

THE FLORA OF WALLS IN THE CHEW VALLEY

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INTRODUCTION

During the two years 1988 and 1989, 305 walls in the Chew Valley were kept under observation, with the particular aim of assessing the relative frequency of different plant species on the various kinds of walls in the area. Only flowering plants and pteridophytes were studied. Stone bridges and some buildings were included in the survey but not quarries, cliff faces or any other semi-natural habitats. It seems that no comparable study has previously been made in the west of Britain, though Thompson (1925) recorded 104 species growing on pollarded willows and alders along our River Chew – a somewhat similar habitat – and West (1911) listed 78 species growing on a single wall near the sea in the extreme south west of Ireland.

The Chew Valley, in North Somerset and Avon, being the area drained by the small River Chew and its tributary streams, extends from above Chewton Mendip in the south to Keynsham in the north (where the Chew flows into the Avon), and from Marksbury and Emborough in the east to Compton Martin and Felton in the west, a total area of some 140km². The altitudinal range is from 285m to 15m. The area is almost entirely rural with a few large villages but only one town, Keynsham. For this reason pollution is not an important factor in determining the composition of the flora: in any case the higher plants are much less affected by pollution than lichens and bryophytes. Large parts of the area have a high rainfall, the average on the Mendip Hills (where the Chew rises) being some 45 ins per annum, Chew Magna (in the centre of the valley) 38 ins, while down at Keynsham the total is probably about 32 ins.

Almost all the walls are of local stone and predominantly calcareous in nature – White Lias, Carboniferous Limestone, Dolomitic Conglomerate and Grey and Red Sandstone. Even where the stone is not calcareous, eg. Pennant Sandstone at Pensford, the mortared joints, where most plants grow, provide a localised calcareous environment. There are virtually no brick walls except for a very few railway bridges and in suburban roads in the southern districts of Keynsham. There are many miles of drystone walls, particularly at the higher altitudes.

The 305 walls studied were chosen with three criteria in mind: firstly, to cover the whole area (the initial aim being to select at least one wall in each 1km square); secondly, to include reasonable numbers of walls of particular kinds, eg. dividing and retaining walls, river walls, churches, drystone walls etc – some of these categories may, of course, overlap; thirdly, to select, as far as was consistent with these two more important criteria, walls with a relatively rich flora, so as to obtain as large a sample as possible of plants colonising walls in the area. Needless to say, every wall selected had at least one plant species growing on it during some part of the survey period: as Kent (1961) noted in his paper on Middlesex walls, it was not uncommon to find on a later visit that a wall had been repointed or rebuilt to the

detriment of the flora! Retaining walls with a substantial depth of soil on top were generally excluded from the survey, since plants growing on their tops could not reasonably be distinguished from the flora of the adjoining field or wood. For the same reason plants at the extreme base of a wall which appeared to be rooted in the ground were not recorded.

Except for churches (see below), the unit for the survey was either a single wall or, occasionally, a series of very short adjacent walls of identical construction and aspect (for example, a farmyard wall with a break for a gate in the centre). In the case of long drystone and other field walls a sample length of up to 50 metres was chosen.

As Darlington (1981) points out, the angle of inclination of a wall has an important effect on colonisation, in that the nearer to the horizontal the greater the range of plants. Partly for this reason the survey excluded the shelving river embankments along the lower Chew in Keynsham and also the sloping concrete and stone walls of the Chew Valley Reservoir. With the single exception of the aqueduct revetment in Harptree Combe, which is marginally out of the vertical, all the walls surveyed had vertical sides.

The nomenclature of plants used in this paper is that of Clapham, Tutin and Moore (1987), and to save space the names of authors are omitted.

LIST OF PLANTS

A total of 291 species of flowering plants and ferns were seen on the Chew Valley walls, but of these, 72 (25%) occurred on only one wall, with another 42 (14%) on only two walls. The species are listed below, with the number of walls on which they were seen.

<i>Taraxacum officinale</i> agg	174	<i>Poa annua</i>	40
<i>Urtica dioica</i>	161	<i>Polypodium interjectum</i>	40
<i>Hedera helix</i>	159	<i>Lolium perenne</i>	38
<i>Cymbalaria muralis</i>	140	<i>Alliaria petiolata</i>	37
<i>Geranium robertianum</i>	138	<i>Acer pseudo-platanus</i>	35
<i>Galium aparine</i>	136	<i>Poa trivialis</i>	35
<i>Poa pratensis</i>	135	<i>Sedum acre</i>	34
<i>Asplenium ruta-muraria</i>	123	<i>Veronica arvensis</i>	34
<i>Dactylis glomerata</i>	117	<i>Geranium lucidum</i>	32
<i>Sambucus nigra</i>	112	<i>Crataegus monogyna</i>	31
<i>Rubus fruticosus</i> agg	108	<i>Fraxinus excelsior</i>	31
<i>Arrhenatherum elatius</i>	94	<i>Galium mollugo</i>	30
<i>Festuca rubra</i>	92	<i>Ranunculus repens</i>	30
<i>Anthriscus sylvestris</i>	91	<i>Rosa canina</i> agg	30
<i>Asplenium ceterach</i>	90	<i>Alnus glutinosa</i>	28
<i>Asplenium trichomanes</i>	84	<i>Myosotis arvensis</i>	28
<i>Bromus sterilis</i>	81	<i>Sonchus asper</i>	28
<i>Sonchus oleraceus</i>	74	<i>Angelica sylvestris</i>	27
<i>Asplenium scolopendrium</i>	69	<i>Saxifraga tridactylites</i>	26
<i>Epilobium montanum</i>	65	<i>Epilobium ciliatum</i>	24
<i>Lapsana communis</i>	65	<i>Leontodon autumnalis</i>	24
<i>Holcus lanatus</i>	64	<i>Agrostis stolonifera</i>	23
<i>Lamium album</i>	58	<i>Bromus hordeaceus</i>	23
<i>Cardamine hirsuta</i>	57	<i>Mycelis muralis</i>	23
<i>Brachypodium sylvaticum</i>	53	<i>Cirsium vulgare</i>	22
<i>Plantago lanceolata</i>	50	<i>Lamium purpureum</i>	21
<i>Glechoma hederacea</i>	44	<i>Rumex sanguineus</i>	21
<i>Veronica hederifolia</i>	44	<i>Silene dioica</i>	21
<i>Senecio vulgaris</i>	42	<i>Veronica chamaedrys</i>	21

<i>Achillea millefolium</i>	20	<i>Chelidonium majus</i>	6
<i>Cotoneaster horizontalis</i>	20	<i>Clematis vitalba</i>	6
<i>Elymus repens</i>	20	<i>Crepis vesicaria</i>	6
<i>Scrophularia auriculata</i>	20	<i>Hypochaeris radicata</i>	6
<i>Cirsium arvense</i>	19	<i>Ilex aquifolium</i>	6
<i>Heracleum sphondylium</i>	19	<i>Lamium galeobdolon</i>	6
<i>Senecio jacobaea</i>	19	<i>Leucanthemum vulgare</i>	6
<i>Dryopteris filix-mas</i>	18	<i>Parietaria judaica</i>	6
<i>Umbilicus rupestris</i>	18	<i>Plantago major</i>	6
<i>Aegopodium podagraria</i>	17	<i>Trisetum flavescens</i>	6
<i>Centranthus ruber</i>	17	<i>Bromus erectus</i>	5
<i>Cerastium fontanum</i>	17	<i>Elymus caninus</i>	5
<i>Festuca ovina</i>	17	<i>Ligustrum vulgare</i>	5
<i>Oenanthe crocata</i>	17	<i>Lonicera peri-clymenum</i>	5
<i>Poa nemoralis</i>	17	<i>Mercurialis annua</i>	5
<i>Stachys sylvatica</i>	17	<i>Nasturtium officinale</i>	5
<i>Epilobium parviflorum</i>	16	<i>Ranunculus bulbosus</i>	5
<i>Eupatorium cannabinum</i>	16	<i>Stellaria neglecta</i>	5
<i>Festuca gigantea</i>	15	<i>Allium ursinum</i>	4
<i>Mercurialis perennis</i>	15	<i>Aphanes arvensis</i> agg	4
<i>Convolvulus arvensis</i>	14	<i>Aquilegia vulgaris</i>	4
<i>Calystegia sepium</i>	13	<i>Arabis caucasica</i>	4
<i>Ranunculus ficaria</i>	13	<i>Asplenium adiantum-nigrum</i>	4
<i>Corydalis lutea</i>	12	<i>Bellis perennis</i>	4
<i>Epilobium hirsutum</i>	12	<i>Chaerophyllum temulentum</i>	4
<i>Geum urbanum</i>	12	<i>Cheiranthus cheiri</i>	4
<i>Tanacetum parthenium</i>	12	<i>Fagus sylvatica</i>	4
<i>Cardamine flexuosa</i>	11	<i>Hieracium pilosella</i>	4
<i>Crepis capillaris</i>	11	<i>Leontodon hispidus</i>	4
<i>Poa compressa</i>	11	<i>Ribes sanguineum</i>	4
<i>Rubus caesius</i>	11	<i>Sempervivum tectorum</i>	4
<i>Solanum dulcamara</i>	11	<i>Ulmus glabra</i>	4
<i>Cystopteris fragilis</i>	10	<i>Veronica persica</i>	4
<i>Filipendula ulmaria</i>	10	<i>Ajuga reptans</i>	3
<i>Fragaria vesca</i>	10	<i>Apium nodiflorum</i>	3
<i>Potentilla reptans</i>	10	<i>Arabidopsis thaliana</i>	3
<i>Stellaria media</i>	10	<i>Carex pendula</i>	3
<i>Ulmus procera</i>	10	<i>Chamaecyparis lawsoniana</i>	3
<i>Vicia sepium</i>	10	<i>Chrysosplenium oppositifolia</i>	3
<i>Arenaria serpyllifolia</i>	9	<i>Deschampsia caespitosa</i>	3
<i>Bromus ramosus</i>	9	<i>Epilobium tetrandrum</i>	3
<i>Potentilla sterilis</i>	9	<i>Euonymus europaeus</i>	3
<i>Adoxa moschatellina</i>	8	<i>Hieracium maculatum</i>	3
<i>Agrostis capillaris</i>	8	<i>Kerria japonica</i>	3
<i>Alopecurus pratensis</i>	8	<i>Lotus corniculatus</i>	3
<i>Erophila verna</i> agg	8	<i>Meconopsis cambrica</i>	3
<i>Rumex obtusifolius</i>	8	<i>Medicago lupulina</i>	3
<i>Sedum reflexum</i>	8	<i>Prunella vulgaris</i>	3
<i>Sorbus aucuparia</i>	8	<i>Quercus robur</i>	3
<i>Anthoxanthum odoratum</i>	7	<i>Ribes rubrum</i>	3
<i>Arum maculatum</i>	7	<i>Taxus baccata</i>	3
<i>Aubrieta deltoidea</i>	7	<i>Trifolium repens</i>	3
<i>Cerastium tomentosum</i>	7	<i>Verbascum thapsus</i>	3
<i>Chamaenerion angustifolium</i>	7	<i>Viola reichenbachiana</i>	3
<i>Corylus avellana</i>	7	<i>Aesculus hippocastanum</i>	2
<i>Euphorbia peplus</i>	7	<i>Anthriscum majus</i>	2
<i>Ribes uva-crispa</i>	7	<i>Aster lanceolatus</i>	2
<i>Rumex acetosa</i>	7	<i>Ballota nigra</i>	2
<i>Sedum album</i>	7	<i>Cumpanula portenschlagiana</i>	2
<i>Symphoricarpos albus</i>	7	<i>Capsella bursa-pastoris</i>	2
<i>Syringa vulgaris</i>	7	<i>Cardamine pratensis</i>	2
<i>Veronica polita</i>	7	<i>Carduus acanthoides</i>	2
<i>Buddleia davidii</i>	6	<i>Carpinus betulus</i>	2

<i>Cotoneaster x watereri</i>	2	<i>Cotoneaster integrifolius</i>	1
<i>Cotoneaster sternianus</i>	2	<i>Cotoneaster buxifolius</i>	1
<i>Cotoneaster dielsianus</i>	2	<i>Cotoneaster franchetii</i>	1
<i>Dipsacus fullonum</i>	2	<i>Crataegus crus-galli</i>	1
<i>Draba muralis</i>	2	<i>Epilobium obscurum</i>	1
<i>Equisetum arvense</i>	2	<i>Euphorbia helioscopia</i>	1
<i>Euphorbia amygdaloides</i>	2	<i>Euphrasia nemorosa</i>	1
<i>Geranium dissectum</i>	2	<i>Fumaria officinalis</i>	1
<i>Geranium molle</i>	2	<i>Geranium rotundifolium</i>	1
<i>Hordeum distichon</i>	2	<i>Hieracium acuminatum</i>	1
<i>Hordeum murinum</i>	2	<i>Hieracium trichocaulon</i>	1
<i>Hyacinthus non-scriptus</i>	2	<i>Hypericum androsaemum</i>	1
<i>Hypericum hirsutum</i>	2	<i>Hypericum calycinum</i>	1
<i>Hypericum tetrandrum</i>	2	<i>Hypericum perforatum</i>	1
<i>Lycopus europaeus</i>	2	<i>Juniperus communis</i>	1
<i>Malva sylvestris</i>	2	<i>Lactuca serriola</i>	1
<i>Melica uniflora</i>	2	<i>Linaria purpurea</i>	1
<i>Moehringia trinervia</i>	2	<i>Lolium multiflorum</i>	1
<i>Oxalis acetosella</i>	2	<i>Lonicera nitida</i>	1
<i>Papaver somniferum</i>	2	<i>Lunaria annua</i>	1
<i>Phleum pratense</i>	2	<i>Luzula campestris</i>	1
<i>Polygonum aviculare</i>	2	<i>Lycium barbarum</i>	1
<i>Primula vulgaris</i>	2	<i>Malva moschata</i>	1
<i>Rorippa palustris</i>	2	<i>Melissa officinalis</i>	1
<i>Rumex crispus</i>	2	<i>Milium effusum</i>	1
<i>Sonchus arvensis</i>	2	<i>Myosotis sylvatica</i>	1
<i>Stellaria holostea</i>	2	<i>Nepeta x faassenii</i>	1
<i>Torilis japonica</i>	2	<i>Nigella damascena</i>	1
<i>Trifolium dubium</i>	2	<i>Phalaris canariensis</i>	1
<i>Tripleurospermum inodorum</i>	2	<i>Phygelius capensis</i>	1
<i>Valerianella locusta</i>	2	<i>Polystichum aculeatum</i>	1
<i>Veronica filiformis</i>	2	<i>Polystichum setiferum</i>	1
<i>Viburnum lantana</i>	2	<i>Prunus domestica</i>	1
<i>Acer campestre</i>	1	<i>Ranunculus sceleratus</i>	1
<i>Agrostis gigantea</i>	1	<i>Rubus idaeus</i>	1
<i>Arcitum minus</i>	1	<i>Sagina procumbens</i>	1
<i>Artemisia vulgaris</i>	1	<i>Scrophularia nodosa</i>	1
<i>Atriplex patula</i>	1	<i>Sedum spurium</i>	1
<i>Atriplex prostrata</i>	1	<i>Senecio squalidus</i>	1
<i>Avena sativa</i>	1	<i>Silene vulgaris ssp maritima</i>	1
<i>Avenula pubescens</i>	1	<i>Sison amomum</i>	1
<i>Betula pendula</i>	1	<i>Soleirolia soleirolii</i>	1
<i>Bidens tripartita</i>	1	<i>Solidago gigantea</i>	1
<i>Campanula cochlearifolia</i>	1	<i>Symphytum x uplandicum</i>	1
<i>Campanula poscharskyana</i>	1	<i>Thymus drucei</i>	1
<i>Campanula trachelium</i>	1	<i>Tragopogon pratense</i>	1
<i>Cardamine impatiens</i>	1	<i>Trifolium pratense</i>	1
<i>Carex divulsa</i>	1	<i>Tussilago farfara</i>	1
<i>Centaurea nigra</i>	1	<i>Veronica agrestis</i>	1
<i>Cerastium glomeratum</i>	1	<i>Veronica montana</i>	1
<i>Chenopodium album</i>	1	<i>Vicia sativa</i>	1
<i>Circaea lutetiana</i>	1	<i>Viola riviniana</i>	1
<i>Cirsium palustre</i>	1	<i>Vulpia myuros</i>	1

COMPARISON WITH WALL FLORAS OF OTHER AREAS

The table below, which is based on a similar table in Kent (1961), compares the relative frequency of the 21 commonest wall plants in this survey with the frequency of some of them in earlier wall surveys in Wiltshire (Grose 1957), Middlesex (Kent 1961), London (Kent 1961), Essex (Payne 1978), Warwickshire (Cadbury *et al* 1971), Cambridge (Rishbeth 1948) and Durham (Woodell and Rossiter 1959).

PERCENTAGE OCCURRENCES (WHERE KNOWN) IN VARIOUS SURVEYS OF THE 21 COMMONEST SPECIES IN THE CHEW VALLEY SURVEY

	305 CV Walls	18 Wilts Walls	650 Essex Walls	500 Middx Walls	72 London Walls	66 Durham Walls	Warks Walls*	Camb Walls*
1 Tarax off	57	83	16	13	11	64		(2)
2 Urt dio	53	67	16	4				
3 Hedera	52	78	27	2			(2)	
4 Cym mur	46	56	17	24	7		(3)	(5)
5 Geran rob	45	50	<5	<1			(19)	
6 Gal apar	45	56	12	<1				
7 Poa prat	44	61	7	5		23		
8 Aspl r-m	40	50	<5	2			(1)	
9 Dacty glo	38	44	11	1		40		
10 Sambucus	37		19	6	1	41		(7)
11 Rub frut	35		15	2		23		
12 Arrh elat	31		12	2				
13 Fest rub	30		<5	<1				(2)
14 Anthr syl	30		7	<1				
15 Aspl cet	30	63	<5	<1			(19)	
16 Aspl tric	28		<5	1				
17 Brom ster	27	61	14	2			(19)	
18 Sonch ol	24	44	35	19	13			
19 Aspl scol	23		10	4			(6)	
20 Epilob mon	21		<5	8	17	38		
21 Laps comm	21		5	<1				
Total No. of spp	291		286	204	83	168		186

* Order of frequency

It is hardly surprising that the Wiltshire figures, though based on a very small sample of walls, come closer to those in the present survey than any from more distant parts of England.

The most striking absentee from a high place in the Chew Valley list is *Poa annua*, which occurred on only 13% of our walls, compared with 56% in Wilts, 54% in Essex, 48% in Middlesex, 40% in Durham and 38% in London, while it topped the Cambridge list. Other surprising species are *Dryopteris filix-mas* on only 6% (35% in Middlesex, 28% in London, 22% in Essex), *Chamaenerion angustifolium* on 2% (53% in Durham, 24% in Middlesex and 12% in Cambridge), *Senecio squalidus* on only 1 wall (29% in Essex, 25% in Middlesex, 22% in London) and *Sagina procumbens* also on only 1 wall (18% in Essex, 17% in Middlesex, 10% in London).

Poa annua, *Chamaenerion angustifolium*, *Senecio squalidus* and *Sagina procumbens* are all plants primarily of artificial, even urban, habitats, which are relatively

infrequent in the pastoral Chew Valley, so there may be a comparatively small reservoir of populations of these species. Bolton (1985) found the *Sagina* abundant on walls in Exeter (an urban area), though Darlington (1981) refers to it as a common mural species generally.

The scarcity of Male Fern is harder to explain.

There may be two other factors to consider. The Chew Valley has a relatively heavy rainfall, which perhaps leads to annual and small species like *P. annua* and *Sagina* being overwhelmed by perennials, such as nos. 11, 12, 13, 14 and 21 on our list. And since many of the limestone walls in the lower parts of the Valley are surrounded by soils with low lime content, local races of plants may not readily adapt to the lime of the walls.

DRYSTONE WALLS

Drystone walls, which of course contain no mortar, initially offer little or no nutriment to the higher plants, but when they have been colonised by lichens and then mosses, some flowering plants and ferns soon appear and the drystone walls of the upper parts of the Chew basin support a flora which is to some extent distinctive. A factor in this distinctiveness may be the higher rainfall on Mendip.

The commonest species on the 40 drystone walls surveyed were as follows, with the percentage of such walls on which they were noted:-

<i>Geranium robertianum</i>	88	<i>Asplenium trichomanes</i>	50
<i>Galium aparine</i>	85	<i>A. ceterach</i>	48
<i>Urtica dioica</i>	78	<i>Anthriscus sylvestris</i>	48
<i>Arrhenatherum elatius</i>	73	<i>Geranium lucidum</i>	48
<i>Taraxacum officinale</i> agg.	70	<i>Saxifraga tridactylites</i>	45
<i>Poa pratensis</i>	68	<i>Sedum acre</i>	45
<i>Dactylis glomerata</i>	63	<i>Holcus lanatus</i>	35
<i>Hedera helix</i>	63	<i>Lapsana communis</i>	33
<i>Festuca rubra</i>	58	<i>Bromus sterilis</i>	30
<i>Polypodium interjectum</i>	58	<i>Cymbalaria muralis</i>	30
<i>Cardamine hirsuta</i>	53		

Species which showed a statistically significant preference for drystone walls (on the basis of the χ^2 test¹) were:-

	χ^2 value		
<i>Polypodium interjectum</i>	75.17	<i>Festuca rubra</i>	14.87
<i>Saxifraga tridactylites</i>	73.26	<i>Crataegus monogyna</i>	13.05
<i>Geranium lucidum</i>	62.68	<i>Urtica dioica</i>	10.45
<i>Sedum acre</i>	49.40	<i>Asplenium trichomanes</i>	10.38
<i>Arrhenatherum elatius</i>	35.30	<i>Dactylis glomerata</i>	10.20
<i>Cardamine hirsuta</i>	32.13	<i>Poa pratensis</i>	9.02
<i>Geranium robertianum</i>	31.79	<i>Anthriscus sylvestris</i>	5.92
<i>Galium aparine</i>	28.57	<i>Lolium perenne</i>	5.38

On the other hand, the following two species showed a marked relative aversion to drystone walls:-

<i>Asplenium ruta-muraria</i>	8.91	<i>Asplenium ceterach</i>	6.20
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¹The statistical tests were performed by constructing 2×2 contingency tables (species present or absent vs. selected wall category or other) and calculating χ^2 with one degree of freedom. Yates' correction for continuity was applied, but in view of the large number of observations it made virtually no difference.

RIVER WALLS

In this category are included vertical walls embanking the River Chew and its tributary streams, as well as revetments of stone bridges over streams. Only plants growing on the sides of these walls were recorded, ie those most likely to be influenced by the permanent proximity of water.

The commonest species on the 69 river walls were:-

<i>Urtica dioica</i>	64%	<i>Hedera helix</i>	36
<i>Asplenium ruta-muraria</i>	55	<i>Anthriscus sylvestris</i>	33
<i>Cymbalaria muralis</i>	49	<i>Angelica sylvestris</i>	29
<i>Taraxacum officinale</i> agg	46	<i>Scrophularia auriculata</i>	29
<i>Asplenium scolopendrium</i>	45	<i>Oenanthe crocata</i>	25
<i>Rubus fruticosus</i> agg	45	<i>Dactylis glomerata</i>	23
<i>Alnus glutinosa</i>	41	<i>Holeus lanatus</i>	22
<i>Asplenium trichomanes</i>	38	<i>Sambucus nigra</i>	22
<i>Brachypodium sylvaticum</i>	38	<i>Galium aparine</i>	19
<i>Geranium robertianum</i>	36	<i>Poa pratensis</i>	19

Species which showed a significant preference for river walls were:-

	chi ² value		
<i>Alnus glutinosa</i>	85.04	<i>Eupatorium cannabinum</i>	22.84
<i>Scrophularia auriculata</i>	61.00	<i>Cardamine flexuosa</i>	16.89
<i>Angelica sylvestris</i>	52.14	<i>Rumex sanguineus</i>	13.24
<i>Oenanthe crocata</i>	50.64	<i>Nasturtium officinale</i>	11.59
<i>Epilobium hirsutum</i>	33.89	<i>Parietaria judaica</i>	8.28
<i>Filipendula ulmaria</i>	24.16	<i>Tanacetum parthenium</i>	6.56
<i>Brachypodium sylvaticum</i>	23.62		

Species with a relative aversion to river walls were:-

<i>Asplenium ceterach</i>	17.81	<i>Geranium lucidum</i>	7.28
<i>Hedera helix</i>	8.91	<i>Cardamine hirsuta</i>	7.08
<i>Sonchus oleraceus</i>	7.69	<i>Festuca rubra</i>	5.20
<i>Sedum acre</i>	7.67	<i>Senecio vulgaris</i>	5.01

SHADED WALLS

In an attempt to show the influence of a shaded situation on the composition of a wall flora, 32 walls overhung by trees were selected. The selection was often difficult, in that a wall might well be under dense shade in summer but more or less exposed in winter when the overhanging trees were leafless. To that extent any conclusions drawn from this part of the survey are probably of less value than those relating to other, more clearly defined categories of walls.

The commonest species on the 32 shaded walls were:-

<i>Urtica dioica</i>	88%	<i>Asplenium trichomanes</i>	44
<i>Galium aparine</i>	78	<i>Poa pratensis</i>	44
<i>Geranium robertianum</i>	75	<i>Sambucus nigra</i>	41
<i>Hedera helix</i>	66	<i>Lapsana communis</i>	35
<i>Taraxacum officinale</i> agg	63	<i>Dactylis glomerata</i>	33
<i>Asplenium scolopendrium</i>	61	<i>Crataegus monogyna</i>	31
<i>Rubus fruticosus</i> agg	50	<i>Cymbalaria muralis</i>	31
<i>Brachypodium sylvaticum</i>	47	<i>Epilobium montanum</i>	31
<i>Alliaria petiolata</i>	44	<i>Polypodium interjectum</i>	31
<i>Anthriscus sylvestris</i>	44	<i>Rosa canina</i> agg	31

Species showing a significant preference for shaded walls were:-

	chi ² value		
<i>Adoxa moschatellina</i>	51.76	<i>Rosa canina</i> agg	15.89
<i>Mercurialis perennis</i>	44.00	<i>Bromus ramosus</i>	15.41
<i>Alliaria petiolata</i>	30.30	<i>Crateagus monogyna</i>	14.97
<i>Asplenium scolopendrium</i>	27.94	<i>Galium aparine</i>	14.79
<i>Festuca gigantea</i>	23.80	<i>Geranium robertianum</i>	11.47
<i>Brachypodium sylvaticum</i>	21.48	<i>Fraxinus excelsior</i>	10.53
<i>Urtica dioica</i>	16.56	<i>Polypodium interjectum</i>	8.62

Perhaps surprisingly, the species showing the most marked aversion to shaded walls was a fern:-

<i>Asplenium ruta-muraria</i>	12.83
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CHURCHES

All the old parish churches in the Chew Valley had plants growing on their outside walls: for the purpose of this survey each church was treated as a single unit. Church-yard walls were not included in this category. With the addition of five 19th-century nonconformist chapels, 27 churches were surveyed.

Of the 63 species noted on church walls (including their towers) the commonest was *Sambucus nigra*, which occurred on no less than 20 of the 27 churches. The dispersal of Elder by birds no doubt accounts for the frequent seedlings seen high up on church towers. Other common species were:-

<i>Asplenium ruta-muraria</i>	59%	<i>Festuca rubra</i>	26
<i>Hedera helix</i>	59	<i>Cardamine hirsuta</i>	22
<i>Rubus fruticosus</i> agg	37	<i>Cymbalaria muralis</i>	22
<i>Taraxacum officinale</i> agg	33	<i>Arrhenatherum elatius</i>	19
<i>Poa annua</i>	30	<i>Geranium robertianum</i>	19
<i>Epilobium montanum</i>	26	<i>Senecio vulgaris</i>	19

Only *Sambucus nigra* showed a significant preference for church walls (chi² value 16.07). On the other hand, three species were significantly less frequent on churches:-

<i>Geranium robertianum</i>	7.48	<i>Cymbalaria muralis</i>	5.68
<i>Taraxacum officinale</i> agg	5.78		

OTHER BUILDINGS

Several farm buildings, mainly old barns, were included in the survey, together with two tall disused chimneys: 17 stone structures in all.

Of the 50 species noted from these buildings, the most frequent were:-

<i>Urtica dioica</i>	47%	<i>Hedera helix</i>	24
<i>Bromus sterilis</i>	29	<i>Asplenium scolopendrium</i>	24
<i>Dactylis glomerata</i>	29	<i>Taraxacum officinale</i> agg	24

The data are insufficient to warrant any further comments.

RAILWAY WALLS

In a similar survey of the wall flora in Essex some years ago (Payne 1978) it was found that the walls of railway bridges and stations had a distinctive flora. In the Chew Valley, however, apart from the main Bristol to London line that runs through Keynsham at the extreme northern tip of our area, the one railway that formerly extended for some 4 miles through the Valley, the Bristol and North Somerset, was finally closed in 1968. Although every accessible bridge and other structure was examined – with the exception of Pensford Viaduct, access to which proved to be impracticable – there is little evidence that any distinctive flora has survived the 20 years of disuse. It may just be significant that the commonest plant overall was a fern, *Asplenium ruta-muraria*, which occurred on no less than 90% of those railway walls which supported any of the higher plants, and that one old bridge near Pensford still harbours one of the very few colonies of *Asplenium adiantum-nigrum* in the valley. (*Hedera* and *Taraxacum* came a poor joint second to Wall Rue). Railway walls, particularly those at stations, have long been known to botanists as a favourable habitat for ferns, presumably because of the damp micro-climate brought about by the frequent discharges of steam from locomotives in earlier times: once established, ferns tend to persist in such sites long after the demise of steam trains.

GARDEN WALLS

Some 66 stone garden walls were included in the survey. Only the outside faces of such walls were recorded, since it is unlikely that plants would have been deliberately introduced there. (In any case, as Clement (1984) has pointed out, it is far from easy to establish a plant on a wall). Even so, a high proportion of garden plants occurred on these walls, presumably self-seeded or dispersed from the adjacent gardens by birds. It is hardly surprising that *all* the occurrences of the following species were on walls backing on to gardens:-

Antirrhinum majus
Aquilegia vulgaris
Arabis caucasica
Aubrieta deltoidea
Campanula poscharskyana
Crataegus crus-galli
Euphorbia helioscopia
 [a common garden weed]
Hypericum calycinum
Juniperus communis
Kerria japonica
Linaria purpurea

Lonicera nitida
Lunaria annua
Lycium barbarum
Melissa officinalis
Nigella damascena
Papaver somniferum
Phytolacca capensis
Sedum spurium
Sempervivum tectorum
Soleirolia soleirolii
Solidago gigantea
Syringa vulgaris

On the other hand, only half the records of *Cheiranthus cheiri* and *Centranthus ruber* were from garden walls, while in the genus *Cotoneaster* 11 out of the total of 29 records were on walls well away from gardens, doubtless dispersed through the agency of birds feeding on their berries. Other species originally introduced into England as garden plants but which are increasingly becoming established outside gardens, and which occurred on non-garden walls in this survey, are *Buddleia davidii*, *Corydalis lutea*, *Leycesteria formosa* and *Meconopsis cambrica*.

DIVIDING AND RETAINING WALLS

A comparison was made between the floras of dividing and retaining walls. Retaining walls, being backed up by a deep mass of earth, tend to retain moisture and nutrients to a much greater extent than isolated dividing walls, and might therefore be expected to harbour a different association of plants.

The following species showed a significant preference one way or the other:-

Dividing Walls		Retaining Walls	
	chi ² value		chi ² value
<i>Poa pratensis</i>	25.34	<i>Senecio vulgaris</i>	6.05
<i>Dactylis glomerata</i>	20.90	<i>Poa compressa</i>	5.68
<i>Saxifraga tridactylites</i>	15.17	<i>Veronica arvensis</i>	5.46
<i>Cymbalaria muralis</i>	12.62	<i>Poa annua</i>	5.46
<i>Sedum acre</i>	12.06		
<i>Asplenium ceterach</i>	10.65		
<i>Galium aparine</i>	9.21		
<i>Bromus hordeaceus</i>	8.96		
<i>Cotoneaster horizontalis</i>	8.73		
<i>Sonchus asper</i>	8.28		
<i>Geranium lucidum</i>	8.15		
<i>Bromus sterilis</i>	7.91		
<i>Myosotis arvensis</i>	6.26		

However, it should be noted that some of the species showing a preference for retaining walls are markedly associated with river walls, which of course were all of this type.

TOPS AND SIDES OF WALLS

The more or less flat top of a wall clearly receives more light and rain than the vertical sides, and accumulates more debris which leads to the formation of rudimentary soils. Fruits and seeds dropped or evacuated by birds are much more likely to arrive on the top of a wall than on its sides. It seemed probable, therefore, that certain species would tend to be found on the exposed tops of walls, while shade-loving plants and those not primarily dispersed by birds would be more at home on their sides. To this end, separate records were kept of occurrences of species on tops and sides, and the following species were found to show a significant preference for one or the other habitat:-

TOPS		SIDES	
	chi ² value		chi ² value
W <i>Poa annua</i>	18.15	W <i>Alopecurus pratensis</i>	6.26
B W <i>Dactylis glomerata</i>	18.09	W <i>Veronica arvensis</i>	6.17
B <i>Cotoneaster horizontalis</i>	15.26	W <i>Cirsium arvense</i>	5.29
B <i>Plantago lanceolata</i>	14.93		
W <i>Bromus hordeaceus</i>	12.86		
W <i>Arrhenatherum elatius</i>	12.34	<i>Asplenium ceterach</i>	75.76
B <i>Crataegus monogyna</i>	12.33	<i>A. ruta-muraria</i>	68.64
B <i>Sambucus nigra</i>	12.29	<i>Hedera helix</i>	51.39
B <i>Galium aparine</i>	11.67	<i>Asplenium trichomanes</i>	50.38
B W <i>Taraxacum officinale</i> agg.	9.72	<i>Cymbalaria muralis</i>	29.27
W <i>Fraxinus excelsior</i>	8.68	<i>Asplenium scolopendrium</i>	20.74
W <i>Lolium perenne</i>	8.15	<i>Rubus fruticosus</i> agg.	15.85
B W <i>Senecio vulgaris</i>	7.44	<i>Umbilicus rupestris</i>	8.87
W <i>Poa pratensis</i>	6.85	<i>Urtica dioica</i>	8.64

B Known to be dispersed by birds

W Known to be dispersed by wind

(Cannon 1957, Ridley 1930, Salisbury 1961)

The high proportion of grasses preferring wall tops is notable, while ferns dominate the other side of the table (with very high χ^2 values).

ASPECT

Darlington (1981) draws attention to ways in which the aspect of a wall may affect plant life growing on it. Thus a south-facing wall is exposed to desiccation by direct insolation, while on a north wall water will remain longer because the sun's rays reach it only peripherally and temperatures are less extreme on a north wall, so plant life may often be more luxuriant.

Records were kept of the aspect of each of the walls in the survey, but it is disappointing to have to admit that very few marked preferences appeared to be shown, perhaps because of the relatively high rainfall in the area. However, on the basis of the χ^2 test *Dryopteris filix-mas*, *Asplenium trichomanes*, *A. scolopendrium* and *Angelica sylvestris* showed a significant preference for north-facing walls as against all other aspects, while *Sonchus oleraceus* very markedly disliked the north aspect.

ALTITUDE

Although the height above sea-level of each wall was noted, the results of the survey suggested that the overall range of only some 270 metres was insufficient to constitute a significant factor in determining the wall flora.

COMMENTS ON PARTICULAR PLANTS

Ivy (*Hedera helix*), which more or less covers a high proportion of walls in the area, often smothering other plants, was only recorded when it appeared to be established in crevices without making contact with the ground.

Brambles (*Rubus fruticosus* agg) are always difficult for the non-specialist to identify, and the difficulty is made worse when they are growing on walls, because such plants normally fail to produce flowers or fruit. The same problems arise with wild roses, which I have treated as *Rosa canina* agg.

Special attention was paid to grasses and ferns. *Poa compressa* is generally regarded as a typical grass of old walls, and *P. nemoralis* as a woodland species: indeed Segal (1969) says that *nemoralis* is hardly ever found on walls. Nevertheless, on Chew Valley walls *nemoralis* was almost twice as frequent as *compressa*, showing however some preference for the sides of walls (the more shaded position), while *compressa* evinced a marked preference for the tops. The surprising infrequency of *Poa annua* has already been commented on. *Poa subcoerulea* and *P. angustifolia* have both been recorded as typical wall species, the latter particularly in Eastern England, but neither was seen during the present survey.

Elymus caninus may seem a surprising colonist of walls, but each of the five walls on which it was noted adjoined either a wood or a shady hedgerow in which the grass was also growing. The seeds of *Melica* spp are dispersed by ants (Ridley 1930, Segal 1969), and this may explain the presence of *M. uniflora* on two walls.

It is difficult to account for the total absence of *Desmazeria rigida* from the Chew Valley walls, a grass described as common on limestone walls in Wiltshire (Grose 1957) and a wall-top plant as near to the survey area as Wells.

Asplenium adiantum-nigrum was relatively much scarcer in the Chew Valley than I had found it in Essex (Payne 1978), perhaps because it may be more partial to brick walls (Page 1988).

Polypody, unlike all the other ferns in the survey, seemed equally happy on the tops of walls as on their sides, although showing some preference for shaded sites. Because of the practical impossibility of separating in the field the three species (and three hybrids) into which this genus is now divided, I have treated all the wall Polypodies as *P. interjectum*, which is by far the most abundant of the segregates in this area.

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