

THE FLORA OF OLD TOWN CENTRES IN EUROPE

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Abstract

The spontaneous floras of 66 old town centres have been mapped in different regions of Europe (Germany, France, Belgium, Austria, Switzerland, Italy, and Portugal). Similarity as well as geographical variability of the old town floras are studied. Our investigations show that the number of common species in old town centres of central and/or West Europe is high. Similar climatic conditions in old towns of the western part of the mediterranean area also lead to relatively uniform stocks of plant species. Differences between the floras of old cities and old villages are pointed out.

1. Introduction

In the last 3 decades there have been numerous papers concerned with the flora and vegetation of European cities (review: Sukopp 1990). Urban areas are very heterogeneous and contain a large number of different habitats, which are usually sharply separated: old town centres, young housing estates, railway sites, industrial sites, highways, cemeteries, villages, dumping sites, fields, urban forests.

This paper considers the old town centres, which differ from newer quarters in their long settlement and old buildings. One can assume that the floristic similarities between old town centres are high, as climatic and geographic differences are compensated – at least partly – by the similar and long-enduring use.

The botanical exploration of towns started with old town centres 140 years ago. In 1855 Deakin studied the flora of the Colosseum of Rome and found 420 taxa growing spontaneously upon its ruins. Jourdan (1866, 1867, 1872) analysed the flora of ancient walls in Algeria as well as in France. The systematic investigation of old town centres, however, did not start before 1980 (Aey 1990, Brandes 1982, 1985, 1991, Schulte 1989).

I tried to investigate as many old town centres as possible in different areas of Europe, using uniform methods to obtain comparable data. Our interest is focussed on the geographic variability of the flora, as well as on the question of which species are typical for old towns.

2. Methods

The floras of old town centres (within the historical fortifications) have been mapped in different seasons as completely as possible. To facilitate comparability, the data of the towns were combined regionally:

1. Northern part of Lower Saxony (FRG): Emden, Leer, Lüneburg, Stade, Verden.
2. Southeastern part of Lower Saxony (FRG): Brunswick (= Braunschweig), Goslar, Helmstedt, Hildesheim, Wolfenbüttel.

Table 1. Frequency of vascular plant species in old town centres of different regions in Europe.

Region	1	2	3	4	5	6	7	8	9	10	11
<i>Sisymbrium altissimum</i>	III	IV	.	.	.	.	.	.	.	.	.
<i>Rumex crispus</i>	I	IV	II	IV	.	.	.	.	.	.	.
<i>Heracleum mantegazzianum</i>	IV	III	III	I	.	.	.	.	.	.	.
<i>Helianthus annuus</i>	I	I	II	IV	I	.	.	.	.	.	.
<i>Lepidium ruderae</i>	I	III	IV	I	IV	II	.	.	.	.	.
<i>Oxalis europaea</i>	I	IV	II	II	IV	IV	.	.	.	.	.
<i>Acer platanoides</i>	IV	V	V	IV	IV	I	II	.	.	.	.
<i>Aegopodium podagraria</i>	II	V	V	V	II	I	III	.	.	.	.
<i>Calamagrostis epigejos</i>	I	V	IV	II	II	.	I	.	.	.	.
<i>Epilobium angustifolium</i>	IV	IV	IV	II	.	I	III	.	.	.	.
<i>Solidago canadensis</i>	III	V	V	IV	V	.	I	.	.	.	.
<i>Sorbus aucuparia</i>	III	IV	II	I	.	.	III	.	.	.	.
<i>Tanacetum vulgare</i>	II	V	IV	II	II	.	I	.	.	.	.
<i>Urtica urens</i>	II	V	III	II	III	II	II	.	.	.	.
<i>Bromus tectorum</i>	II	I	.	.	IV	.	I	.	.	.	.
<i>Impatiens glandulifera</i>	III	.	II	IV	.	I	I	.	.	.	.
<i>Acer pseudoplatanus</i>	V	V	V	V	III	III	V	IV	.	.	.
<i>Agrostis stolonifera</i>	III	V	II	IV	.	I	III	III	.	.	.
<i>Agropyron repens</i>	V	IV	IV	III	V	.	IV	III	.	.	.
<i>Atriplex patula</i>	V	IV	III	IV	II	I	III	IV	.	.	.
<i>Bromus hordeaceus ssp. hord.</i>	IV	I	I	.	.	I	.	II	.	.	.
<i>Cirsium arvense</i>	V	V	V	V	V	II	V	II	.	.	.
<i>Crepis capillaris</i>	II	II	IV	II	.	.	I	IV	.	.	.
<i>Dryopteris filix-mas</i>	IV	IV	IV	I	II	V	IV	IV	.	.	.
<i>Epilobium hirsutum</i>	II	I	I	IV	.	.	V	IV	.	.	.
<i>Geum urbanum</i>	III	III	IV	V	I	I	I	IV	.	.	.
<i>Lapsana communis</i>	III	V	IV	V	V	IV	IV	IV	.	.	.
<i>Matricaria discoidea</i>	V	IV	IV	V	V	V	III	II	.	.	.
<i>Medicago lupulina</i>	II	II	III	IV	IV	.	III	II	.	.	.
<i>Poa nemoralis</i>	III	IV	V	IV	I	V	III	IV	.	.	.
<i>Poa pratensis</i>	I	IV	III	IV	III	II	I	III	.	.	.
<i>Poa trivialis</i>	IV	.	I	IV	.	I	I	I	.	.	.
<i>Poa compressa</i>	III	V	III	IV	IV	II	V	I	.	.	.
<i>Polygonum persicaria</i>	II	II	II	III	II	.	IV	IV	.	.	.
<i>Sonchus arvensis</i>	I	II	I	IV	.	.	III	I	.	.	.
<i>Sonchus asper</i>	V	III	III	II	I	II	III	IV	.	.	.
<i>Tripleurospermum inodorum</i>	III	IV	IV	II	.	I	II	I	.	.	.
<i>Tussilago farfara</i>	II	V	IV	IV	III	.	III	I	.	.	.
<i>Ulmus cf. campestris juv.</i>	III	II	III	IV	.	.	II	III	.	.	.
<i>Veronica arvensis</i>	IV	II	I	II	II	V	I	II	.	.	.
<i>Artemisia vulgaris</i>	IV	V	V	IV	V	II	V	I	II	.	.
<i>Asplenium ruta-muraria</i>	III	V	V	V	V	V	V	II	II	.	.
<i>Bellis perennis</i>	IV	V	IV	II	V	III	III	IV	I	.	.
<i>Betula pendula</i>	V	V	V	V	V	V	V	II	II	.	.
<i>Calystegia sepium</i>	IV	IV	V	V	I	IV	III	V	II	.	.
<i>Cerastium fontanum agg.</i>	III	IV	III	IV	.	III	III	II	I	.	.
<i>Chelidonium majus</i>	IV	V	V	V	V	V	IV	IV	III	.	.
<i>Clematis vitalba</i>	III	III	V	III	.	III	V	II	I	.	.
<i>Conyza canadensis</i>	V	V	IV	V	V	V	V	III	V	.	.
<i>Fraxinus excelsior juv.</i>	V	V	V	V	I	I	V	IV	I	.	.
<i>Galinisoga ciliata</i>	II	III	V	IV	III	IV	III	.	V	.	.
<i>Galinisoga parviflora</i>	IV	IV	.	II	IV	.	I	.	II	.	.
<i>Ceranium pusillum</i>	IV	I	II	II	III	I	III	II	I	.	.
<i>Hordeum murinum</i>	V	IV	III	I	V	III	V	II	III	.	.

Table 1. Continued.

Region	1	2	3	4	5	6	7	8	9	10	11
<i>Lamium album</i>	II	III	II	IV	.	II	I	.	I	.	.
<i>Mycelis muralis</i>	I	II	V	IV	III	V	V	.	I	.	.
<i>Plantago lanceolata</i>	III	IV	IV	V	V	I	III	IV	III	.	.
<i>Prunella vulgaris</i>	II	I	II	II	III	.	IV	III	II	.	.
<i>Ranunculus repens</i>	V	IV	IV	V	I	IV	IV	IV	I	.	.
<i>Robinia pseudacacia</i> juv.	II	III	I	II	III	I	IV	II	III	.	.
<i>Rorippa sylvestris</i>	V	II	IV	II	.	.	I	.	I	.	.
<i>Rumex obtusifolius</i>	V	V	V	IV	I	I	III	IV	II	.	.
<i>Sagina procumbens</i>	V	V	V	V	V	V	V	IV	V	.	.
<i>Salix caprea</i>	V	V	V	IV	IV	III	V	I	II	.	.
<i>Sambucus nigra</i>	V	V	V	V	V	V	V	V	I	.	.
<i>Urtica dioica</i>	V	V	V	V	V	V	V	IV	III	.	.
<i>Viola odorata</i>	III	V	III	II	IV	II	.	II	I	.	.
<i>Bromus sterilis</i>	II	III	III	I	IV	V	II	IV	.	I	.
<i>Dactylis glomerata</i>	III	V	V	V	V	II	III	V	I	II	.
<i>Lolium perenne</i>	V	V	V	V	V	IV	IV	V	III	I	.
<i>Malva neglecta</i>	II	IV	IV	V	IV	IV	III	II	I	II	.
<i>Plantago major</i>	V	V	V	V	V	V	V	V	V	V	.
<i>Taraxacum officinale</i> agg.	V	V	V	V	V	V	V	V	V	IV	.
<i>Cymbalaria muralis</i>	IV	V	V	V	IV	V	V	V	V	IV	V
<i>Capsella bursa-pastoris</i>	V	V	V	V	V	V	V	IV	II	I	I
<i>Chenopodium album</i>	IV	V	V	V	V	IV	V	IV	V	II	V
<i>Convolvulus arvensis</i>	II	IV	II	V	V	III	III	IV	I	I	II
<i>Euphorbia pepus</i>	III	IV	IV	IV	IV	IV	III	V	III	.	IV
<i>Galium aparine</i>	IV	II	II	III	II	IV	III	II	.	II	V
<i>Hedera helix</i>	V	V	IV	V	V	V	V	V	I	IV	II
<i>Lactuca serriola</i>	I	IV	V	III	I	V	III	II	.	I	?IV
<i>Mercurialis annua</i>	I	IV	.	I	V	IV	V	IV	I	.	V
<i>Oxalis corniculata</i>	II	.	I	.	III	I	II	II	V	V	V
<i>Poa annua</i>	V	V	V	V	V	V	V	V	V	IV	V
<i>Polygonum aviculare</i> agg.	V	V	V	V	V	IV	V	V	V	IV	IV
<i>Sisymbrium officinale</i>	V	V	V	IV	II	III	V	II	.	.	I
<i>Senecio vulgaris</i>	V	V	IV	V	V	V	V	V	III	III	V
<i>Solanum nigrum</i>	II	II	II	I	III	?	IV	V	II	IV	I
<i>Sonchus oleraceus</i>	V	V	V	V	V	V	V	IV	III	V	V
<i>Stellaria media</i>	V	V	V	V	V	V	V	V	V	III	V
<i>Geranium robertianum</i>	.	V	II	IV	.	V	II	IV	I	.	?V
<i>Asplenium trichomanes</i>	.	I	II	II	IV	III	III	IV	IV	III	.
<i>Ailanthus altissima</i>	.	I	.	I	III	.	III	I	V	.	.
<i>Arrhenatherum elatius</i>	.	II	III	II	IV	.	IV	III	I	.	.
<i>Buddleja davidii</i>	.	I	.	.	.	.	IV	II	II	.	.
<i>Eragrostis minor</i>	.	I	.	II	V	.	I	.	V	.	.
<i>Trifolium pratense</i>	.	III	III	IV	II	.	I	II	I	.	.
<i>Corylus avellana</i>	.	III	I	I	.	II	.	IV	.	.	.
<i>Veronica persica</i>	.	I	I	IV	.	.	.	IV	.	.	.
<i>Festuca rubra</i> agg.	.	III	II	IV	II	I	.	.	.	.	.
<i>Lamium maculatum</i>	.	II	.	IV	.	I	.	.	.	.	.
<i>Ballota nigra</i> ssp. <i>nigra</i>	.	IV	III	II	V	.	.	.	.	.	.
<i>Potentilla anserina</i>	.	.	II	IV	.	.	.	.	.	.	.
<i>Rubus fruticosus</i> agg.	.	.	II	I	.	III	III	V	.	.	.
<i>Sedum reflexum</i>	.	.	I	.	.	.	.	IV	.	.	.

Table 1. Continued.

Region	1	2	3	4	5	6	7	8	9	10	11
<i>Parietaria judaica</i>	.	.	I	I	.	I	III	V	V	V	V
<i>Amaranthus retroflexus</i>	.	.	.	I	IV	.	I	.	.	.	.
<i>Digitaria sanguinalis</i>	.	.	.	I	II	.	II	III	V	III	.
<i>Sedum album</i>	.	.	.	II	IV	V	I	II	I	.	I
<i>Parthenocissus quinquefolia</i> agg.	.	.	.	.	IV	I	.	.	.	.	.
<i>Cynodon dactylon</i>	.	.	.	.	IV	.	.	.	IV	IV	IV
<i>Cheiranthus cheiri</i>	.	.	.	.	.	III	III	V	.	III	.
<i>Centranthus ruber</i>	.	.	.	.	.	.	III	V	I	V	.
<i>Polypodium vulgare</i>	.	.	.	.	.	.	III	V	.	.	.
<i>Amarantus deflexus</i>	.	.	.	.	.	.	.	I	V	V	II
<i>Coronopus didymus</i>	.	.	.	.	.	.	.	II	.	I	V
<i>Umbilicus rupestris</i>	.	.	.	.	.	.	.	IV	.	III	V
<i>Portulaca oleracea</i>	.	.	.	.	.	.	.	.	V	II	I
<i>Ficus carica</i>	.	.	.	.	.	.	.	.	II	III	V
<i>Conyza albida</i>	.	.	.	.	.	.	.	.	.	IV	.
<i>Hyoseris radiata</i>	.	.	.	.	.	.	.	.	.	V	.
<i>Lepidium graminifolium</i>	.	.	.	.	.	.	.	.	.	IV	.
<i>Bromus madritensis</i>	.	.	.	.	.	.	.	.	.	I	V
<i>Conyza bonariensis</i>	.	.	.	.	.	.	.	.	.	II	V
<i>Erodium malacoides</i>	.	.	.	.	.	.	.	.	.	III	?V
<i>Fumaria capreolata</i>	.	.	.	.	.	.	.	.	.	II	V
<i>Hyoscyamus albus</i>	.	.	.	.	.	.	.	.	.	II	IV
<i>Hordeum leporinum</i>	.	.	.	.	.	.	.	.	.	V	III
<i>Oxalis pes-caprae</i>	.	.	.	.	.	.	.	.	.	II	V
<i>Oryzopsis miliacea</i>	.	.	.	.	.	.	.	.	.	IV	III
<i>Polycarpon tetraphyllum</i>	.	.	.	.	.	.	.	.	.	IV	III
<i>Phagnalon saxatile</i>	.	.	.	.	.	.	.	.	.	I	V
<i>Urtica dubia</i>	.	.	.	.	.	.	.	.	.	IV	V
<i>Campanula erinus</i>	.	.	.	.	.	.	.	.	.	.	IV
<i>Centranthus calcitrapa</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Lavatera cretica</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Misopates orontium</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Sagina apetala</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Sonchus tenerrimus</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Nicotiana glauca</i>	.	.	.	.	.	.	.	.	.	.	V

3. Southern part of Lower Saxony (FRG): Einbeck, Göttingen, Hameln, Holzminden, Münden.

4. Southern part of Bavaria (FRG): Abensberg, Berching, Kelheim, Landsberg, Landshut, Munich (= München), Riedenburg.

5. Wachau (Lower Austria): Dürnstein, Krems, Langenlois, Melk, Stein, Weißenkirchen.

6. Alsace (France): Berghheim, Dambach-la-ville, Eguisheim, Kaysersberg, Ribeauvillé, Riquewihr.

7. Belgium and northern parts of France: Boulogne-sur-Mer, Bruges, Douai, Huy, Laon, Mons, Namur.

8. Brittany (France): Dinan, Guérande, La Trinité-Porhoet, Moncontour, Quintin, Uzel, Vannes, Vitré.

9. Insubrian region of the Alps (Switzerland and Italy): Bellinzona, Chiavenna, Ivrea, Laveno, Lugano, Luino.

10. Liguria (Italy): Albenga, Cervo, Finalborgo, San Remo, Taggia.

11. Algarve (Portugal): Albufeira, Faro, Lagos, Loulé, Silves, Tavira.

The frequency of the species is grouped into classes (e.g., Brandes & Griesse 1991): I: occurring in 1–20% of the towns; II: occurring in 21–40% of the towns; III: occurring in 41–60% of the towns; IV: occurring in 61–80% of the towns; V: occurring in 81–100% of the towns. Table 1 contains only species occurring with high frequency (IV or V) in at least one region.

3. The flora of old town centres

3.1. Central Europe

3.1.1. The flora

Walls and pavements

Table 1 (column 1–6) shows that about 90 species of vascular plants are widespread in the towns of Central Europe. The most important habitats in the crowded built-up old towns are walls and pavements. Common species typical for walls are *Asplenium ruta-muraria*, *Asplenium trichomanes*, *Cymbalaria muralis*, *Dryopteris filix-mas* and *Hedera helix*. *Poa compressa*, *Bromus tectorum*, *Betula pendula* and *Sedum* species are growing on the wall top. If there are enough old walls in the town, the number of species can be rather high. Of special interest are old city walls with many species which have escaped from the gardens (Brandes 1992).

Directly in front of the wall base, *Conyza canadensis*, *Galinsoga ciliata*, *Galinsoga parviflora*, *Hordeum murinum*, *Lactuca serriola*, *Malva neglecta* and *Sisymbrium officinale* are to be found. At wall bases which are more shadowed, as well as beneath shrubs, *Chelidonium majus*, *Geum urbanum*, *Lapsana communis*, *Mycelis muralis*, *Sonchus oleraceus* and *Stellaria media* are growing. At shadowed and less trodden pavements we find young shrubs like *Acer pseudoplatanus*, *Acer platanoides*, *Betula pendula*, *Clematis vitalba*, *Fraxinus excelsior*, *Salix caprea* and *Sambucus nigra*. These species play an important role in succession on ruins of buildings. At wall bases with a southern aspect the thermophilous *Robinia pseudacacia* is often to be found. In the cracks of beaten pavements *Poa annua*, *Polygonum aviculare* agg., *Matricaria discoidea*, *Sagina procumbens*, *Plantago major* and *Lolium perenne* are common species.

Small gardens

Characteristic for the small gardens are *Aegopodium podagraria*, *Agropyron repens*, *Atriplex patula*, *Chenopodium album*, *Euphorbia peplus*, *Geranium pusillum*, *Galinsoga parviflora*, *Mercurialis annua*, *Oxalis europaea*, *Solanum nigrum* and others. In the medieval towns there were no lawns, those exist even nowadays only as small areas. Important species are: *Bellis perennis*, *Crepis capillaris*, *Lolium perenne*, *Prunella vulgaris*.

River embankments

The embankments of a river flowing through the centre of an old town are very rich in plant species, as the example of the river Oker in Brunswick shows (Grote & Brandes 1991). 311 different vascular plant species – almost one third of the spontaneous flora of the whole city – are present on the riverbanks. 64% of the species are indigenous, 10% are archaeophytes. 14.1% are naturalized aliens and 11.9% are ephemerophytes. On embankments in the town centre *Acer pseudoplatanus*, *Acer platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Fraxinus excelsior*, *Robinia pseudacacia* and *Ulmus glabra* are the most common trees; the most frequent shrub is *Sambucus nigra*. Very obvious is a high proportion of climbing plants (*Hedera helix*, *Clematis vitalba*, *Bryonia dioica*).

Regional differences

Besides the great number of common species there are naturally regional differences: for example the neophyte *Sisymbrium altissimum* occurs only in the old towns of the northern part of Germany, while a number of species with complex nutritional requirements is declining. In the warm valley of the Danube in Lower Austria (column 5) the high frequency of *Amaranthus retroflexus*, *Cynodon dactylon*, *Eragrostis minor*, *Erigeron annuus* and *Parthenocissus quinquefolia* is noticeable. This already indicates the fringe of the continental pannonian climate.

3.1.2. Life forms and ecological indicator value

In relation to their life forms the species are arranged as follows: Therophytes – 39.1%; Hemicryptophytes – 33.3%; Geophytes – 11.5%; Phanerophytes – 9.2%; Nanophanerophytes – 3.4; Herbaceous chamaephytes – 3.4%.

An analysis of the ecological indicator values shows interesting results especially with respect to the factors temperature (T), water (F), and nitrogen (N):

(a) more than half the species are indicators of (fairly) warm conditions. With the exception of *Clematis vitalba* all warmth indicators (T=7) are neophytes or archaeophytes: *Bromus sterilis*, *Clematis vitalba*, *Cymbalaria muralis*, *Galinsoga ciliata*, *Hordeum murinum*, *Impatiens glandulifera*, *Lactuca serriola*, *Mercurialis perennis*, *Oxalis corniculata*, *Robinia pseudacacia*, *Solidago canadensis*.

Thus old towns – as for towns as a whole – are warmer habitats than the surrounding landscape. This applies, however, only to the temperate area of Europe and supposedly also to northern Europe.

(b) The old towns offer less dry places than often believed. Most of the species are moist-site indicators, mainly on soils of average dampness.

(c) Most of the more frequent species indicate a good nitrogen supply.

3.1.3. Differences between the flora of old towns and villages

What is the difference between the flora of old towns and villages? For Lower Saxony a direct comparison is possible, for villages have been investigated with the same methods as old towns (Brandes, Griesse & Köller 1990):

(a) The main result is the large common number of species in both settlement types. Many of the so-called 'village plants' and 'town plants' are better to be declared as 'settlement indicators'.

(b) Only a few plants are characteristic of villages. The frequencies of *Arctium lappa*, *Arctium minus*, *Ballota nigra*, *Chenopodium bonus-henricus*, *Conium maculatum* and *Leonurus cardiaca* are higher in villages than in old towns, so that these species can be labelled as 'village plants'. Others included in this category, for example *Hyoscyamus niger*, *Marrubium vulgare* or *Nepeta cataria* are very rare in Lower Saxony and/or show no particular accumulation in villages. The species mentioned were all used for medical purposes; at least *Ballota nigra*, *Chenopodium bonus-henricus* and *Leonurus cardiaca* can be seen as cultural relicts.

(c) Species of the wall flora (*Cymbalaria muralis*, *Dryopteris filix-mas*, *Poa compressa*, *Poa nemoralis*) are more frequent in old towns than in villages. *Cymbalaria muralis* in our opinion is the most characteristic plant of old towns (and castles) in Europe. Also other warmth indicators as *Hordeum murinum*, *Galinsoga ciliata* and *Lactuca serriola* are common in old towns. The high frequency of *Calamagrostis epigejos*, *Mycelis muralis* and *Tussilago farfara* is noteworthy. There are also differences in the occurrence of spontaneous woody plants: *Acer platanoides*, *Clematis vitalba* and *Hedera helix* are more frequent in old towns than in villages. Species of meadows, pastures and flooded places (Molinio-Arrhenatheretea, Agrostietalia

Table 2. Comparison between the floras of old town centres. (Number of species occurring in various old town centres which are also found in the old town centre of Brunswick.)

old town centre	number of common species	region	distance to Brunswick (average)
Wolfenbüttel	88	southeastern	30 km
Helmstedt	82	part of	
Goslar	70	Lower Saxony	
Hildesheim	66	(FRG)	
	$\bar{X} = 76.5$		
Lüneburg	71	northern part	175 km
Verden	68	of Lower Saxony	
Stade	58	(FRG)	
Leer	56		
Emden	53		
	$\bar{X} = 61.2$		
Munich (München)	72	southern part	410 km
Landshut	72	of Bavaria	
Riedenburg	69	(FRG)	
Kelheim	63		
Augsburg	60		
Abensberg	44		
Berching	43		
Landsberg	41		
	$\bar{X} = 58.0$		
Bruges	71	Belgium and	515 km
Mons	64	northern part	
Douai	62	of France	
Namur	59		
Laon	53		
Boulogne-sur-Mer	49		
Huy	36		
	$\bar{X} = 56.3$		
La Trinité-Porhoet	55	Brittany	1050 km
Moncontour	53	(France)	
Vitré	48		
Dinan	43		
Guérande	43		
Uzel	43		
Quintin	36		
Vannes	35		
	$\bar{X} = 44.5$		
Bellinzona	41	Insubrian region	710 km
Luino	34	of the Alps	
Chiavenna	16	(Switzerland and	
Laveno	16	Italy)	
Ivrea	15		
Lugano	15		
	$\bar{X} = 22.8$		
Mdina	11	Malta	1770 km
Tunis	1	Tunisia	1710 km

Table 3. Frequency of selected wall-dwelling species in towns of different regions in Europe.

Region	1	2	3	4	5	6	7	8	9	10	11
<i>Hieracium sylvaticum</i>	I	I	III	I	.	II	I	.	.	.	.
<i>Corydalis lutea</i>	I	III	I	II	.	I	III	.	.	.	.
<i>Bromus tectorum</i>	II	I	.	.	IV	.	I	.	.	.	.
<i>Syringa vulgaris</i>	I	II	I	I	II	.	II	II	.	.	.
<i>Sedum acre</i>	I	II	.	.	.	II	I	III	.	.	.
<i>Dryopteris filix-mas</i>	IV	IV	IV	II	II	V	IV	IV	.	.	.
<i>Poa compressa</i>	III	V	IV	IV	IV	II	IV	I	.	.	.
<i>Asplenium ruta-muraria</i>	III	V	V	V	V	V	V	II	II	.	.
<i>Cymbalaria muralis</i>	IV	V	V	V	IV	V	V	V	V	IV	V
<i>Hedera helix</i>	V	V	IV	V	V	V	V	V	I	IV	II
<i>Cystopteris fragilis</i>	.	II	II	I	.	.	I	.	.	.	.
<i>Sedum reflexum</i>	.	I	.	I	.	I	.	IV	.	.	.
<i>Asplenium trichomanes</i>	.	.	.	II	IV	III	III	IV	IV	III	.
<i>Sedum album</i>	.	.	.	II	IV	V	I	II	I	.	II
<i>Phyllitis scolopendrium</i>	.	.	.	.	.	I	I	II	.	.	.
<i>Polypodium vulgare</i>	.	.	.	.	.	.	III	V	.	.	.
<i>Parietaria judaica</i>	.	.	.	I	.	I	III	V	V	V	V
<i>Antirrhinum majus</i>	.	.	.	I	II	II	I	III	I	III	.
<i>Cheiranthus cheiri</i>	.	.	.	.	.	III	III	V	.	III	.
<i>Centranthus ruber</i>	.	.	.	.	.	.	III	V	I	V	.
<i>Ficus carica</i>	.	.	.	.	.	.	.	.	II	III	V
<i>Sedum dasyphyllum</i>	.	.	.	.	.	.	.	.	I	III	.
<i>Erigeron karvinskianus</i>	.	.	.	.	.	.	.	.	III	I	.
<i>Adiantum capillus-veneris</i>	.	.	.	.	.	.	.	.	.	III	.
<i>Capparis spinosa</i>	.	.	.	.	.	.	.	.	.	II	.
<i>Ceterach officinarum</i>	.	.	.	.	.	.	.	.	.	III	.
<i>Hyoseris radiata</i>	.	.	.	.	.	.	.	.	.	V	.
<i>Veronica cymbalaria</i>	.	.	.	.	.	.	.	.	.	III	.
<i>Fumaria capreolata</i>	.	.	.	.	.	.	.	.	.	II	V
<i>Misopates orontium</i>	.	.	.	.	.	.	.	.	.	I	V
<i>Phagnalon saxatile</i>	.	.	.	.	.	.	.	.	.	I	V
<i>Umbilicus rupestris</i>	.	.	.	.	.	.	.	.	.	III	V
<i>Centranthus calcitrapa</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Nicotiana glauca</i>	.	.	.	.	.	.	.	.	.	.	V
<i>Campanula erinus</i>	.	.	.	.	.	.	.	.	.	.	IV

stoloniferae) however are of secondary importance in comparison with villages. For further discussions see Brandes & Griesse (1991) and Pyšek & Pyšek (1990).

3.2. Western part of continental Europe (France and Belgium)

The old towns in Belgium and northern France (table 1, column 7) show a flora which is very similar to those of old towns in central Europe. There is also a high frequency of *Buddleja davidii* as well as the occurrence of non-hardy wall plants (*Parietaria judaica*, *Centranthus ruber*, *Cheiranthus cheiri*). More significant are the differences between central Europe and Brittany (column 8): besides the above mentioned species especially *Umbilicus rupestris* and *Rubus fruticosus* agg. are highly frequent, whereas nitrophilous species like *Artemisia vulgaris*, *Lamium album* or *Mycelis muralis* are rare or even absent.

3.3. Southern Europe

Table 1 (column 9–11) shows the highly frequent species in old towns of the insubrian alps region. The basic components of the flora are definitely central European, even if many of nitrophilous and shade species are absent. The mild climate is reflected by the occurrence (with high frequency) of *Ailanthus altissima*, *Amaranthus deflexus*, *Cynodon dactylon*, *Digitaria sanguinalis*, *Eragrostis minor*, *Oxalis corniculata*, *Parietaria judaica* and *Portulaca oleracea*.

In the transition from submediterranean to mediterranean climate, old towns in Tuscany (Brandes 1985) and in Istria (Schulte 1989) had a relatively high number of species which are also common in central European old towns. The old towns in the mediterranean region are more densely built up, and a smaller percentage of the soil is uncovered in comparison to central Europe. The small number of species (highly frequent species at least) is noticeable. Spontaneous shrubs and trees, except *Ficus carica*, are not important (see Table 1, no. 10–11). Regionally *Ailanthus altissima*, *Nicotiana glauca* and/or *Rubus ulmifolius* are growing in old towns.

Highly frequent wall-dwelling species are *Cymbalaria muralis*, *Ficus carica*, *Hyoscyamus albus*, *Parietaria judaica* and *Umbilicus rupestris*. Regionally *Campanula erinus*, *Centranthus ruber*, *Hyoseris radiata*, *Phagnalon saxatile*, and *Sonchus tenerrimus* are common. Table 3 shows the great differences between the wall floras of central Europe and southern Europe: only *Cymbalaria muralis* and *Hedera helix* are common wall plants in all regions.

Important species in pavements are *Amaranthus deflexus*, *Aster squamatus* (regionally), *Cynodon dactylon*, *Euphorbia chamaesyce*, *Oxalis corniculata*, *Poa annua*, *Polygonum aviculare*, and *Polycarpon tetraphyllum*.

In densely built-up mediterranean old towns some tender leaf herbs, with surface area/weight ratios like those of shade plants, are able to grow, whereas they are absent from the surrounding garrigue. Our measurements showed that in summer time, noon temperatures in the towns can be a few degrees lower than in the surroundings. Similar climatic conditions lead to relatively uniform stocks of species in old towns in the mediterranean area. Despite the great distance between southern Portugal and Liguria (1560 km) the similarity of the flora in the old towns is very high.

3.4. Outlook on north Africa

The investigations started in Algeria (Jourdan 1866, 1867, 1872). Recently we only have investigated the kasba of Tunis, so it is not possible to give a general statement for northern Africa. In the kasba of Tunis we found spontaneous vegetation only on walls and – above all – on roofs. The most common species are *Hyoscyamus niger* and *Reseda alba*. Widespread are other minor mediterranean weeds such as *Conyza bonariensis*, *Lavatera cretica*, *Mercurialis annua*, *Ricinus communis*, *Sisymbrium irio*, and *Urtica dubia*. *Parietaria judaica* however seems to be quite seldom.

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