physiognomy and structure: generally compact grasslands, for which the physiognomy is conferred by the rhizomatose geophyte *Imperata cylindrica*.

Characteristic species: *Imperata cylindrica*, *Juncus littoralis* and *Daucus carota* subsp. *maritimus*.

Syntaxonomy: this vegetation is thought to be referable to the association *Imperato cylindricae-Juncetum tommasinii* of Brullo & Furnari (1976)

Tab. 6 - *Imperato cylindricae-Juncetum tommasinii* Brullo & Furnari 1976

Rel. n.	1	2
Coverage (%)	90	85
Surface (m ²)	30	25
<hr/>		
Charact. sp. of the ass. <i>Imperato cylindricae-Juncetum tommasinii</i>		
<i>Imperata cylindrica</i> (L.) P. Beauv.	5	4
<i>Juncus maritimus</i> Lam.	+	1
Charact. sp. of upper units		
<i>Scirpoides holoschoenus</i> (L.) Soják	+	1
<i>Carex extensa</i> Gooden.	+	1
<i>Elymus athericus</i> (Link) Kerguelen	+	2
<i>Centaureum tenuiflorum</i> (Hoffmanns. & Link) Fritsch s.l.	1	.
Other species		
<i>Agrostis stolonifera</i> L.	2	1
<i>Dittrichia viscosa</i> (L.) Greuter	2	+
<i>Hypericum perforatum</i> L.	+	+
<i>Pulicaria dysenterica</i> (L.) Bernh.	+	1
<i>Helminthotheca echioides</i> (L.) Holub	+	.
<i>Bromus secalinus</i> L. subsp. <i>secalinus</i>	+	.
<i>Blackstonia perfoliata</i> (L.) Huds. ssp. <i>perfoliata</i>	+	.
<i>Equisetum ramosissimum</i> Desf.	+	.
<i>Centaurea jacea</i> L. subsp. <i>jacea</i>	.	+
<i>Briza minor</i> L.	.	+

for southern Sicily, where it was also reported by Bartolo *et al.* (1982), and more recently by Brullo & Sciandrello (2006). The association has been included in the syntaxa *Plantaginion crassifoliae*, *Juncetalia* and *Juncetea maritimi*.

For the Trigno, this association is floristically impoverished; in particular, one of the characteristic species is absent: *Daucus carota* subsp. *maritimus*, while *Juncus maritimus* is the vicariant of *Juncus tommasinii*. *Juncus maritimus* is a species that is rare in Abruzzo, where it is known for very few locations, with this of the Trigno being the only one for internal areas (Conti *et al.*, 2002).

Populations of *Imperata cylindrica* have also been found in Sardinia, where the association *Imperato cylindricae-Schoenetum nigricantis* (*Plantaginion crassifoliae*) has been described (Arrigoni, 1996). Other communities that have been reported without their precise reference at the association level have been described for Vasto, in Abruzzo (Pirone, 1995) and in central-western Calabria (Maiorca *et al.*, 2002).

Syndynamics: enduring community, conditioned by the pedological conditions and by the hydrology. It enters in chain contact with the series of *Tamarix africana* woods.

Synecology: weakly hygro-alophilous grasslands that develop in slight depressions in the first terrace, on lime-sandy soils that are slightly alomorphous due to the salt from the catchment basin.

Synchorology: Described at present for Sicily and the Trigno basin.

SCHOENO NIGRICANTIS-ERIANTHETUM RAVENNAE PIGNATTI 1953 (TABLE 7)

Physiognomy and structure: grasslands physiognomically dominated by *Erianthus ravennae*, a large caespitose hemicryptophyte that can reach 4 m in height. In Abruzzo, this species has been recorded for few locations, and the Trigno area is one of the very few in Italy for internal areas (Conti *et al.*, 2002).

Characteristic species: *Erianthus ravennae*.

Syntaxonomy: the populations of the Trigno can be ascribed to an impoverished aspect of the association *Schoeno nigricantis-Erianthetum ravennae*, described by Pignatti (1953) for the Veneto lithoral. The association is included in the syntaxa *Molinio-Juncetea*, *Holoschoenetalia vulgaris* and *Molinio-Holoschoenion vulgaris*. In the populations of the Trigno, the characteristic species of *Schoenus nigricans* is absent, while *Juncus maritimus* is the vicariant of *Juncus littoralis*.

Syndynamics: community with its evolution blocked by the hydrology of the substratum, in the context of the geosigmentum of the fluvial terraces of the Trigno. Synecology: weakly alophilous hygrophilous vegetation that has developed in depressions in the lime-sandy substratum of the first fluvial terrace. For the presence of this phytocoenosis along the Trigno, the same considerations are relevant as reported for *Artemisio variabilis-Lomelosietum pseudisetensis* var. of *Elymus athericus* and for *Imperato cylindricae-Juncetum littoralis*. In the classical situations, the association is linked to the humid depressions of the coastal dunal systems.

Synchorology: this has been reported for various locations in Veneto (Pignatti, 1953; Géhu *et al.*, 1984), Emilia-Romagna (Piccoli, 1995), Tuscany (Vagge & Biondi, 1999), Abruzzo (Pirone, 1983, 1995; Géhu *et al.*, 1984), and Puglia (Biondi *et al.*, 2006).

Comment on the helophytic vegetation and the hygrophilous woods

Along the Trigno in the segment under study, there are some helophytic communities and willow wood units that were not considered in the present study, as well as some phytocoenoses of the class *Artemisietea vulgaris*. The populations observed can be referred to the following associations, almost all of which are very common in Abruzzo:

Phragmitetum australis Schmale 1939

Scirpetum tabernaemontani Pass. 1964

Scirpetum maritimi (W. Christiansen 1934) Tx. 1937

Tab. 7 - *Schoeno nigricantis-Erianthetum ravennae* Pignatti 1953

Rel. n.	1	2
Coverage (%)	100	100
Surface (m ²)	20	35
<hr/>		
Charact. sp. of the ass. <i>Schoeno nigricantis-Erianthetum ravennae</i>		
<i>Erianthus ravennae</i> (L.) P. Beauv.	4	4
<i>Juncus maritimus</i> Lam.	.	1
<hr/>		
Charact. sp. of <i>Molinio-Holoschoenion/Holoschoenetalia/Molinio-Juncetea</i>		
<i>Scirpoides holoschoenus</i> (L.) Soják	2	2
<i>Dittrichia viscosa</i> (L.) Greuter	+	1
<i>Holcus lanatus</i> L.	+	.
<i>Pulicaria dysenterica</i> (L.) Bernh.	.	+
<i>Agrostis stolonifera</i> L.	.	1
<hr/>		
Other species		
<i>Elymus athericus</i> (Link) Kerguélen	3	3
<i>Salix purpurea</i> L. ssp. <i>purpurea</i>	2	2
<i>Populus alba</i> L.	1	1
<i>Juncus acutus</i> L. ssp. <i>acutus</i>	1	+
<i>Blackstonia perfoliata</i> (L.) Huds. ssp. <i>perfoliata</i>	1	1
<i>Sixalis atropurpurea</i> (L.) Greuter & Burdet ssp. <i>grandiflora</i> (Scop.) Soldano & F. Conti	+	+
<i>Carex flacca</i> Schreb. ssp. <i>flacca</i>	1	.
<i>Equisetum ramosissimum</i> Desf.	1	.
<i>Bupleurum baldense</i> Turra	+	.
<i>Linum strictum</i> L. ssp. <i>strictum</i>	+	.
<i>Picris hieracioides</i> L.	+	.
<i>Brachypodium rupestre</i> (Host) Roem. & Schult.	1	.
<i>Daucus carota</i> L.	+	.
<i>Dorycnium herbaceum</i> Vill.	+	.
<i>Centaureum erythraea</i> Rafn ssp. <i>erythraea</i>	+	.
<i>Populus nigra</i> L.	.	+
<i>Tamarix africana</i> Poir.	.	+
<i>Salix eleagnos</i> Scop.	.	+
<i>Agrimonia eupatoria</i> L. ssp. <i>eupatoria</i>	.	+
<i>Linum tenuifolium</i> L.	.	+
<i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	.	+
<i>Ononis spinosa</i> L.	.	+

Typhetum latifoliae (Sòo 1927) Lang 1973

Typhetum angustifoliae (Sòo 1927) Pign. 1953

Rubo ulmifolii – *Salicetum albae* Allegrezza, Biondi & Felici 2006

Saponario-Salicetum purpureae (Br.-Bl. 1930) Tchou 1946

Arundinetum plinianae Biondi, Brugiapaglia, Allegrezza & Ballelli 1992

Syntaxonomical scheme

PEGANO HARMALAE-SALSOLETEA VERMICULATAE Br.-Bl. & Bolòs 1958

Helichryso-Santolinetalia Peinado & Martínez-Parras 1984

Artemision variabilis Biondi, Ballelli, Allegrezza, Taffetani & Francalancia 1994

Artemisio variabilis-Helichrysetum italici Brullo & Spampinato 1990

arundinetosum plinii subass. nova

BIDENTETEA TRIPARTITAE Tüxen, Lohmeyer & Preising ex von Rochow 1951

Bidentetalia tripartitae Br.-Bl. & Tüxen ex Klika & Hadac 1944

Chenopodion fluviatile Tüxen 1960

Polygono lapatifolii-Xanthietum italici Pirola & Rossetti 1974

ROSMARINETEA OFFICINALIS Rivas-Martínez, T. E. Diaz, F. Prieto, Loidi & Penas 1991

Rosmarinetalia officinalis Br.-Bl. ex Molinier 1934

Cisto eriocephali-Ericion multiflorae Biondi 2000

Artemisio variabilis-Lomelosietum pseudisetensis ass. nova

var. a *Elymus athericus*

LYGEO-STIPETEA Rivas-Martínez 1978

Hypparrietalia Rivas-Martínez 1978

?

Onosmo echioidis-Hypparrietum hirtae Biondi, Allegrezza & Manzi 1988

imperatetosum cylindricae subass. nova

RHAMNO-PRUNETEA Rivas Goday & Borja Carbonell ex Tüxen 1962

- Prunetalia spinosae* Tüxen 1952
Pruno-Rubion ulmifolii O. Bolòs 1954
 Aggr. a *Tamarix africana* e *Pyracantha coccinea*
 var. a *Juniperus oxycedrus* subsp. *oxycedrus*
 var. a *Erianthus ravennae*
JUNCETEA MARITIMI Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
Juncetalia maritimi Br.-Bl. ex Horvatic 1934
Plantaginion crassifoliae Br.-Bl. (1931) 1952
Imperato cylindricae-Juncetum tommasinii Brullo & Furnari 1976
MOLINIO-JUNCETEA Br.-Bl (1931) 1947
Holoschoenetalia vulgaris Br.-Bl. & Tchou 1948
Molinio-Holoschoenion vulgaris Br.-Bl. & Tchou 1948
Schoeno nigricantis-Erianthetum ravennae Pignatti 1953

References

- Arrigoni P.V., 1996. La vegetazione del complesso dunale di Capo Comino (Sardegna Nord-Orientale). *Parlatorea* 1: 35-45.
- Bartolo G., Brullo S. & Marcenò C., 1982. La vegetazione costiera della Sicilia sud-orientale. *Quaderni C.N.R., serie AQ/1/226*: 1-49.
- Biondi E., 2000. Syntaxonomy of the mediterranean chamaephytic and nanofanerophytic vegetation in Italy. *Coll. Phytosoc.* 27: 123-145.
- Biondi E. & Allegrezza M., 1996. Inquadramento fitosociologico di alcune formazioni prative del territorio collinare anconetano. *Giorn. Bot. Ital.* 130 (1): 136-148.
- Biondi E., Allegrezza M. & Frattaroli A.R., 1992a. Inquadramento fitosociologico di alcune formazioni pascolive dell'Appennino abruzzese-molisano. *Doc. Phytosoc., n.s.*, 14: 195-210.
- Biondi E., Allegrezza M. & Manzi A., 1988. Inquadramento fitosociologico di formazioni a *Juniperus oxycedrus* L. ssp. *macrocarpa* (Sibth & Sm.) Ball e a *Cymbopogon hirtus* (L.) Thomson rinvenute nel bacino idrografico del Fiume Sangro. *Giorn. Bot. Ital.* 122 (3-4): 179-188.
- Biondi E. & Baldoni M., 1994. La vegetazione del fiume Marecchia (Italia centrale). *Biogeographia* 17: 51-87.
- Biondi E., Ballelli S., Allegrezza M., Taffetani F. & Francalancia C., 1994. La vegetazione delle "fumare" del versante jonico lucano-calabro. *Fitosociologia* 27: 51-66.
- Biondi E., Ballelli S. & Principi D., 1985. Sur le pelouses sèches des substrats marneaux-arenacés de l'Appennin septentrional (Italie). *Doc. Phytosoc.* 9 : 351-357.
- Biondi E., Ballelli S. & Taffetani F., 1992b. La vegetazione di alcuni territori calanchivi in Basilicata (Italia meridionale). *Doc. Phytosoc.* 14: 489-498.
- Biondi E., Casavecchia S. & Guerra V., 2006. Analysis of vegetation diversity in relation to the geomorphological characteristics in the Salento coasts (Apulia – Italy). *Fitosociologia* 43 (1): 25-38.
- Biondi E., Vagge I., Baldoni M. & Taffetani F., 1997. La vegetazione del Parco fluviale regionale del Taro (Emilia-Romagna). *Fitosociologia* 34: 69-110.
- Biondi E., Vagge I., Baldoni M. & Taffetani F., 1999. La vegetazione del Parco fluviale regionale dello Stirone (Emilia-Romagna). *Fitosociologia* 36 (1): 67-93.
- Biondi E., Zivkovic L., Esposito L. & Pesaresi S., 2009. Vegetation, plant landscape and habitat analyses of a fluvial ecosystem in central Italy. *Acta Bot. Gallica* 156 (4): 571-587.
- Braun-Blanquet J., 1964. *Pflanzensoziologie*, ed. 3, J. Springer, Wien.
- Brullo S. & Furnari F., 1976. Le associazioni vegetali degli ambienti palustri costieri della Sicilia. *Not. Fitosoc.* 11: 1-43.
- Brullo S., Scelsi F. & Spampinato G., 1998. Considerazioni sintassonomiche sulla vegetazione perenne pioniera dei substrati incoerenti dell'Italia meridionale e Sicilia. *Itineraria geobotanica* 11: 403-424.
- Brullo S., Scelsi F. & Spampinato G., 2001. La Vegetazione dell'Aspromonte. Studio fitosociologico. Laruffa Editore, Reggio Calabria.
- Brullo S. & Sciandrello, 2006. La vegetazione del bacino lacustre "Biviere di Gela" (Sicilia meridionale). *Fitosociologia* 43 (2): 21-40.
- Brullo S. & Spampinato G., 1990. La vegetazione dei corsi d'acqua della Sicilia. *Boll. Acc. Gioenia Sci. Nat. Catania* 23: 119-252.
- Conti F., 1998. An annotated checklist of the flora of the Abruzzo. *Boccone* 10: 1-273.
- Conti F., Abbate G., Alessandrini A. & Blasi C., 2005. An Annotated Checklist of the Italian Vascular Flora. Palombi Editori, Roma.
- Conti F., Manzi A., Tinti D., 2002. Aggiunte alla flora

- d'Abruzzo. I° contributo. Inform. Bot. Ital. 34 (1): 55-61.
- Corbetta F., Pirone G., 1981. Carta della vegetazione di Monte Alpi e zone contermini (Tavoletta "Latronico" della Carta d'Italia). C.N.R. Collana del Programma finalizzato "Promozione della qualità dell'ambiente", AQ/1/22, pp. 1-38.
- Cutini M., Cancellieri L., Ceschin S., Lucchese F. & Caneva G., 2007. Analisi cenologica e sintassonomica delle garighe a *Salvia officinalis* L. lucane nel quadro dei salvieti peninsulari (Basilicata, Appennino meridionale). Webbia 62 (2): 225-244.
- Géhu J.M., Costa A., Scoppola A., Biondi E., Marchiori S., Peris G.B., Franck J., Caniglia G. & Veri L., 1984. Essai synsystematique et synchorologique sur les végétations littorales italiennes dans un but conservatoire. 1. Dunes et vases salées. Doc. Phytosoc. 8: 393-474.
- Maiorca G., Spampinato G. & Caprio A., 2002. Flora e vegetazione dei laghi costieri La Vota (Calabria centro-occidentale). Fitosociologia 39 (1): 81-108.
- Peinado M. & Martínez-Parras J.M., 1984. Sobre la classe *Pegano-Salsoletea*: *Helichryso-Santolinetalia* Ord. Novo. Anal. Jard. Bot. Madrid 40: 437-444.
- Peinado M., Martínez-Parras J.M., Bartolomé C. & Alcaraz F., 1988. Sintesi sintaxonomica de la classe *Pegano-Salsoletea* en España. Doc. Phytosoc. 11: 283-301.
- Piccoli F., 1995. Elementi per una cartografia della vegetazione del Parco Regionale del Delta del Po (Regione Emilia-Romagna). Fitosociologia 30: 213-29.
- Pignatti S., 1953. Introduzione allo studio fitosociologico della pianura veneta orientale, con particolare riguardo alla vegetazione litoranea. Atti Ist. Bot. Lab. Critt. Univ. Pavia, s. 5, 9: 92-258.
- Pignatti S., 1982. Flora d'Italia. Edagricole, Bologna.
- Pirola A. & Rossetti A., 1974. *Polygono-Xanthietum italicum* ass. nova, vegetazione di geto del corso medio del fiume Reno (Bologna). Not. Fitosoc. 8: 15-27.
- Pirone G., 1983. La vegetazione del litorale Pescara (Abruzzo). Not. Fitosoc. 18: 37-62.
- Pirone G., 1991. Flora e vegetazione del fiume Saline (Abruzzo). Micol. e Veget. Medit. 6 (1): 45-76.
- Pirone G., 1995. La vegetazione alofila della costa abruzzese (Adriatico Centrale). Fitosociologia 30: 233-256.
- Pirone G., Ciaschetti G., Frattaroli A.R. & Corbetta F., 2003. La vegetazione della Riserva Naturale Regionale "Lago di Serranella" (Abruzzo - Italia). Fitosociologia 40 (2): 55-71.
- Pirone G. & Tammaro F., 1997 - The hilly calciophilous garigues in Abruzzo (Central Apennines, Italy). Fitosociologia 32: 73-90.
- Rivas-Martínez S., 1978. Sur la syntaxonomie des pelouses therophytiques de l'Europe occidentale. Coll. Phytosoc. 6: 55-71.
- Taffetani F., 2000. Serie di vegetazione del complesso geomorfologico del Monte dell'Ascensione (Italia centrale). Fitosociologia 37 (1): 93-152.
- Taffetani F. & Biondi E., 1992. La vegetazione del litorale molisano e pugliese tra le foci dei Fiumi Biferno e Fortore (Adriatico centro-meridionale). Coll. Phytosoc. 18: 323-250.
- Vagge L. & Biondi E., 1999. La vegetazione delle coste sabbiose dl Tirreno settentrionale italiano. Fitosociologia 36 (2): 61-95.
- Vezzani L. & Ghisetti F., 1998. Carta Geologica dell'Abruzzo. Regione Abruzzo - Settore Urbanistica, Beni Ambientali e Cultura.

Other syntaxa quoted in the text

- Thlaspietea rotundifolii* Br.-Bl. 1947
- Scrophulario-Helichrysetalia* Brullo 1984
- Euphorbion rigidum* Brullo & Spampinato 1990
- Scrophulario-Helichrysetea* Brullo, Scelsi & Spampinato 1998
- Artemisio-Santolinion rosmarinifoliae* Costa 1975
- Loto commutati-Artemisietum variabilis* Taffetani & Biondi 1992
- Inulo viscosae-Agropyron repentis* Biondi & Allegrezza 1996
- Convolvulo-Agropyron repentis* Görs 1966
- Stellarietea mediae* Tx, Lohm. & Prsg. 1950
- Cymbopogo-Brachypodium ramosi* Horvatic (1956) 1958
- Thero-Brachypodietalia* Br.-Bl. (1931) 1936
- Thero-Brachypodietea* Br.-Bl. 1942
- Centaureo rupestris-Scabiosetum crenatae* Biondi, Allegrezza & Frattaroli 1992
- Sideridenion italicum* Biondi, Ballelli, Allegrezza & Zuccarello 1995
- Phleo ambigu-Bromion erecti* Biondi & Blasi ex Biondi, Ballelli, Allegrezza & Zuccarello 1995
- Artemisio albae-Bromenalia erecti* Biondi, Ballelli, Allegrezza & Zuccarello 1995
- Brometalia erecti* Br.-Bl. 1936
- Festuco-Brometea* Br.-Bl. & Tx. ex Br.-Bl. 1949
- Sideritido italicum-Globularietum meridionalis scabiosetosum crenatae* Pirone & Tammaro 1997
- Cytiso spinescentis-Satureion montanae* Pirone & Tammaro 1997
- Cisto cretici-Ericetalia manipuliflorae* Horvatic 1958
- Cisto cretici-Micromerietea julianae* Oberdorfer 1954
- Asperulo aristatae-Fumantetum thymifoliae* Allegrezza, Biondi, Formica & Ballelli 1997 *scabiosetosum crenatae*

Taffetani 2000

Coronillo minima-*Astragalium monspessulani* Biondi, Ballelli & Principi 1985

Astragalo monspessulani-Scabiosetum crenatae Biondi, Allegrezza & Frattaroli 1992

Helichryso italici-Sarcopoterietum spinosi Géhu & Costa 1984

Hyperico-Micromerion graecae Barbero & Quezel 1989

Astragalo onobrychidis-Artemisietum albae Biondi, Vagge, Baldoni & Taffetani 1997

Saturejo-Hyparrhenion hirtae Bolòs 1961

Salici purpureae-Populetea nigrae Rivas-Martínez & Cantò ex Rivas-Martínez, Bascónes, T.E. Díaz, Fernández-González & Loidi 2001.

Imperato cylindricae-Schoenetum nigricantis Arrigoni 1996

Roso sempervirentis-Quercetum pubescentis Biondi 1986

Cyclamino hederifolii-Quercetum ilicis Biondi, Casavecchia & Gigante 2003

Appendix 1

Sporadic species

Tab. 1 - *Artemisio variabilis-Helichrysetum italici arundinetosum plinii* Rel.1: *Onobrychis caput-galli* (L.) Lam. (+), *Artemisia vulgaris* L. (+), *Beta vulgaris* L. (+), *Anthyllis vulneraria* L. ssp. *maura* (Beck) Maire (+), *Sinapis alba* L. (+), *Verbena officinalis* L. (+), *Diplotaxis eruroides* L. (DC.) ssp. *eruroides* (+), *Scorpiurus muricatus* L. (1), *Leucanthemum vulgare* Lam. s.l. (+), *Rostraria cristata* (L.) Tzvelev s.l. (+), *Parentucellia viscosa* (L.) Caruel (+), *Alopecurus myosuroides* Huds. (+), *Linum strictum* L. ssp. *strictum* (1), *Silene nocturna* L. (+). Rel. 2: *Lomelosia crenata* (Cirello) Greuter & Burdet ssp. *pseudisetensis* (Lacaita) Greuter & Burdet (+), *Anagallis arvensis* L. ssp. *arvensis* (+), *Sherardia arvensis* L. (+), *Equisetum ramosissimum* Desf. (1), *Micromeria graeca* (L.) Benth. ex Rchb. ssp. *tenuifolia* (Ten.) Nyman (+). Rel. 3: *Calamintha nepeta* (L.) Savi ssp. *nepeta* (+), *Bromus erectus* Huds. ssp. *erectus* (+), *Ononis spinosa* L. (1), *Phalaris aquatica* L. (+), *Lolium perenne* L. (+), *Bromus hordeaceus* L. (+), *Polypogon monspeliensis* (L.) Desf. (1), *Echium italicum* L. ssp. *italicum* (+), *Spartium junceum* L. (+). Rel. 4: *Torilis arvensis* (Huds.) Link (+), *Plantago afra* L. ssp. *afra* (+), *Setaria viridis* (L.) P. Beauv. ssp. *viridis* (+), *Leontodon crispus* Vill. ssp. *crispus* (+), *Malva sylvestris* L. ssp. *sylvestris* (+), *Fallopia convolvulus* (L.) Á. Löve (+), *Clematis vitalba* L. (+), *Bromus squarrosus* L. (+). Rel. 5: *Trifolium campestre* Schreb. (1), *Silene vulgaris* (Moench) Garce ssp. *tenoreana* (Colla) Soldano & F. Conti (+), *Silene otites* (L.) Wibel ssp. *otites* (+), *Symphyotrichum squamatum* (Spreng.) G.L. Nesom (+), *Dorycnium hirsutum* (L.) Ser. (+).

Tab. 3 - *Artemisio variabilis-Lomelosietum pseudisetensis*

Rel. 1: *Festuca pratensis* Huds. (+), *Dactylis glomerata* L. ssp. *hispanica* (Roth) Nyman (1), *Sherardia arvensis* L. (+), *Avena barbata* Pott ex Link (1), *Juniperus oxycedrus* L. ssp. *oxycedrus* (+), *Echium italicum* L. (+), *Allium atroviolaceum* Boiss. (+), Muschi (3), *Trifolium angustifolium* L. ssp. *angustifolium* (+), *Dianthus ciliatus* Guss. ssp. *ciliatus* (+), *Anthyllis vulneraria* L. ssp. *maura* (Beck) Maire (+), *Teucrium chamaedrys* L. ssp. *chamaedrys* (+). Rel. 2: *Populus nigra* L. (+), *Pistacia lentiscus* L. (+), *Astragalus hamosus* L. (+), *Emerus majus* Mill. ssp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti (+), *Urospermum dalechampii* (L.) F.W. Schmidt. (+), *Dittrichia viscosa* (L.) Greuter (+). Rel. 3: *Ajuga chamaeepytis* (L.) Schreb. s.l. (+), *Polygala nicaeensis* W.D.J. Koch ssp. *mediterranea* Chodat (+), *Onobrychis caput-galli* (L.) Lam. (+). Rel. 4: *Ononis spinosa* L. (1), *Sixalis atropurpurea* (L.) Greuter & Burdet ssp. *grandiflora* (Scop.) Soldano & F. Conti (1), *Cynodon dactylon* (L.) Pers. (+), *Equisetum ramosissimum* Desf. (+), *Daucus carota* L. (+), *Parentucellia viscosa* (L.) Caruel (+), *Blackstonia perfoliata* (L.) Huds. ssp. *perfoliata* (+), *Erianthus ravennae* (L.) P. Beauv. (1), *Koeleria cristata* (L.) Roem. & Schult. (+), *Sedum sexangulare* L. (+), *Plantago lanceolata* L. (+), *Leontodon crispus* Vill. ssp. *crispus* (+), *Juniperus communis* L. (+). Rel. 5: *Thymus longicaulis* C. Presl. ssp. *longicaulis* (+), *Xanthium orientale* L. ssp. *italicum* (Moretti) Greuter (+), *Medicago lupulina* L. (+), *Hypericum perforatum* L. (+), *Asterolinon linum-stellatum* (L.) Duby (+), *Melilotus sulcatus* Desf. (+), *Lotus ornithopodioides* L. (1). Rel. 6: *Rhamnus saxatilis* Jacq. (+), *Bromus diandrus* Roth (+), *Helminthotheca echioides* (L.) Holub (+), *Petrorhagia prolifera* (L.) P.W. Ball & Heywood (+). Rel. 7: *Carlina corymbosa* L. (+), *Lagurus ovatus* L. (+), *Plantago afra* L. ssp. *afra* (1), *Crataegus monogyna* Jacq. (+), *Cerastium pumilum* Curtis (+), *Eryngium campestre* L. (+), *Onosma echioides* (L.) L. (+).

Appendix 2

Locality and date of the relevés

Tab. 1 - *Artemisio variabilis-Helichrysetum italici arundinetosum plinii* Rel. 1: Celenza sul Trigno, 31.05.2008; rel. 2: Tufillo, 31.05.2008; rel. 3, 4, 5 : S. Giovanni Lipioni, 03.07.2008

Tab. 2 - *Polygono lapatifolii-Xanthietum italici* Rel. 1, 2, 3: S. Giovanni Lipioni, 03.07.2008

Tab. 3 - *Artemisio variabilis-Lomelosietum pseudisetensis*
Rel. 1, 3: Celenza sul Trigno, 31.05.2008; rel. 2: Dogliola,
31.05.2008; rel. 4, 7: S. Giovanni Lipioni, 03.07.2008; rel. 5,
6: Tuffillo, 03.07.2008.

Tab. 4 - *Onosmo echioidis-Hyparrietum hirtae*
imperatosum cylindricae Rel. 1, 2: Lentella, 03.07.2008

Tab. 5 - Aggr. a *Tamarix africana* e *Pyracantha coccinea*
Rel. 1, 2, 3: Tuffillo, 03.07.2008

Tab. 6 - *Imperato cylindricae-Juncetum litoralis* Rel. 1, 2:
Tuffillo, 03.07.2008

Tab. 7 - *Eriantho ravennae-Schoenetum nigricantis* Rel. 1,
2: S. Giovanni Lipioni, 16.06.2008