

Notes on the wall vegetation of the Lake Garda surroundings (North Italy) and its consequences to the syntaxonomy of *Tortulo–Cymbalarietalia* Segal 1969

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Abstract: The paper discusses the differentiation of the wall plant communities occurring in the vicinity of Lake Garda (North Italy), between the cities of Lazise and Torbole. Three associations have been recorded: *Linario cymbalariae–Parietarietum ramiflorae* Pignatti 1952, *Linario–Erigeronetum mucronati* Segal 1969, *Oxalido–Parietarietum judaicae* (Br.–Bl. 1952) Segal 1969, and community with domination of *Asplenium ceterach*. The results can indicate that some of the associations distinguished by Brullo & Guarino (1998) in their pan-European synthesis do not exist as separable units.

Keywords: *Linario cymbalariae–Parietarietum ramiflorae*, *Linario–Erigeronetum mucronati*, *Oxalido–Parietarietum judaicae*, *Tortulo–Cymbalarietalia*, Lake Garda, North Italy, wall vegetation.

Introduction

The wall communities of the northern part of Italy are sufficiently known. Much information come from the papers of Brandes (1987, 1992a, 1992b), Brandes & Brandes (1981), Hruska (1987), Poldini & Vidali (1994) and Brullo & Guarino (1998). Poldini & Vidali (1994) discussed the syntaxonomical position of the plant communities occurring in North and Central Italy and determined the linear borders between the distribution range of the Central-European *Tortulo–Cymbalarietalia* and the Mediterranean *Parietarietalia judaicae* orders. In their wide, pan-European, syntaxonomic revision, Brullo & Guarino (1998) tried to clarify the differentiation of the class *Parietarietea judaicae* Oberd. 1997, which groups (in many opinion) the wall vegetation. However, the investigations carried out in the neighbourhood of Lake Garda bring new information, which should be taken under discussion as it may change some of the pertinent hypotheses.

Methods

Phytosociological studies were conducted on the eastern shore of Lake Garda, between the cities of Lazise and Torbole (North Italy). At the beginning of May 2003, 77 relevés were collected according to Braun-Blanquet approach (Westhoff & van der Maarel 1978; Mueller-Dombois & Ellenberg 2003). Plots of 4–10 m², depending on the degree of development and homogeneity of patches, were adapted to those proposed by Chytrý & Otýpková (2003) for rocky communities. The abundance of species is presented in a Braun-Blanquet scale. Relevés were classified using the TWINSpan method (Roleček et al. 2009) available within the JUICE 7.0 program (Tichý 2002). Pseudospecies cut levels were set to 5 and values of cut levels to 0.1%, 0.5%, 2%, 16% and 32%. Three relevés were selected as a minimum group size for division. Total Inertia methods was used as measure of cluster heterogeneity (Tichý et al. 2007). Diagnostic species for particular vegetation units were determined using the phi coefficient as a measure of fidelity (Chytrý et al. 2002) in a synoptic table. The phi coefficient was used for clusters of equalized size (Tichý & Chytrý 2006). Only species with both a significant concentration in particular vegetation units (using Fisher's exact test and significance level $P < 0.01$) and phi coefficient ≥ 0.30 were considered to be diagnostic species (Boublík et al. 2007).

The nomenclature of syntaxonomic units follows Brullo & Guarino (1998), the nomenclature of vascular plants in accordance with Tutin et al. (1964-1980), and that of bryophytes follows Ochýra et al. (2003). Herbarium material is stored in the WRSL (Herbarium of the Museum of Natural History, Wrocław University, Poland).

List of studied localities:

Gar 1 – Garda, a wall in the centre of the town (80 m a.s.l); Cis 1 – Cisano, a church wall (80 m a.s.l); Cis 2 – Cisano, low walls near the road to Garda (75 m a.s.l); Cis 3 – Cisano, a shaded wall of a house in the centre (80 m a.s.l); Laz 1 – Lazise, low walls near the bank of Lago di Garda (65 m a.s.l); Laz 2 – Lazise, a stone wall near the port (65 m a.s.l); Laz 3 – Lazise, walls of the castle and old-town streets (75 m a.s.l); Cast 1 – Casteletto, shaded old town walls (80 m a.s.l); Cast 2 – Casteletto, low stony walls, east of the village, near *Olea* plantations (110 m a.s.l); Cast 3 – Casteletto, shaded walls by the stream (90 m a.s.l); Tor 1 – Torri del Bianco, walls near the road to Garda, south of the city (80 m a.s.l); Tor 2 – Torri del Bianco, low walls near the road to Garda (90 m a.s.l); Tor 3 – Torri del Bianco, low wall in the town (80 m a.s.l); Torb – Torbole, brick wall, near the port (65 m a.s.l).

Results

The TWINSpan analysis shows the presence of four different groups of phytocoenoses. Three of which can be classified into known syntaxa and one may be of local community. Syntaxonomic position of wall communities discussed in this paper is as follows:

Cl. *Asplenietea trichomanis* (Br.–Bl. in Meier et Br.–Bl. 1934) Oberd. 1977

O. *Tortulo–Cymbalarietalia* Segal 1969

All. *Parietarium judaicae* Segal 1969

Ass. *Oxalido–Parietarium judaicae* (Br.–Bl. 1952) Segal 1969

Ass. *Linario–Erigeronetum mucronati* Segal 1969

All. *Cymbalarium–Asplenion* Segal 1969

Ass. *Linario cymbalariae–Parietarium ramiflorae* Pignatti 1952

Comm. *Asplenium ceterach–Bryoerythrophyllum recurvirostre*

Description and differentiation of the communities

Ass. *Oxalido–Parietarium judaicae* (Br.–Bl. 1952) Segal 1969 (see Table 1)

Species composition: as indicated by Poldini & Vidali (1994), but with *Euphorbia peplus*, *Oxalis corniculata*, *Mercurialis annua*, *Erigeron annuus*, *Veronica hederifolia* and *Viola odorata* as species locally differentiating.

Distribution: found in Lazise, Cisano, Torri del Bianco and Garda.

Differentiation: no differentiation was noted.

Syntaxonomic remarks: the association is analogous to the *Parietario–Veronicetum cymbalariae* Brullo & Marceno 1985 known from Sicily (Brullo & Marceno 1985) and Crete (Brandes 2002), yet with *Parietaria lusitanica* instead of *P. judaica*.

Ass. *Linario–Erigeronetum mucronati* Segal 1969 (see Table 2, Table 3)

Species composition: the characteristic species is *Erigeron karvinskianus* – a neophyte which has come from Central America, afterwards was naturalised and widely distributed in the Mediterranean zone. Species locally differentiating this association are *Coronilla emerus* and *Ligustrum ovalifolium* – the second neophyte species from Asia. Very common are also the Mediterranean and sub-Mediterranean species of wall communities such as *Centranthus ruber* and *Ficus carica*.

Distribution: This community is common in the south of Torri del Bianco. In Brenzone and Torbole it occurs very rarely, only as isolated patches.

Differentiation: Two clearly distinguishable variants were recorded.

1. *Linario–Erigeronetum mucronati* Segal 1969 var. with *Sonchus oleraceus* - with *Sonchus oleraceus*, *Hordeum murinum* and *Pohlia nutans* as a differentiating species.

2. *Linario–Erigeronetum mucronati* Segal 1969 var. with *Asplenium trichomanes*. Differentiating species are *Asplenium* sp. dif., *Adiantum capillus–veneris*, *Cottinus coggyria* and *Clematis vitalba*. The variant shows some similarities to ass. *Adiantum–Parietarium judaicae* Segal 1969 (Segal 1969, Brullo & Guarino 1998), but its species composition is not distinct enough to distinguish a separate association.

Syntaxonomic remarks: syntaxonomic position of *Linario–Erigeronetum mucronati* Segal 1969 is unclear. The species pointed out by Poldini & Vidali (1994) as strictly associated with the order *Parietarietalia judaicae* (*Sonchus tenerrimus*, *Hyoseris radiata* and *Reichardia picroides*) do not occur on investigated area. However, the association consists of many species of Mediterranean and sub-Mediterranean character (*Parietaria judaica*, *Centranthus ruber*, *Ficus carica*, *Adiantum capillus–veneris*, *Cottinus coggyria*, *Coronilla emerus*, *Artemisia alba* and others). In my opinion (following Brandes 1992a and Brullo & Guarino 1998), the floristic composition of the association is closer to the Mediterranean *Parietarion* communities than to the Central-European *Cymbalaria–Asplenion* (see also table 7 and 8).

Ass. *Linario cymbalariae–Parietarietum ramiflorae* Pignatti 1952 (see Table 4, Table 5)

Species composition: *Cymbalaria muralis* and *Homalothecium sericeum* are characteristic species.

Distribution: the most common association, recorded in all investigated localities (Lazise, Cisano, Garda, Torri del Bianco, Castelletto), also observed in Malcesine, Torbole and Riva del Garda but no phytosociological documentation was gathered.

Differentiation: two different form of this association were recorded.

1. *Linario cymbalariae–Parietarietum ramiflorae* Pignatti 1952 var. with *Centranthus ruber* (Table 4) [=“basic phytocoenon of (*Cymbalaria–Asplenion*) a *Cymbalaria muralis*” sensu Poldini & Vidali 1994]. Phytocoenoses belonging to the variant are termo- and nitrophilous and devoid of the *Asplenium* species. Some sub-mediterranean species (*Centranthus ruber* and *Ficus carica*) occur here with high constancy (Table 4), together with *Hordeum murinum*, *Sonchus oleraceus* and *Saxifraga tridactylites*.

2. *Linario cymbalariae–Parietarietum ramiflorae* Pignatti 1952 var. with *Asplenium trichomanes* (Table 5), representing the most typical form of the association, occurred in shaded and moist localities. *Asplenium trichomanes* and *A. ruta–muraria* were observed only in this variant. At the same time nitrophilous species common to other wall communities were lacking. This variant is very common in Central Europe (Szcześniak & Świerkosz 2003), but without the share of *Parietarion judaicae* species.

Syntaxonomic remarks: Variant with *Asplenium trichomanes* is clearly distinguishable, and, with no doubts belongs to the *Cymbalaria–Asplenion* alliance. The first variant, more thermophilous and nitrophilous in character, reveals closer similarity to the *Parietarion judaicae* communities.

Comm. *Asplenium ceterach–Bryoerythrophyllum recurvirostre* (see Table 6)

Species composition: *Asplenium ceterach* and *Bryoerythrophyllum recurvirostre* are differentiating species.

Distribution: it was found only in Casteletto on stony, dry and sunny walls, near *Olea europea* plantations, east of the village.

Differentiation: no differentiation was noted.

Syntaxonomic remarks: the community belongs to the *Cymbalaria–Asplenion* alliance, and shows some similarities to *Linario cymbalariae–Parietarietum ramiflorae*. During the first, canonical analysis these relevés were included in the second syntaxon, however the TWINSpan algorithm showed statistically important difference. Also very dry and sunny habitat is different from other localities of *Linario–Parietarietum*.

Discussion and conclusions

From the vicinity of Lake Garda eight wall plant communities have been reported so far (Brandes 1992a, 1992b; Poldini & Vidali 1994; Brullo & Guarino 1998), but complete phytosociological documentation was published only in the form of short synoptic tables. Among them were: *Centranthetum rubri* Oberd. 1969, *Linario–Erigeronetum mucronati* Segal 1969, *Oxalido–Parietarietum judaicae* (Br.–Bl. 1952) Segal 1969, *Corydalidetum luteae* Kaiser 1926, *Asplenietum rutaemurariae–trichomanis* Kuhn 1937, *Linario cymbalariae–Parietarietum ramiflorae* Pignatti 1952, *Asplenio–Parietarietum judaicae* Segal 1969 and *Capparidetum rupestris* Bolos & Molinier 1958.

Table 8 provides a comparison of available material, which does not require any special comments. Four of the associations described by Brullo & Guarino (1998) as a separate, are indistinguishable in the synoptic table, and all of them only represent forms of *Linario cymbalariae–Parietarietum ramiflorae*, with various frequencies of characteristic or dominating species. Both the investigations summarised in this paper and the available

comparative material show that *Linario cymbalariae–Parietarium ramiflorae* Pignatti 1952 is the only association of the *Cymbulario–Asplenion* alliance in the environs of Lake Garda. The syntaxonomic position of *Asplenium ceterach–Bryoerythrophyllum recurvirostre* community is unclear.

In my opinion, not more than five well-distinguishable and evidenced associations actually occur here. Three are confirmed in this paper, and *Corydalidetum luteae* Kaiser 1926 is well documented by Brullo & Guarino (1998). The occurrence of *Capparidetum rupestris* Bolos & Molinier 1958 is mentioned by Brandes (1992a) in a synoptic table that groups phytosociological relevés from the vicinity of Verona (Brandes 1992a, tab. 5, col. 13). Poldini & Vidali (1994) present one relevé of *Oxalido–Parietarium judaicae* from Malcesine, but it has only two species, thus being useless in a comparison.

Some patches with *Centranthus ruber* as a dominating component (e.g. Table 2, rel 10; Table 3, rel. 9), also were observed, but always the characteristic species of other associations (usually *Erigeron karvinskianus*) were present. These patches should not be distinguished as the independent association *Centranthetum rubri* Oberd 1969, what is suggested by Brullo & Guarino (1998). Its species composition is almost identical to other syntaxa, and the high abundance of *Centranthus ruber* is the only difference distinguishing those patches.

The numerical methods used by Brullo & Guarino (1998) focused on the abundance of species, so the dominating species were strongly preferred. This kind of methods allowed to recognise “species aggregations” rather than well-distinguishable associations in the meaning of Braun–Blanquet’s school. When these communities are grouped in a separate table, they look like really existing associations, but re-arrangement of the tables shows their “virtual” existence. From this point of view, the syntaxonomy of the order *Tortulo–Cymbalarietalia* as studied by Brullo & Guarino (1998) needs further research. Independence of some associations distinguished by these authors as separate units (especially *Centranthetum rubri* and *Asplenio–Parietarium judaicae*) is really doubtful.

The results of the investigations suggest that the borders between the Central-European and Mediterranean wall plant communities delimited by Poldini & Vidali (1994) are not sufficiently clear. The sites of phytocoenoses belonging to *Linario–Erigeronetum mucronati* and *Oxalido–Parietarium judaicae* recognised near Lake Garda probably mark the absolute northern limit of occurrence of the *Parietarium judaicae* alliance in Italy. Presence of *Asplenium trichomanes* and *A. ruta-muraria* in one of the variants of *Linario–Erigeronetum mucronati* and, on the other hand, occurrence of sub-Mediterranean species in *Linario cymbalariae–Parietarium ramiflorae* (tab. 8) indicate that the border is a wide transitional zone rather than linear in character as Poldini & Vidali (1994) supposed. Brullo & Guarino (1998) share the former opinion.

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Appendix:

Table 1: Ass. *Oxalido-Parietarium judaicae* (Br.-Bl. 1952) Segal 1969 in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	C
No. of record	11	13	49	9	12	5	19	10	16	48	17	15	14	18	o
Area of record in sq. M	10	10	10	10	10	8	10	10	10	10	10	9	4	4	n
Slope degree	90	90	90	90	90	90	90	90	90	90	90	90	90	90	s
Exposure	W	NW	NW	W	W	W	SW	NW	SW	W	SW	SW	SW	SW	t
Date (2003 year)	7,05	7,05	10,05	7,05	7,05	6,05	8,05	7,05	8,05	10,05	8,05	8,05	8,05	8,05	a
Cover of herb layer in %	20	20	45	70	25	30	30	15	35	80	60	20	30	20	n
No. of species in the record	11	11	9	10	7	6	5	4	4	9	3	5	4	4	c
Locality	Cis2	Cis2	Tor3	Cis2	Cis2	Gar1	Laz1	Cis2	Laz1	Tor3	Laz1	Laz1	Laz1	Laz1	y
D. Oxalido-Parietarium judaicae (Br.-Bl. 1952) Segal 1969															
<i>Euphorbia peplus</i>	c	r	.	+	.	+	+	.	+	+	+	.	.	+	57
<i>Oxalis corniculata</i>	c	+	r	r	+	r	.	+	.	.	.	.	.	.	50
<i>Erigeron annuus</i>	c	.	.	r	+	+	.	+	.	.	.	+	.	+	43
<i>Viola odorata</i>	c	r	r	.	+	.	.	.	.	.	.	+	.	.	29
<i>Mercurialis annua</i>	c	.	.	+	+	.	+	.	.	.	.	.	.	r	21
<i>Veronica hederifolia</i>	c	r	+	.	.	.	.	.	.	.	.	+	.	.	21
Ch. O. Tortulo-Cymbalarietalia Segal 1969															
<i>Parietaria judaica</i>	c	1	1	2	3	2	2	2	3	4	4	2	3	2	100
<i>Cymbalaria muralis</i>	c	.	+	+	2	+	1	.	.	.	.	.	.	.	35
<i>Ficus carica</i>	c	r	.	2	.	.	.	1	.	+	.	.	.	.	29
Accompanying															
<i>Hedera helix</i>	c	.	+	.	2	.	1	1	.	.	2	+	1	.	57
<i>Sonchus oleraceus</i>	c	1	+	.	1	1	.	.	+	+	.	.	(+)	r	50
<i>Taraxacum sect. Vulgaria</i>	c	r	.	+	+	.	.	.	.	.	.	r	+	.	36
<i>Bromus tectorum</i>	c	+	+	.	.	.	.	+	.	+	.	.	.	.	29
<i>Fumaria capreolata</i>	c	.	+	.	.	+	.	.	.	.	.	.	.	.	14
<i>Poa annua</i>	c	r	r	.	.	.	.	.	.	.	.	.	.	.	14
<i>Convolvulus arvensis</i>	c	r	.	+	.	.	.	.	.	.	.	.	.	.	14
Sporadic: <i>Bromus hordaceus</i> 48 (+); <i>Campanula</i> sp. 48 (+); <i>Geranium pusillum</i> 48 (+); <i>Hordeum murinum</i> 12 (r); <i>Medicago lupulina</i> 13 (r); <i>Plantago maior</i> 9 (+); <i>Rubus ulmifolius</i> c 16 (r).															

Table 2: Ass. *Linario-Erigeronetum mucronati* Segal 1969 var. with *Sonchus oleraceus* in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	5	6	7	8	9	10	11	12	13	
No. of record	77	78	63	61	69	62	65	60	53	54	71	72	56	C
Area of record in sq. m	10	10	5	10	4	4	4	10	4	10	4	4	10	o
Slope degree	60	60	70	90	70	90	90	90	90	90	90	90	90	n
Exposure	SW	SW	SW	W	NW	W	NW	W	W	W	NW	W	W	s
Date - all. 05.2003	12	12	4	4	4	4	4	4	3	3	5	5	4	t
Cover of shrub layer in %	.	.	.	.	.	.	.	.	.	.	.	.	10	a
Cover of herb layer in %	60	80	60	70	60	30	50	60	40	50	50	50	100	n
Cover of moss layer in %	5	5	20	.	10	20	.	.	.	.	+	20	.	c
No. of species in the record	11	17	10	9	9	9	6	5	4	4	9	7	4	y
Locality	Torb	Torb	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	
Ch. et loc. D.* Ass. <i>Linario-Erigeronetum mucronati</i> Segal 1969														
<i>Erigeron karvinskianus</i>	3	4	3	4	2	2	2	3	3	1	+	1	5	100
<i>Ligustrum ovalifolium*</i> c	.	.	.	.	.	.	.	.	.	.	+	+	r	24
<i>Coronilla emerus*</i>	.	.	.	.	.	.	.	.	.	.	+	1	.	15
Diff. subass. <i>hederetosum</i>														
<i>Sonchus oleraceus</i>	+	+	+	+	+	.	+	+	.	.	.	.	.	54
<i>Pohlia nutans</i> d	.	.	2	.	1	1	.	.	.	.	+	2	.	38
<i>Hordeum murinum</i>	+	+	.	+	.	.	.	.	.	.	.	.	.	24
Ch. All. <i>Parietaria judaiceae</i> Segal 1969														
<i>Centranthus ruber</i>	+	+	1	r	1	+	+	1	1	3	1	+	.	92
<i>Ficus carica</i> b	.	1	+	.	.	.	.	.	.	.	.	.	1	31
<i>Ficus carica</i> c	.	.	1	1	.	.	.	.	.	.	.	.	r	.
Ch et D*. all. <i>Cymbalaria-Asplenion</i> Segal 1969														
<i>Tortula muralis</i> d	+	r	.	.	.	.	.	.	.	.	.	.	.	24
<i>Sedum album*</i>	.	.	2	.	.	+	.	.	.	.	+	.	.	24
Ch. O. <i>Tortulo-Cymbalarietalia</i> Segal 1969														
<i>Parietaria judaica</i>	2	+	2	1	3	1	2	2	1	2	1	.	.	85
<i>Cymbalaria muralis</i>	.	1	.	.	.	+	2	.	.	.	.	.	.	24
Accompanying														
<i>Hedera helix</i>	.	.	+	+	1	+	2	1	+	+	2	2	+	85
<i>Bromus tectorum</i>	+	+	.	.	+	.	.	.	.	.	.	.	.	24
<i>Geranium purpureum</i>	.	.	.	+	+	+	.	.	.	.	.	.	.	24
Sporadic: <i>Arenaria serpyllifolia</i> 78 (r); <i>Bryum argenteum</i> d 77 (+); 78 (+); <i>Capsella bursa pastoris</i> 78 (r); <i>Cotoneaster horizontalis</i> c 61 (+); <i>Galium verum</i> 69 (+); 71 (+); <i>Lolium perenne</i> 78 (+); <i>Lonicera</i> sp. 63 (+); <i>Medicago lupulina</i> 78 (+); <i>Pistacia lentiscus</i> 77 (+); <i>Poa annua</i> 77 (+); 78 (+); <i>Rosmarinus officinalis</i> 78 (+); <i>Taraxacum</i> sect. <i>Vulgaria</i> 77 (+); 78 (+); <i>Artemisia alba</i> 62 (+); 72 (+).														

Table 3: Ass. *Linario-Erigeronnetum mucronati* Segal 1969 var. with *Asplenium trichomanes* in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	5	6	7	8	9	10	11	12	
No. of record	68	66	67	64	50	55	58	59	75	51	57	52	C
Area of record in sq. m	4	6	10	4	4	6	10	10	10	4	10	10	o
Slope degree	90	90	90	90	90	90	70	90	70	90	80	90	n
Exposure	SW	NW	W	W	W	W	W	W	W	W	W	W	s
Date - all. 05.2003	4	4	4	4	4	4	4	4	5	3	3	3	t
Cover of shrub layer in %	30	.	.	.	20	.	10	10	.	10	10	20	a
Cover of herb layer in %	40	50	80	50	30	90	80	100	70	50	80	50	n
Cover of moss layer in %	.	.	+	.	.	.	.	.	.	.	.	20	c
No. of species in the record	5	4	8	11	6	7	15	9	14	8	10	11	y
Locality	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	Tor 1	
Ch. et loc. D.* Ass. <i>Linario-Erigeronnetum mucronati</i> Segal 1969													
<i>Erigeron karvinskianus</i>	3	3	3	1	1	4	4	5	+	2	4	2	100
<i>Adiantum capillus veneris*</i> (D. var.)	1	+	+	1	.	.	+	2	.	.	.	.	50
<i>Clematis vitalba*</i> (D. var.)	c	.	.	+	.	.	1	+	+	.	.	.	33
<i>Ligustrum ovalifolium*</i>	c	.	.	.	.	.	+	+	.	.	.	.	17
<i>Coronilla emerus*</i>	.	.	.	.	.	.	.	.	+	+	.	.	17
D. variant													
<i>Asplenium trichomanes</i>	.	.	.	.	+	+	+	+	1	+	+	.	58
<i>Cottinus coggyria</i>	b	.	.	.	.	.	+	.	.	.	1	2	33
<i>Cottinus coggyria</i>	c	.	.	.	.	.	.	.	.	+	1	+	.
Sporadic: <i>Asplenium ruta muraria</i> 67 (+); <i>Asplenium ceterach</i> 12 (1).													
Ch. All. <i>Parietaria judaica</i> Segal 1969													
<i>Ficus carica</i>	b	3	.	.	.	.	1	.	.	1	.	.	66
<i>Ficus carica</i>	c	+	+	+	.	.	+	+	+	+	+	.	.
<i>Centranthus ruber</i>	.	.	2	.	.	+	2	.	4	.	+	1	50
Ch. O. <i>Tortulo-Cymbalarietalia</i> Segal 1969													
<i>Parietaria judaica</i>	.	2	2	+	1	2	1	+	1	2	+	.	83
<i>Sedum dasyphyllum</i>	.	.	.	+	.	.	.	.	.	.	.	+	17
<i>Tortula muralis</i>	d	.	.	+	.	.	+	.	.	.	.	+	17
<i>Homalothecium sericeum</i>	d	.	.	+	.	.	.	.	.	.	.	2	17
Sporadic: <i>Antirrhinum major</i> 55 (+); <i>Sedum album</i> 64 (1).													
Accompanying													
<i>Hedera helix</i>	.	.	.	+	.	1	+	+	+	+	+	.	58
<i>Bromus tectorum</i>	.	.	.	.	+	+	.	.	+	.	.	.	25
<i>Galium verum</i>	.	.	.	.	.	.	+	.	1	.	+	.	25
<i>Artemisia alba</i>	.	.	.	.	.	.	.	.	+	.	.	1	17
Sporadic: <i>Acer pseudoplatanus</i> b 59 (1); c 58 (+); <i>Brachythecium</i> sp. d 52 (+); <i>Bromus</i> sp. 75 (+); <i>Crataegus monogyna</i> 58 (+); <i>Dactylis glomerata</i> 64 (+); <i>Epilobium parviflorum</i> 68 (r); 57 (r); <i>Fraxinus ornus</i> b 51 (1); <i>Geranium purpureum</i> 75 (r); <i>Galium album</i> 50 (1); 52 (+); <i>Pohlia nutans</i> d 52 (r); <i>Potentilla repens</i> 64 (+); <i>Rubus ulmifolius</i> b 50 (2); c 58 (r); <i>Sonchus oleraceus</i> 64 (+); 57 (+); <i>Taraxacum</i> sect. <i>Vulgaria</i> 64 (+); 75 (+).													

Table 4: Ass. *Linario cymbalariae-Parietarium ramiflorae* Pignatti 1952 var. with *Centranthus ruber* in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	5	6	7	8	9	10	11	12		
No. of record	23	33	34	70	73	25	31	74	22	32	28	29	C	
Area of record in sq. M	5	5	4	10	10	10	12	6	4	5	10	4	o	
Slope degree	90	90	90	80	80	90	90	90	90	90	90	90	n	
Exposure	SW	SW	E	W	W	W	SW	E	NE	W	S	SE	s	
Date (2003 year)	8,05	8,05	8,05	10,05	10,05	8,05	8,05	10,05	8,05	8,05	8,05	8,05	t	
Cover of herb layer in %	50	70	70	45	95	30	60	30	60	60	50	40	a	
Cover of moss layer in %	.	.	+	.	.		10	.	.	.	10	20	n	
No. of species in the record	3	4	10	10	8	4	7	10	4	5	5	8	c	
Locality	Laz3	Laz3	Laz3	Tor2	Tor2	Laz3	Laz3	Tor2	Laz3	Laz3	Laz3	Laz3	y	
Ch. Ass. <i>Linario cymbalariae-Parietarium ramiflorae</i> Pignatti 1952														
<i>Cymbalaria muralis</i>	c	+	3	1	3	4	.	2	1	+	2	3	2	92
<i>Homalothecium sericeum</i>	d	.	.	1	.	.	.	2	.	.	.	.	1	25
D. Var. (Ch. All. <i>Parietaron judaiceae</i> Segal 1969**)														
<i>Centranthus ruber**</i>	c	2	1	1	+	+	.	1	+	.	.	.	+	66
<i>Sonchus oleraceus</i>	c	.	.	.	+	+	+	.	+	.	(+)	+	.	58
<i>Hordeum murinum</i>	c	.	+	.	.	+	+	.	.	+	.	.	.	33
<i>Ficus carica**</i>	c	.	.	1	+	.	+	.	.	.	.	.	.	25
<i>Saxifraga tridactylites</i>	c	.	.	.	.	.	.	.	.	.	+	+	1	25
Ch. et. D.* All. <i>Cymbalario-Asplenion</i> Segal 1969 and Ch. O. <i>Tortulo-Cymbalarietalia</i> Segal 1969														
<i>Parietaria judaica</i>	c	3	3	2	+	3	3	2	2	4	3	2	2	100
<i>Sedum album*</i>	c	.	.	1	+	.	.	.	+	1	1	.	r	50
<i>Tortula muralis</i>	d	.	.	.	.	.	.	.	.	.	.	2	2	17
<i>Syntrichia ruralis</i>	d	.	.	+	.	.	.	+	.	.	.	.	.	17
<i>Asplenium trichomanes</i>	c	.	.	.	.	.	.	.	+	.	.	.	.	8
Accompanying and sporadic: <i>Arenaria serpyllifolia</i> 32 (+); <i>Calystegia sepium</i> 70(r); <i>Chelidonium majus</i> 29 (+); <i>Carduus</i> sp. 70 (+); <i>Erigeron anuus</i> 34 (+); 74 (r); <i>Festuca rubra</i> 73 (+); <i>Galium verum</i> 70 (+); 74 (+); <i>Geranium purpureum</i> 74 (+); <i>Geranium pusillum</i> 34 (+); <i>Hedera helix</i> 73 (1); 31 (1); <i>Lagurus ovatus</i> 31 (+); <i>Ligustrum ovalifolium</i> 73 (+); <i>Lolium perenne</i> 73 (+); <i>Taraxacum</i> sect. <i>Vulgaria</i> 70 (+); <i>Veronica arvensis</i> 34 (+).														

Table 5: Ass. *Linario cymbalariae-Parietarietum ramiflorae* Pignatti 1952 var. with *Asplenium trichomanes* in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
No. of record	2	3	35	36	37	38	43	40	41	42	76	8	7	21	27	24	20	4	6	1	26	C	
Area of record in sq. M	4	10	4	4	4	6	10	10	6	4	4	4	4	4	5	4	6	10	4	8	4	o	
Slope degree	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	n	
Exposure	SW	W	NW	SE	N	E	NW	S	S	W	N	W	W	NE	NW	NE	SW	W	W	SW	NW	s	
Date (2003 year)	6,05	6,05	9,05	9,05	9,05	9,05	9,05	9,05	9,05	9,05	11,1	7,05	7,05	8,05	8,05	8,05	8,05	6,05	6,05	6,05	8,05	t	
Cover of herb layer in %	60	70	40	30	70	80	60	60	60	20	60	25	40	50	50	20	70	40	70	70	20	a	
Cover of moss layer in %	.	.	.	.	20	.	+	.	.	10	10	.	.	10	+	5	5	.	.	.	.	n	
No. of species in the record	5	8	5	4	9	4	7	6	4	5	6	3	3	4	7	5	5	7	4	4	4	c	
Locality	Gar1	Gar1	Cast1	Cast1	Cast3	Cast3	Cast1	Cast3	Cast3	Cast1	Cis3	Cis1	Cis1	Laz3	Laz3	Laz3	Laz2	Gar1	Gar1	Gar1	Laz3	y	
Ch. Ass. <i>Linario cymbalariae-Parietarietum ramiflorae</i> Pignatti 1952																							
<i>Cymbalaria muralis</i>	c	+	3	1	1	+	1	1	4	1	+	3	+	1	2	2	1	2	1	4	2	1	100
<i>Homalothecium sericeum</i>	d	.	.	.	.	2	.	+	+	.	2	.	.	.	1	+	.	.	.	.	.	.	35
Ch. Et. D.* All. <i>Cymbalario-Asplenion</i> Segal 1969																							
<i>Asplenium trichomanes</i>	c	1	+	2	2	1	2	+	+	3	+	+	.	.	.	.	.	.	.	.	.	.	65
<i>Sedum album*</i>	c	.	1	.	r	.	.	+	.	.	.	.	2	1	2	+	.	.	.	.	.	.	41
<i>Tortula muralis</i>	d	.	.	+	.	+	+	.	+	.	.	2	.	.	.	+	+	.	.	.	.	.	41
<i>Chelidonium majus*</i>	c	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	.	.	24
Sporadic: <i>Asplenium ruta muraria</i> 76 (1).																							
Ch. O. <i>Tortulo-Cymbalarietalia</i> Segal 1969																							
<i>Parietaria judaica</i>	c	4	2	1	+	3	4	4	1	2	+	2	+	3	1	2	+	4	1	+	3	1	100
<i>Antirrhinum major</i>	c	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	+	19
Sporadic: <i>Ficus carica</i> 40 (1).																							
Accompanying																							
<i>Hedera helix</i>	c	1	+	.	.	1	.	.	.	.	.	.	.	.	.	.	2	1	2	.	.	.	35
<i>Bromus tectorum</i>	c	.	+	.	.	.	.	r	.	.	.	.	.	.	.	+	.	.	.	.	r	.	24
Sporadic: <i>Amaranthus</i> sp. 24 (r); <i>Arenaria serpyllifolia</i> 27 (+); <i>Arrhenatherum elatius</i> 37 (1); <i>Cerastium holosteoides</i> 4 (+); <i>Erigeron annuus</i> 6 (+); 27 (+); <i>Euphorbia peplus</i> 4 (+); <i>Fumaria capreolata</i> 3 (+); 4 (+); <i>Galium album</i> 1 (+); <i>Geranium purpureum</i> 37 (+); <i>Oxalis corniculata</i> 41 (+); <i>Rumex</i> sp. 20 (1); <i>Stellaria media</i> 35 (+); <i>Taraxacum</i> sect. <i>Vulgaria</i> 76 (+); <i>Urtica dioica</i> 37 (+); <i>Veronica arvensis</i> 24 (r).																							

Table 6: Community *Asplenium ceterach-Bryoerythrophyllum recurvirostre* in the vicinity of Garda Lake (North Italy).

Successive no. of record	1	2	3	4	
No. of record	44	45	46	47	C
Area of record in sq. M	10	4	4	4	o
Slope degree	90	90	90	90	n
Exposure	SW	SE	S	S	s
Date (2003 year)	9,05	9,05	9,05	9,05	t
Cover of herb layer in %	60	50	40	35	a
Cover of moss layer in %	.	10	+	10	n
No. of species in the record	7	11	8	9	c
Locality	Cast2	Cast2	Cast2	Cast2	y
D. comm. <i>Asplenium ceterach-Bryoerythrophyllum recurvirostre</i>					
<i>Asplenium ceterach</i>	c	1	3	2	100
<i>Bryoerythrophyllum recurvirostre</i>	d	.	2	+	75
Ch. Et. D.* All. <i>Cymbalario-Asplenion</i> Segal 1969					
<i>Asplenium trichomanes</i>	c	+	.	+	75
<i>Tortula muralis</i>	d	.	+	+	75
<i>Sedum album</i>	c	.	1	+	75
<i>Homalothecium sericeum</i>	d	.	.	+	50
<i>Cymbalaria muralis</i>	c	+	.	.	50
Ch. O. <i>Tortulo-Cymbalarietalia</i> Segal 1969					
<i>Parietaria judaica</i>	c	4	+	2	100
Accompanying					
<i>Hedera helix</i>	c	1	+	+	75
<i>Sedum reflexum</i>	c	+	+	.	50
Sporadic: <i>Galium album</i> 44 (+); <i>Olea europaea</i> c 45 (+); <i>Pistacia lentiscus</i> c 45 (+); <i>Thymus</i> sp. 45 (+); <i>Galium verum</i> 47 (+); <i>Poa annua</i> 45 (+).					

Table 7: Comparison of the species compositions of wall communities distinguished in the vicinity of Garda Lake. North Italy (short table).

No of Table	1	2	3	4	5	6
No of records	14	13	12	12	21	4
Mean number of species	6,5	8	9	6,5	5,2	8,8
D. Oxalido-Parietarium judaicae (Br.-Bl. 1952) Segal 1969						
<i>Euphorbia peplus</i>	57	.	.	.	5	.
<i>Oxalis corniculata</i>	50	.	.	.	5	.
<i>Erigeron annuus</i>	43	.	.	17	9	.
<i>Viola odorata</i>	29	.	.	.	.	.
<i>Veronica hederifolia</i>	21	.	.	.	.	.
<i>Mercurialis annua</i>	21	.	.	.	.	.
Ch. et loc. D. Ass. Linario-Erigeronietum mucronati Segal 1969						
<i>Erigeron karvinskianus</i>	.	100	100	.	.	.
<i>Ligustrum ovalifolium*</i>	.	24	17	8	.	.
<i>Coronilla emerus*</i>	.	15	17	.	.	.
<i>Adiantum capillus-veneris</i> (D. var.)	.	.	50	.	.	.
<i>Clematis vitalba</i> (D. var.)	.	.	33	.	.	.
Ch. Ass. Linario cymbalariae-Parietarium ramiflorae Pignatti 1952						
<i>Cymbalaria muralis</i>	35	24	.	92	100	50
<i>Homalothecium sericeum</i>	.	.	17	25	35	50
D. comm. Asplenium ceterach-Bryoerythrophyllum recurvirostre						
<i>Asplenium ceterach</i> (D. O.)	.	.	8	.	.	100
<i>Bryoerythrophyllum recurvirostre</i>	.	.	.	.	.	75
D. variants						
<i>Asplenium trichomanes</i> (Ch. all.)	.	.	58	8	65	75
<i>Asplenium ruta muraria</i> (Ch. all.)	.	.	8	.	5	.
<i>Cottinus coggyria</i>	.	.	33	.	.	.
<i>Saxifraga trydactylites</i>	.	.	.	25	.	.
<i>Sonchus oleraceus</i>	50	54	8	58	.	.
<i>Hordeum murinum</i>	7	24	.	33	.	.
<i>Pohlia nutans</i>	.	38	8	.	.	.
Ch. All. Parietarium judaicae Segal 1969						
<i>Ficus carica</i>	29	31	66	25	5	.
<i>Centranthus ruber</i>	.	92	50	66	.	.
Ch. Et. D.* All. Cymbalarion-Asplenion Segal 1969						
<i>Sedum album*</i>	.	24	8	50	41	75
<i>Tortula muralis</i>	.	24	17	17	41	75
<i>Chelidonium majus*</i>	.	.	.	8	24	.
<i>Syntrichia ruralis</i>	.	.	.	17	.	.
Ch. O. Tortulo-Cymbalarietalia						
<i>Parietaria judaica</i>	100	85	63	100	100	100
<i>Antirrhinum major</i>	.	.	8	.	19	.
<i>Sedum dasyphyllum</i>	.	.	17	.	.	.
Absent in Oxalido-Parietarium judaicae						
<i>Geranium purpureum</i>	.	24	8	8	5	.
<i>Galium verum</i>	.	15	25	17	.	25
<i>Galium album</i> agg.	.	.	8	.	5	25
Accompanying						
<i>Hedera helix</i>	57	85	58	17	35	75
<i>Bromus tectorum</i>	29	24	25	.	24	.
<i>Taraxacum</i> sect. <i>Vulgaria</i>	36	15	8	8	5	.
<i>Poa annua</i>	14	15	.	.	.	25
<i>Fumaria capreolata</i>	14	.	.	.	10	.

Table 8: Comparison of the synoptic tables of the wall associations and communities distinguished in the vicinity of Garda Lake in 1998-2011 (short table).

Source of data	hoc loco, Table 1	hoc loco, Table 2	hoc loco, Table 3	B&G 1998 Table 6 col. 9	B&G 1988 Table 5 col. 17	hoc loco, Table 4	B&G 1998, table 12, col. 7	B&G 1998, table 10, col. 9	hoc loco, Table 5	B&G 1998, table 9, col. 10	B&G 1988, table 8 col. 12	hoc loco, Table 6
Original name of the association	O-P.	L.-Erig.	L.-Erig.	L.-Erig.	C. rub.	L.-P.	As-Par	L.-P.	L.-P.	A. m-t.	Cor.l.	Ac-Br
Name of the association after verification	O-P.	L.-Erig.			L.-P.						Cor.l.	Ac-Br
No of relevés	14	13	12	5	6	12	7	8	21	9	6	4
	All. <i>Parietarion judaicae</i>				All. <i>Cymbalaria-Asplenion</i>							
All. <i>Parietarion judaicae</i> and diagnostic species of the associations												
<i>Euphorbia peplus</i>	III	.	.	.	.	.	.	.	s	.	.	.
<i>Oxalis corniculata</i>	III	.	.	.	.	.	.	.	s	.	.	.
<i>Erigeron annuus</i>	III	.	.	.	.	I	.	.	s	.	.	.
<i>Viola odorata</i>	II	.	.	.	.	.	.	.	.	.	.	.
<i>Mercurialis annua</i>	II	.	.	.	.	.	.	.	.	.	.	.
<i>Veronica hederifolia</i>	II	.	.	.	.	.	.	.	.	.	.	.
<i>Erigeron karvinskianus</i>	.	V	V	V	I	.	.	.	.	.	.	.
<i>Ligustrum ovalifolium</i>	.	II	I	.	.	s	.	.	.	.	.	.
<i>Coronilla emerus</i>	.	II	I	.	.	.	.	.	.	.	.	.
<i>Adiantum capillus-veneris</i>	.	.	III	.	.	.	.	.	.	.	.	.
<i>Ficus carica</i>	II	II	IV	III	I	II	I	.	s	.	.	.
<i>Centranthus ruber</i>	.	V	III	V	V	IV	III	II	.	.	.	.
All. <i>Cymbalaria-Asplenion</i> and diagnostic species of the associations												
<i>Cymbalaria muralis</i>	II	II	.	.	IV	V	V	V	V	V	V	III
<i>Homalothecium sericeum</i>	.	.	I	.	.	II	II	I	II	II	.	III
<i>Corydalis lutea</i>	.	.	.	.	.	.	.	.	.	.	V	.
<i>Bryoerythrophyllum recurvirostre</i>	.	.	.	.	.	.	.	.	.	.	.	IV
<i>Asplenium trichomanes</i>	.	.	III	V	III	s	IV	V	IV	V	V	IV
<i>Asplenium ruta muraria</i>	.	.	s	I	IV	.	II	IV	s	V	IV	.
<i>Sedum album</i>	.	II	s	.	.	III	.	IV	III	IV	.	IV
<i>Tortula muralis</i>	.	II	I	.	.	I	III	V	III	V	V	IV
<i>Bryum caespiticium</i>	.	.	.	.	.	.	.	.	.	III	V	.
<i>Ceratodon purpureus</i>	.	.	.	.	.	.	I	II	.	III	.	.
Or. <i>Tortulo-Cymbalariaetalia</i>												
<i>Parietaria judaica</i>	V	V	IV	V	V	V	V	V	V	V	V	V
<i>Asplenium ceterach</i>	.	.	s	II	.	.	I	II	.	V	.	V
<i>Antirrhinum majus</i>	.	.	s	III	I	.	III	I	I	.	.	.
<i>Sedum dasyphyllum</i>	.	.	I	.	I	.	IV	V	.	V	V	.

Explanations:

Shortcut of the associations name: O-P - *Oxalido-Parietarium judaice*; L-Erig. - *Linario-Erigeronetum mucronati*; C. rub - *Centranthetum rubri*; L.-P. - *Linario cymbalariae-Parietarium ramiflorae*; As-Par - *Asplenio-Parietarium*; A. r-t. - *Asplenietum rutae-murariae-trichomanis*; Cor. l. - *Corydaletosum luteae*, Ac-Br - comm. *Asplenium ceterach-Bryoerythrophyllum recurvirostre*

B&G 1998 - Brullo & Guarino 1998 tables

s. - sporadic species, less than 10% of occurrence