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# The Hieracium flora of chalk and limestone quarries in England

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### ABSTRACT

22 species of *Hieracium* were identified from chalk and limestone quarries in 23 vice-counties in England during 1974–1976. Species thought to be introduced into Britain accounted for half of all the records and for five of the seven new vice-county records. This survey doubles the number of individual records of *Hieracium* from chalk and limestone quarries published in county Floras since 1948 or held on record cards at the Biological Records Centre at Monks Wood. The number of *Hieracium* species recorded in these habitats is increased by 50%. The importance of quarries for the establishment and spread of *Hieracium* species is discussed.

#### INTRODUCTION

An ecological survey of chalk and limestone quarries in England was made during 1974–1976. The purpose was to record the distribution of species in such habitats and to examine the geographical and historical factors that are important in determining colonization. Chalk or limestone quarries occur in every English administrative county except four—Cheshire, Greater Manchester, Merseyside and West Midlands. The selection of sites was based partly on lists of quarries which were thought to be of some biological interest by the Nature Conservancy Council, county naturalists' trusts and others; and partly on lists of quarries produced by the Ministry of Housing and Local Government during the 1950s for a series of Regional Limestone Conferences. Random samples were taken from the Conference lists roughly in proportion to the numbers of quarries in each county. Over 200 quarries were visited altogether but some of these were in operation and highly disturbed and others had been completely filled in.

*Hieracium* species are frequent and sometimes abundant constituents of the flora of quarries, but they present great difficulties in identification and are therefore frequently omitted in surveys. As with all critical or unpopular groups, records tend to reflect the activities of experts or, as in this case, collections submitted to an expert. The *Hieracium* records from this survey (excluding *H. pilosella*) are presented here as a contribution to the ecology of this genus. Other data from the survey will be published separately.

#### RESULTS

About 150 specimens were collected from 59 quarries in 23 vice-counties. Table 1 lists 22 species in taxonomic order within Sections and gives their distributions (nomenclature follows Perring & Sell (1968)). Seven new vice-county records and 40 new 10 km square records are indicated against the appropriate vice-county number or quarry. Several specimens could not be named with certainty beyond the Section to which they belonged, either because they were not fully in flower or were collected outside the main flowering period for the Section. The features needed for distinguishing species are often not fully developed under these circumstances, e.g. number of cauline leaves, types of hairs on leaves and bracts, colour of style. Eight such specimens which were clearly additional to the named species from individual quarries are listed at the end of the table to encourage further study at these sites.

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## TABLE 1. HIERACIUM SPECIES FROM CHALK AND LIMESTONE QUARRIES IN ENGLAND

Section Species	National Status	Vic	e-county	Quarry Geological horizon and grid reference				
Cerinthoidea	ump more	-ymm	mis mino i	o wron numberalls and				
ampliatum	Endemic	64	Mid-W. Yorks.	Salt Lake B 34/77.78.				
Oreadea								
caledonicum	Endemic	57	Derbys.	Ricklow B 43/16.66.				
Vulgata								
exotericum s.str.	Introduced	16	W. Kent	Borough Green R 51/60.56.				
exotericum agg.	Introduced	17	Surrey	Betchworth C 51/20.51.				
		57	Derbys.	Rutland B 43/16.56.				
grandidens	Introduced	*20	Herts.	Redbournbury C 52/12.10.†				
U		66	Durham	Wingate P 45/37.37.†				
sublepistoides	Introduced	*6	N. Somerset	Tedbury Covert B 31/74.48.†				
to chantly and an internation		16	W. Kent	Borough Green R 51/60.56.				
		17	Surrey	Betchworth C 51/20.51.				
			~~~~	Brockham C 51/19 51				
		*66	Durham	Bishop Middleham P 45/33.32.†				
nellucidum	Native	57	Derhys	Hopton Wood B 43/26 55				
stenstroemii	Native	33	E Gloucs	Coopers Hill I 32/88 14				
stenstroemu	Induire	36	Hereford	Rudge End S 32/58 35				
aumhifalium	Endemic	57	Derbys	Millers Dale B 43/13 73				
cymoljonum	Endemic	61	Mid W. Vorks	Salt Lake B 34/77 78				
crebridentijorme	Nativo	64	Mid W. Vorks.	Salt Lake D $34/77.79$				
maculosum	Induve	04	NIG-W. TOIKS.	Salt Lake D $54/77.70$ .				
maculatum	Introduced	0	IN. Somerset	Shiphory Hill D 21/45 56				
				Snipnam Hill B $31/43.56$ .				
				Tedbury Covert B 31//4.48.				
			C IIII	Windsor Hill B 31/61.45.7				
		8	S. Wilts.	Whitesheet C 31/93.23†				
		16	W. Kent	Wouldham C 51/71.63.†				
		17	Surrey	Betchworth C 51/20.51.				
		ensteri	some biological	Brockham C 51/19.51.				
vitainible ada and headh	mer minnen h	55b	Rutland	Ketton J 43/97.05.				
diaphanum	Introduced	6	N. Somerset	Shipham Hill B 31/45.56.†				
strumosum	Introduced	16	W. Kent	Cliffe C 51/72.75.†				
		23	Oxon.	Ardley J 42/53.27.				
		38	Warks.	Cross Hands J 42/26.29.†				
				Harbury J 42/38.58.†				
				Stockton J 42/44.64.				
		54	N. Lincs.	Ferriby Cliffe C 54/00.21.†				
				Maws J 44/94.01.†				
				South Ferriby C 44/99.21. <sup>†</sup>				
		55b	Rutland	Clipsham J 43/98.15.†				
				Ketton J 43/97.05.				
		56	Notts.	Aldgate Street P 43/53.45.†				
		57	Derbys.	Coalhill B 43/28.55.				
				Dene B 43/28.56				
				Honton Wood B 43/26 55				
				Millers Dale B 43/13 73				
				Bicklow B 43/16.66				
				Ricklow B +3/10.00.				
		50	C Lana	Rutially $D = \frac{43}{10.30}$				
		59	S. Lancs.	$C_{ross}$ Hills D $\frac{34}{74}$ 42				
		-	C 117 17 1	Cross Hills B $34/14.43$ .				
		63	S.W. YORKS.	Kiveton P 43/50.82.7				
		64	Mid-W. Yorks.	Burton Leonard P 44/32.63.†				
				Jackdaw Crag P 44/46.41.†				
		14 1100	not really develop	Skipton Rock B 44/00.52.				
		65	N.W. Yorks.	Harmby B 44/12.90.†				
isted at the end of the	diametes acc.	*70	Cumberland	Clints B 35/00.12.†				
cheriense	Introduced	*32	Northants.	Ben Johnsons J 53/12.02. <sup>+</sup>				
				Construction of the second s				

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continued

Section Species	National Status	Vic	e-county	Quarry Geological horizon and grid referen				
subamplifolium	n Endemic	6	N. Somerset	Shipham Hill B 31/45.56.†				
1.9		34	W. Gloucs.	Stenders B 32/65.18				
lenidulum	? Native	16	W. Kent	Offham $B = 51/65.57 \pm$				
i op i unitititit		18	S. Essex	Gravs Thurrock C 51/60 78 *				
		10	D. Loben	Warren C 51/59 79 †				
		*551	Rutland	Clipsham I 43/98 15 t				
ruhiginosum	Native	*54	N Lincs	Clangate Pits I 44/96 10 +				
nulaatum	Native	54	N Lincs	Clapgate Pits J $41/96.10$				
ouiguium	rative	54	I. Lines.	Eerriby Cliffe C 54/00.21				
				Maws I $A4/94.01$				
		57	Derbys	Hartington Station B 43/15.61				
		51	Derbys.	Hopton Wood B 43/26.55				
				Millers Dolo $P \frac{43}{12.72}$				
		50	C Lance	Pollmon Pork P 24/75 42				
		59	S. Lancs.	Costle Hill D $14/51 10 \div$				
		60	Mid W/ Vorks	Durton Loopard D 44/22 62 +				
		04	NIW Varla	Burton Leonard $\mathbf{P} = 44/32.63.7$				
		63	IN.W. IOIKS.	Harmoy B 44/12.90.7				
			D 1	Hulands B 45/01.13.				
		66	Durnam	Bishop Middleham P 45/33.32.				
				Chestergarth B 35/94.41.				
				Fulwell P 45/38.60.†				
				Running Waters P 45/33.40.				
				Trimdon Grange P 45/36.35.				
				Wingate P 45/37.37.				
		69	N. Lancs.	Plumpton B 34/31.78.				
Fridentata	131941							
calcaricola	Endemic	56	Notts.	Aldgate Street P 43/53.45.†				
Sabauda			12 - 1					
vagum	Native	38	Warks.	Stockton J 42/44.64.†				
		56	Notts.	Aldgate Street P 43/53.45.†				
		63	S.W. Yorks.	Kiveton P 43/50.82.†				
				Lindrick P 43/55.82.†				
		66	Durham	Bishop Middleham P 45/33.32.				
				Fulwell P 45/38.60.†				
				Garmondsway P 45/33.33.				
				Wingate P 45/37.37.				
		70	Cumberland	Clints B 35/00.12.†				
perpropinquum	Native	57	Derbys.	Rutland B 43/16.56.†				
		66	Durham	Trimdon Grange P 45/36.35.†				
				Wingate P 45/37.37.†				
	Additional	specimo	ens identified only	to Section				
Drenden		57	Derbys	Honton Wood B 43/26.55				
Vulgata		64	Mid-W. Yorke	Threshfield B 34/97 64				
Tridentata		23	Oxon	Enstone I 42/38 25				
		556	Rutland	Clinsham I 43/98 15				
Sahauda		32	Northants	Ben Johnsons I 53/12.02				
Juounnu		36	Hereford	Rudge End S 32/58 35				
		57	Derbys	Millers Dale B 43/13 73				
		61	Mid-W Vorke	Jackdaw Crag P 44/46 41				
		04	WING-W. I OIKS.	Jackuaw Clag r 44/40.41.				

\* = new vice-county records  $\dagger$  = new 10 km square records S = Silurian, B = Carboniferous, P = Permian, J = Jurassic, C = Chalk, R = Kentish Rag

Fig. 1 shows the distribution of 10 km squares visited and the numbers of Hieracium species recorded in each square. Derbyshire was particularly productive but other noteworthy areas were the Mendips, the North Downs and the magnesian limestone quarries of Durham. No records were obtained from the South Downs, Dorset or East Anglia. However, most quarries



FIGURE 1. Number of Hieracium species recorded in the 10km squares visited. Dots represent nil records.

were visited only once, between the beginning of June and the end of August, so some records will have been missed particularly of early flowering species, such as *H. exotericum* and *H. sublepistoides*, and late season species like *H. vagum*. (*H. perpropinquum* is also a late species but is associated more with sandy habitats).

The two commonest species were *H. strumosum*, recorded in 25 quarries and 12 vice-counties, and *H. vulgatum* in 19 quarries and 9 vice-counties. These were followed by *H. vagum* in nine (possibly 12) quarries and *H. maculatum* in nine quarries. There were six endemic species (see Table 1), six or seven other native species and nine or ten introduced species (*H. exotericum* sensu stricto is a distinct species from that so far identifiable only as *H. exotericum* agg.).

Large colonies of *Hieracium* species were often associated with spoil mounds or areas of stone scree produced by waste material tipped down hillsides. Such colonies were especially well developed at the Hopton Wood, Millers Dale, East Buxton and Rutland quarries in Derbys., Shipham Hill in N. Somerset, Betchworth in Surrey, Redbournbury in Herts., Stockton in Warks., Maws and South Ferriby in N. Lincs. and Clints in Cumberland. Quadrat samples were

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taken from some of these sites and from several other quarries where *Hieracium* species were locally frequent (Table 2). Where two or three species of *Hieracium* were present in the sample area which could have been confused within the quadrat itself (e.g. at the rosette stage) they are bracketed together. Following the initial ten species of *Hieracium* in the table are 31 species arranged by relative frequency in the 14 quadrat samples and headed by *H. pilosella*. Species occurring in only one or two samples are omitted. For each quarry site, the last date of working is given so far as this can be determined. In most cases the dates refer to the closure of the quarry and the particular areas sampled could have been undisturbed for a decade or so before then. The oldest sites were at Stenders, Betchworth and Hopton Wood.

# TABLE 2. QUADRAT RECORDS FROM 14 QUARRIES IN WHICH DENSE COLONIES OF

HIERACIUM SPECIES OCCURRED

Rooting frequencies (1-9) within 1 sq.m. quadrats

						Quarry								
270* 100 1918	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hieracium exotericum agg.					+ )	+ ]						-		
H. grandidens									8	9				
H. lepidulum					6						5	9		
H. maculatum					10 · [	0							9	
H. pellucidum				+ ]		. [								
H. strumosum	9	9	+1	+	+ )	10.00								
H. subamplifolium					as has									9
H. sublepistoides			19		1000	+ ]								
H. vagum								ind:	1					
H. vulgatum			+ ]	+ ]			7	7						
Hieracium pilosella		9	9		9	9	9	3	6		9	4	4	9
Leontodon hispidus	8	4		9	7	6	8	9	3				9	9
Festuca rubra	4	9		9	5	1	9	9	5	8				1
Lotus corniculatus		2			4		9	9	9	9		7	9	9
Linum catharticum		2	9		9	4	9	9		3	3			9
Medicago lupulina		2	8			7	1			3		1	2	4
Tussilago farfara	3	1				2	1	2		9		8	2	
Dactylis glomerata		2		2	4			4		5		1	3	1
Taraxacum officinale agg.	1	1		4	ion marked	1	2					2	1	. 1
Fragaria vesca				4		1 1 1					9	9	2	2
Briza media						9	1	1	9				3	2
Trisetum flavescens				9	1	1					1	2	2	
Prunella vulgaris				1			3				5	3	1	2
Euphrasia officinalis agg.					2	1	2	7				5		
Chrysanthemum leucanthemum	2	4			3	3					2			
Plantago lanceolata							3	7	1			1	1	
Erigeron acer					1	4	1					5		1
Hypericum perforatum						4				4	9	2		
Carlina vulgaris			8		4	1	5							
Gentianella amarella					9		5	2						1
Daucus carota	5					2					2		1	
Senecio jacobaea		1				3						2	2	
Arrhenatherum elatius		2	3							1			1	
Crataegus monogyna						2	1				2			2
Thymus drucei		4					9	9						
Clinopodium vulgare						8				4		9		
Carex flacca				3					2					9
Scabiosa columbaria							1	8	5					
Chamaenerion angustifolium				6								5	1	
Pastinaca sativa	2		3				12 1			3				
Holcus lanatus				5							1	1		
Additional species	4	1	2	6	1	10	1	11	3	2	5	13	2	6

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	the second se							
Quarry and sample date	Habitat	Slope	Aspect	% Cover	Age			
1. Stockton, Warks., 10.7.75	Spoil mound	30°	270°	40	1956			
2. Clints, Cumberland, 19.7.75	Spoil mound	25°	310°	40	1956			
3. Maws, N. Lincs., 14.7.75	Spoil mound		Level	45	1934			
4. Hopton Wood, Derbys., 21.6.76	Scree	35°	320°	60	1920			
5. Rutland, Derbys., 24.7.74	Floor		Level	50	1949			
6. Betchworth, Surrey, 13.6.76	Spoil mound	36°	240°	80	1900-20			
7. Bellman Park, S. Lancs., 17.7.75	Stone mound		Level	99	1959			
8. Running Waters, Durham, 13.8.75	Spoil mound		Level	100	1950			
9. Wingate, Durham, 29.6.76	Terrace		Level	90	?1931			
10. Redbournbury, Herts., 3.7.75	Talus	31°	260°	40	1965			
11. Offham, W. Kent, 14.6.74	Spoil mound	20°	110°	80	1936			
12. Clipsham, Rutland, 11.6.76	Spoil mound	5°	11	80	1941			
13. Windsor Hill, N. Somerset, 6.7.76	Floor	5°		90	?1944			
14. Stenders, W. Gloucs., 10.6.75	Spoil mound	30°	270°	100	1918			

### TABLE 2 continued.

#### DISCUSSION

For the sake of comparison, all records of *Hieracium* species stated to come from quarries were extracted from English county Floras and supplements published since 1948, and from all the record cards in the Biological Records Centre. 13 out of 20 Floras made some reference under Hieracium to quarries, though the mineral was not usually specified, whilst 58 record cards specified quarry habitats which could be ascribed with some confidence to chalk or limestone. Together these referred to 22 *Hieracium* species of which only 11 were the same as in my survey. Again, H. strumosum was the most widespread species with records in 14 vice-counties, followed by H. maculatum and H. diaphanum in nine vice-counties and H. vulgatum in eight vice-counties. The remaining species were H. anglicum, H. angustisquamum, H. brigantum, H. calcaricola, H. diaphanoides, H. exotericum, H. hypochoeroides, H. lasiophyllum, H. leyanum, H. pellucidum, H. perpropinguum, H. rubiginosum, H. salticola, H. stenstroemii, H. subamplifolium, H. subbritannicum, H. trichocaulon and H. umbellatum. These were all confined to one or two vice-counties apart from H. perpropinguum, which occurred in five, and H. salticola, which occurred in three. In contrast to my survey, H. vagum was not recorded in guarries at all. There are doubtless many other known Hieracium records for quarries which have not been formally listed or are included under 'waste places'.

With the taxonomic difficulties mentioned earlier it is not surprising that *Hieracium* species have not been fully mapped. New vice-county records among the introduced species were mainly modest infillings or extensions of range: for example, *H. grandidens* in Herts., *H. strumosum* in Cumberland and *H. cheriense* in Northants. All the localities for *H. lepidulum* were new 10 km records, which supports the view that this is an introduced species which is spreading in artificial habitats. The largest jump in distribution is shown by *H. sublepistoides*. The nearest previous records to the Durham locality were from northern Derbys. (Perring & Sell 1968) and West Lancs. (G. Halliday pers. comm. 1977).

The endemic species were mostly confined to old quarries or parts of quarries that had not been worked for 50 years or more: Salt Lake (with *H. ampliatum* and *H. crebridentiforme*) was worked up till 1899, Ricklow (*H. caledonicum*) until 1905, Millers Dale (*H. cymbifolium*) between 1878 and 1930 and Stenders (*H. subamplifolium*) until 1918. These four quarries were also all located in upland areas (230–300m) of semi-natural calcareous grassland and woodland where these species occurred naturally. *H. calcaricola* was found in a small, recently worked and stillused quarry (Aldgate Street) on the outskirts of Nottingham and must surely have been introduced there. The other record of *H. subamplifolium* was from a quarry near Cheddar worked from the late 19th century to 1969. There is one other record for the whole of Somerset, made in 1965 by P. D. Sell; this is also from a disused limestone quarry on the Lias about 27 km away so both may be introductions from W. Gloucs, or South Wales.

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Of the other native species, *H. pellucidum*, *H. stenstroemii* and *H. maculosum* could have colonized the quarries in which they were found from nearby natural habitats where they are known to occur. *H. rubiginosum*, on the other hand, was found a long way from other known sites but the grassy spoil banks of Clapgate Pits near Scunthorpe are very old and it is more likely that the species has persisted there for a long time than that it has been introduced. *H. vulgatum* and *H. vagum* are both common native species that have colonized habitats such as roadsides and railway banks.

There are over 250 species of *Hieracium* in Britain, many of which have a markedly northern or upland distribution. The genus as a whole is commonly associated with cliffs or ungrazed rocky areas. The species dealt with in this paper represent less than 10% of this flora and consist mainly of those with a southerly distribution and a marked affinity for base-rich habitats. Most of the species in Table 2 are clearly pioneer colonists of spoil mounds, rock ledges and stony ground such as are found in quarries. The conditions of low nutrient status, pronounced water deficit and high insolation which prevail here prevent many ruderal species from becoming established at all and reduce the vigour and thus the competition of aggressive species (Grime 1973). Railway banks, which feature commonly in county Floras as habitats for Hieracium, provide similar habitats. The railways date mainly from the early or mid-19th century and have therefore had longer to become colonized than most quarries. They also offer easy means of dispersal. However, the growth of the quarrying industry during this century has provided new sites for ruderal species all over the country (Davis 1976), whilst the increasing movement of vehicles and materials into and out of quarries must materially assist the dispersal of species. The active spread of several species of *Hieracium* which is therefore probably taking place is worth documenting.

### ACKNOWLEDGMENTS

I am most grateful to P. D. Sell for identifying all the *Hieracium* material for me. I should also like to thank F. H. Perring and T. C. E. Wells for their helpful comments on drafts of this paper.

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(Accepted January 1977)