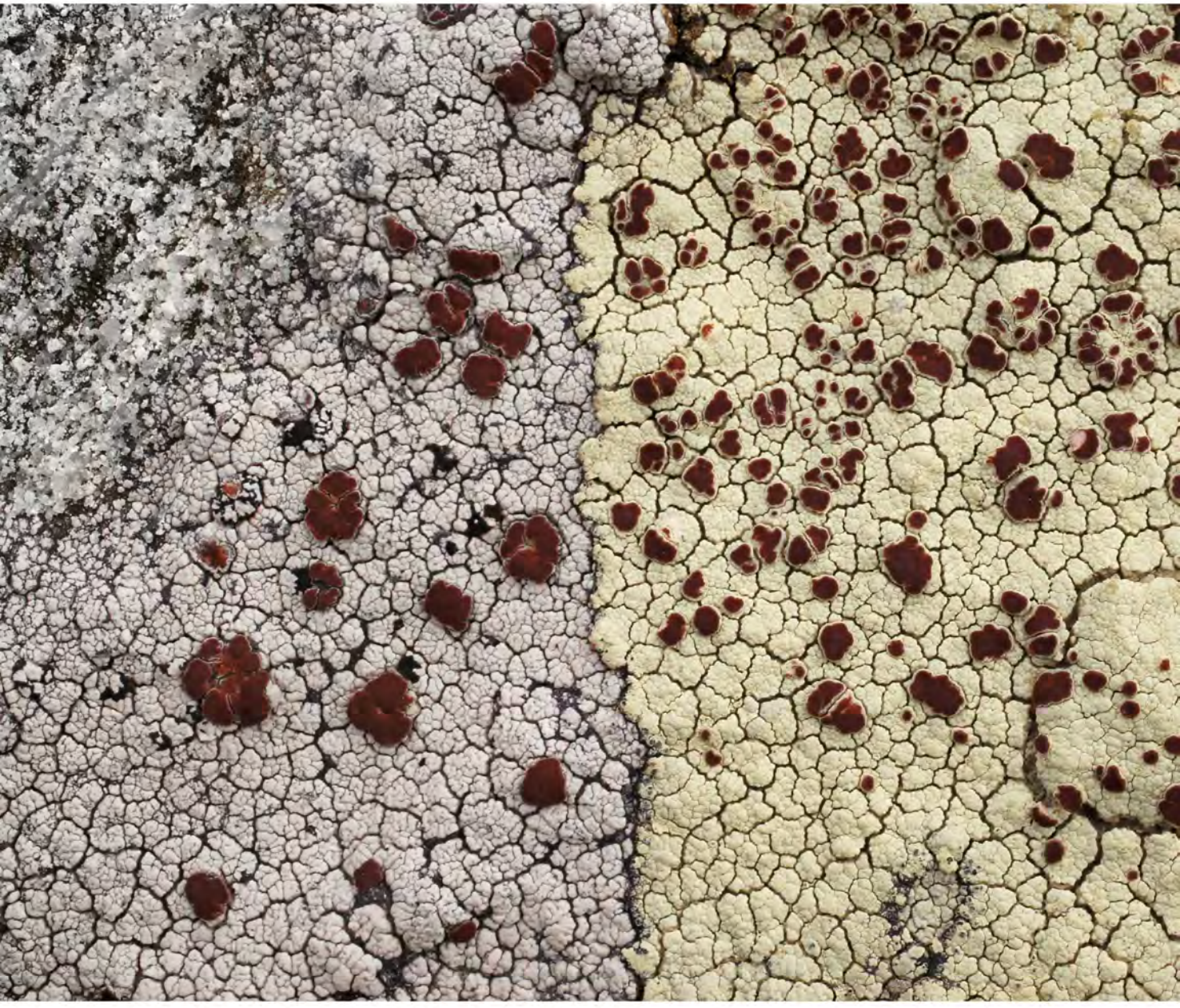
British Lichen Society

Bulletin



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The lichens of the Rollright Stones

Introduction

The Rollright Stones are located on the top of a ridge in the Cotswolds on the Oxfordshire – Warwickshire border about 9 kilometres from Chipping Norton. The OS reference is: SP295309.

The Rollright Stones consist of three groupings of stones: The King's Men, an assemblage of about 77 stones, the Whispering Knights, an assemblage of five stones, and the King Stone, a solitary upright stone with a small circle of several flat stones nearby. The King's Men and the Whispering Knights are in Oxfordshire. The King Stone is in Warwickshire, about 50m across an unclassified road from the main entrance to the Rollright Stones. The main circle of stones, known as the King's Men, is about 33m in diameter. The Whispering Knights is located about 300m in an easterly direction from The King's Men.

The oldest grouping, the Whispering Knights, is thought to be a dolmen or burial chamber about 5000 years of age, pre-dating Stonehenge. Our work is the first study of the lichens of this group of stones. The King's Men date to between 4000 and 4500 years before the present and are considered to be contemporaneous with Stonehenge. The King Stone is the youngest of the Rollright Stones dating to about the middle of the Bronze Age or approximately 3500 years before the present.

The Rollright Stones have been owned and managed by the Rollright Trust since 1998. The most complete and up to date histories of the Rollright Stones are by Lambrick (1988) and Lambrick (2013). Earlier histories explained various theories about their origin, frequently comparing this assemblage of stones to those at Stonehenge (Ravenhill 1932).

The Rollright Stones geology

The stones of the Rollright Stones are about 165 million years old and originate from the Middle Jurassic Period. Geologists consider them to be of a hard siliceous variety of stone from the Great Oolite Group of the Chipping Norton Limestone Formation (Oxford Geology Trust 2007). Viles *et al.* (2011) studied the effects of weathering on the Rollright Stones. They found that rainwater as well as soil moisture, particularly

at the base of the stones, has helped to deteriorate the limestone. The impact of lichen acids, in combination with a multitude of pits in the stone that collect rainwater, may be a factor in the deterioration of some of the stones. However Viles *et al.* (2011) state that at least one species of lichen, *Verrucaria nigrescens*, may have a protective effect on the underlying substrate. This species has been identified on 61 of the stones by Winchester (1988). The stones were not quarried but are thought to have been exposed several hundred metres down the hill from their present location. At some point in history the people who created The Rollright Stones managed to transport them uphill to their present site.

History of lichen studies of the Rollright Stones

The first known study of lichens on The Rollright Stones was during a field meeting by the British Lichen Society. This was held in October 1970. Unfortunately no publications arose out of this field meeting and there are no surviving field notes by any of the participants from this day trip. (Price *pers. comm*., 2013 and Coppins *pers. comm*., 2013).

The most recently published lichen flora of Oxfordshire (Bowen 1980) does not include any information about the lichens of the Rollright Stones. There are no known records of lichens on the King Stone in any of the lichen literature from Warwickshire.

Winchester (1986) presented a talk on her studies in lichenometry at a joint meeting of the British Lichen Society and the Linnean Society. She discussed her findings of dating stone monuments by measuring growth patterns in lichens on the stone monuments at the Rollright Stones and another stone circle at Castlerigg in Cumbria. Winchester (1988) used a variety of sophisticated techniques to study the movement of various stones at the Rollright Stones. As part of her studies she measured growth rates of lichens and did a species count. She identified 58 species of lichens in her study. Among her findings is that at least one thallus of *Aspicilia calcarea* may be over 800 years of age. She also found that the stones have been moved over time, erected, fallen and re-erected on numerous occasions. No doubt this human intervention has impacted on the growth and presence of lichens on individual stones. Similar findings have been found at Stonehenge and many other stone circles found throughout Great Britain as elsewhere in the world.

The last detailed survey of lichens on the Rollright Stones appears to have been carried out by Winchester *et al.* (2000). They made a separate list of lichens for each of their 78 recorded stones of the King's Men stone circle. They found 59 taxa in total. Gilbert (2000) made a general survey of the lichens of the Rollright Stones and noted there were over 50 lichens.

Viles & Zhang (2013) studied weathering on the Rollright Stones. They concluded that 3 – 10 cm of rock material on various stones has eroded in the last 4000 – 5000 years due to the action of rainwater and moisture coming from the surrounding soil. The impact of rock deterioration and water on lichen growth over this period of time may be a contributory factor to the lichen biota.

Our survey

The current survey aimed to update the taxonomy of the species present at Rollright, check previous identifications and to include the King Stone and the Whispering Knights which appear to have no previous lichen records. We have recorded 75 taxa in 34 genera on the Rollright Stones. The most common genera are *Caloplaca* with 13 species, *Lecanora* with 6 species and *Verrucaria* with 10 species. Some records from the former survey have been reinterpreted and additional interesting lichens have been added for the site.

Much progress has been made with the taxonomic understanding of British lichens in the last decade but there is still a long way to go (including with the *Verrucariaceae* which are richly represented at Rollright). The lichens that are most difficult to identify in the field also tend to be those that are most difficult to collect without damaging the stones. Hence our findings presented here are a refinement of the good work done previously but cannot be considered to be the final and complete list of what is present. Collection and analytical techniques continue to be refined and improved and further surveys in future decades will undoubtedly reveal more. The stones are popularly supposed to be uncountable and the cryptic crusts that grow upon them will also be a challenge to any lichenologist who wishes to compile a complete inventory of what is present.

Conservation evaluation

One purpose of this study was to determine if any notable species are present. The Conservation Evaluation Table of Woods & Coppins (2012) has been used to assess the lichen taxa recorded by us at The Rollright Stones. The Red List Categories of the IUCN (International Union for the Conservation of Nature) give an indication of the threat status of each species. All of the lichen species recorded by us at Rollright have a threat category of "LC" (Least Concern) except for *Lecanora horiza*, which is currently listed as "NT" (Near Threatened) and *Verrucaria squamulosa* which is currently Not Evaluated. However *L. horiza* has been much overlooked by British lichenologists and its status will almost certainly be downgraded with the next review of British lichens. A further category relevant to conservation evaluation is the recognition of species with a restricted distribution, providing an indication of rarity based on the post-1960 records held by the British Lichen Society Mapping Scheme Database.

Verrucaria squamulosa is Nationally Rare (occurring in fewer than 16 British hectads) though its true abundance is not yet known. Eight of the lichen species recorded by us at Rollright are listed by Woods & Coppins (2012) as Nationally Scarce (NS) meaning that they have been recorded from 16 to 100 British hectads. Seven of these eight species (*Aspicilia contorta* subsp. *hoffmaniana*, *Bacidia fuscoviridis*, *Caloplaca dichroa*, *Lecania inundata*, *Lecanora horiza*, *Opegrapha rupestris* and *Verrucaria calciseda*) are actually common and widespread species; their designation as NS results from under-recording. This leaves *Caloplaca ochracea* that Fletcher & Laundon (2009) describe as "scarce."

Almost all of the lichen species recorded on The Rollright Stones might be expected to turn up during detailed surveys of churchyards in Warwickshire and Oxfordshire. There are two interesting exceptions; *Caloplaca ochracea* and *Clauzadea immersa* are very rarely recorded in churchyards in the region. The abundance of *Acrocordia conoidea* and *Thelidium papulare* is also very unusual for this region. The last mentioned four species constitute a particularly distinctive element of the lichen communities on the Rollright Stones and the first pair of species appears to be restricted to the King's Men.

The numbering of the stones

During the course of the fieldwork it became obvious that the numbering of the stones of the King's Men used by Winchester *et al*. (2000) was different from the numbering of the plan based on the "1920 official survey." During our survey we only had the 1920 plan to hand but subsequent reference to the plan in Winchester *et al*. (2000) allowed us to resolve this double numbering issue. When we refer to individual stones we use a "W" to indicate the numbering used by Winchester *et al.* and an "S" to indicate the numbering used in the 1920 plan.

There appears to be no previous recognized numbering of the Whispering Knights and we have assigned our own numbering of the five large stones starting with the easternmost of the tall stones and working clockwise around the cluster ending with the low stone at the north-east.

The King's Men

The stones of the King's Men have somewhat richer lichen communities than those of the King Stone and the Whispering Knights. The reasons for the relative richness of the King's Men could perhaps be speculated on by investigating the history of disturbance to the stones and of adjacent land management. Two of the more interesting species at Rollright, viz. *Clauzadea immersa* (on two stones) and the nationally scarce *Caloplaca ochracea* (on three stones), are restricted to the King's Men. The latter species was recorded by Winchester *et al.* (2000) as *Caloplaca dalmatica* but is proved to be *Caloplaca ochracea* on account of its distinctive thick-walled, four-celled spores. In recent years frugal collection methods have been developed (using razor blades rather than chisels) and, with permission of the Rollright Trust, the collection of tiny specimens has allowed us to perform microscopic examination resulting in more reliable identification of critical species. Our determinations broadly agree with those of Winchester *et al.* (2000) and confirm that the community on the King's Men is dominated by *Acrocordia conoidea*, *Aspicilia calcarea*, *Caloplaca aurantia*, *C. flavescens*, *Lecanora albescens*, *Solenopsora candicans* and *Verrucaria nigrescens*. The 2000 survey recorded *Caloplaca flavovirescens* from five stones and *Protoblastenia incrustans* from seven stones. Both are conspicuous species but, despite searching for them, the current survey failed to find any trace of either. We suspect that this may be a case of mistaken identity and cast a slight shadow of doubt upon these records. The stones from which

Protoblastenia incrustans was recorded in 2000 have strong colonies of *Protoblastenia rupestris* and we think that it is only the latter which is present at Rollright.

Until recently, those members of the *Verrucariaceae* which redeposit calcite to create a thick white, marble-like thallus tended to be recorded as *Verrucaria baldensis* on sight. Recent work has shown that in lowland England much of such material is actually *V. calciseda* and that *V. baldensis* is relatively uncommon. Although somewhat similar, these two species are readily separated on morphological and anatomical characters and we find that *V. calciseda* is by far the more frequent species of this pair on the King's Men. Only *V. baldensis* was recorded in the previous survey and this name was probably applied to both species.

Winchester *et al.* (2000) list *Porina linearis* (on two stones) and *Thelidium decipiens* (on three stones) while the current survey failed to find them (though the former was rediscovered during a visit by the Churchyard Group of the BLS in 2014.)

An interesting species which is rather frequent on the King's Men and which was not recorded by the 2000 survey is *Thelidium papulare* (its large prominent perithecia may have been previously passed over as *Acrocordia conoidea* which is even more common on the stones). For discussion of more subtle discrepancies between the two surveys see our Taxonomic Notes below.

The King Stone and other stones in the vicinity

The King Stone has a similar suite of dominant species as that found on the King's Men (*Acrocordia conoidea*, *Aspicilia calcarea*, *Caloplaca aurantia*, *C. flavescens*, *Lecanora albescens*, *Solenopsora candicans* and *Verrucaria nigrescens*). Although it is difficult to compare this single stone with the numerous stones of the King's Men, the impression is of a slightly poorer community on the King Stone. This is not to dismiss its importance, just interesting to note that certain species such as *Caloplaca ochracea* and *Clauzadea immersa* appear to be absent.

The large sheet of white lichen growth near the base of the south side is not a single ancient thallus as is the case with the "largest lichen" on one of the King's Men (stone 56 S). The former comprises numerous thalli

of *Lecanora albescens* while the latter is a single individual of *Aspicilia calcarea*. The top of the King Stone has a large colony of *Lecania erysibe* which is present in only small quantity on a few of the King's Men.

A metal fence surrounds the King Stone and just outside the north side of this fence are a few flattish stones, not quite as flat as paving slabs, but much trodden upon. Although these stones appear to be worn down to bare rock, they actually have a complete and distinct community forming a closed mosaic of pale, thin or immersed thalli. The abundance of *Thelidium incavatum* and *Sarcogyne regularis* are a feature of these well-worn stones.

Some ten metres north of the King Stone is a small circle of modest sized stones which appears to be used for sitting on around a camp fire. These have a distinctly different community to those on the named stones at Rollright. This community appears to be dominated by colonists and the list of species would not be out of place on calcareous paving and garden walls.

The Whispering Knights

The community on these stones is rather similar to that on the King Stone having a similar range of dominants to those on the King's Men but without certain notables such as *Caloplaca ochracea* and *Clauzadea immersa*. Of particular interest here is the presence of *Dermatocarpon miniatum* on stones 1 and 3, and a colony of *Ramalina* cf. *lacera* on stone 2. Stone 3 is one of the tall stones leaning in towards the centre in a conspiratorial manner. Water seeps down the underhanging side, a somewhat unusual occurrence caused by the topography of the apex. The upper portion of this rain track supports a large colony of *Xanthoria candelaria*, its only station at Rollright. The rest of the rain track shows an interesting succession through colonies of *Candelariella medians*, *Physcia adscendens* and *Diploicia canescens*. On stone 4, one of the lower stones, a shady crevice contains a colony of a species of *Verrucaria* with a green, squamulose thallus. At the time of the survey we had no option than to consider this to be a form of *V. viridula* which is the way that British lichenologists had treated such material. Orange (2013) has reported *V. squamulosa* as new to the British Isles and we now consider this to be the identity of the colony on stone 4. A whole day could be spent studying the complex ecology of this cluster of five giant stones.

Comparison with Stonehenge lichens

The Rollright Stones are located 145 kilometres from Stonehenge in Wiltshire. Although roughly of comparable age, created between 4000 and 4500 years ago, one part of the Rollright Stones predates Stonehenge. The Whispering Knights, considered to be a burial chamber consisting of four upright stones and one horizontal stone, was created about 5,000 years ago.

Although geologists describe the rock type of The Rollright Stones as a 'siliceous limestone', the lichen community on all of the stones is as if they were located on a pure, highly calcareous limestone. Stonehenge is composed of sarsen sandstone from Wiltshire as well as the famous bluestones from the Preseli Hills in Wales that are dolerite and rhyolite rocks of volcanic origin.

The most recent lichen survey of Stonehenge, dating from 2013 (Coppins *pers. comm.*, 2013 and as annotated on the NBN database from 7 December 2013), lists 108 species of lichens. Prior studies, done between 1973 and 2004 listed between 50 and 100 species. The Highways Agency (2005) did a three-year study of the lichens of Stonehenge. They concluded that there have been some species increasing in numbers and some decreasing in numbers. The results were inconclusive as to the cause though environmental factors and human influence were part of their study.

In the last forty years the number of species identified at Stonehenge has increased by about 25%. During our study the number of species has also increased from previous studies by about 25%. We can speculate that taxonomic splits and increasing competence and greater survey effort will have been factors in this increase in species numbers.

Stonehenge supports some lichens typical of a maritime environment. It has been speculated that the 'maritime' lichens on Stonehenge and other sarsens might have originated by long distance travel of sea spray but we are not sure that this theory has been accepted. It might be that the hard acidic sarsen stone happens to be conducive to the 'maritime' lichens.

The Rollright Stones do not have any maritime element. The number of species common to both sites is fourteen. These are mainly generalist species associated with nutrient-enriched microhabitats. It is interesting to make some comparison with Stonehenge but the communities are completely different (calcareous limestone vs. hard acidic sandstone and volcanic rock).

Table 1. Species recorded by us at each sub-site at the Rollright Stones

	The King's Men	**The Whispering Knights**	**The King Stone**	**Minor stones near King Stone**
Acrocordia conoidea	•	•	•	
Agonimia tristicula		•		
Aspicilia calcarea	•	•	•	
A. contorta contorta	•	•	•	
A. contorta subsp. *hoffmananiana*	•	•	•	
Bacidia arnoldiana	•		•	
Bacidia fuscoviridis	•	•		
Belonia nidarosiensis	•			
Bilimbia sabuletorum	•	•		
Botryolepraria lesdainii	•	•		
Caloplaca cf. *albolutescens*				•
Caloplaca aurantia	•	•	•	
Caloplaca chrysodeta	•	•	•	

	The King's Men	The Whispering Knights	The King Stone	Minor stones near King Stone
Caloplaca crenulatella	•			
Caloplaca dichroa	•		•	
Caloplaca flavescens	•	•	•	
Caloplaca flavocitrina				•
Caloplaca limonia	•	•	•	
Caloplaca marmorata	•	•		
Caloplaca oasis				•
Caloplaca ochracea	•			
Caloplaca teicholyta	•			
Caloplaca variabilis	•	•	•	
Candelariella aurella	•	•		
Candelariella medians	•	•	•	
Catillaria chalybeia	•	•		
Catillaria lenticularis	•	•	•	
Clauzadea immersa	•			
Clauzadea cf. *metzleri*	•			
Clauzadea monticola	•	•		
Collema crispum	•	•		
Collema cf. *fuscovirens*	•			
Collema tenax	•			
Dermatocarpon miniatum	•	•		
Diploicia canescens	•	•		
Diplotomma alboatrum	•	•	•	
Lecania erysibe s. str.	•		•	
Lecania inundata				•
Lecania rabenhorstii	•		•	
Lecanora albescens	•		•	
Lecanora campestris	•	•		
Lecanora crenulata	•	•	•	
Lecanora dispersa	•	•		
Lecanora horiza	•	•	•	
Lecanora muralis				•

	The King's Men	The Whispering Knights	The King Stone	Minor stones near King Stone
Lecidella stigmatea	•			
Lepraria lobificans	•			
Lepraria vouauxii	•	•		
Leptogium cf. *plicatile*	•			
Opegrapha rupestris	•	•	•	
Phaeophyscia orbicularis	•	•	•	
Physcia adscendens	•	•	•	
Placopyrenium fuscellum	•	•		
Placynthium nigrum	•			
Protoblastenia rupestris	•		•	
Ramalina cf. *lacera*		•		
Sarcogyne regularis	•			
Sarcopyrenia gibba				•
Solenopsora candicans	•	•	•	
Thelidium incavatum				•
Thelidium papulare forma *papulare*		•		
Toninia aromatica	•	•	•	
Verrucaria baldensis	•		•	
Verrucaria caerulea	•			
Verrucaria calciseda	•	•	•	
Verrucaria hochstetteri	•		•	
Verrucaria macrostoma forma *furfuracea*	•	•	•	
Verrucaria macrostoma forma *macrostoma*	•			
Verrucaria nigrescens forma *nigrescens*	•	•	•	
Verrucaria nigrescens forma *tectorum*	•		•	
Verrucaria squamulosa		•		
Verrucaria viridula	•	•		
Xanthoria calcicola	•			
Xanthoria candelaria s. str.		•		
Xanthoria parietina	•	•	•	

Taxonomic notes

Caloplaca* cf. *albolutescens. A sterile thallus, observed on one of the minor stones forming a small fire pit north of the King Stone, closely resembles *C. albolutescens*. When fertile this lichen is very distinctive but when sterile it is rather nondescript. There is a high likelihood that this identification is correct as it is common in such recent calcareous communities but it has been very much overlooked by British lichenologists and confused with *C. teicholyta*.

Caloplaca dichroa was described as new to science in 2006; former surveys will have recorded its thallus as *C. citrina*. *C. dichroa* is common on calcareous substrata, both natural outcrops and artificial structures. It has a preference for horizontal or sloping (rather than vertical) surfaces and takes its name from the variability in colour between different individuals, ranging from bright pure yellow to deep orange. When well developed the thallus is covered in fine blastidia, but the production of blastidia tends to be suppressed in the vicinity of apothecia. The 2000 survey recorded *C. holocarpa* from 21 stones of the King's Men while we failed to find any convincing specimens of it. We suspect that clusters of *C. dichroa* apothecia were misinterpreted as *C. holocarpa*. The habitat seems wrong for *C. holocarpa* which is usually a feature of more acidic substrata. Fletcher & Laundon (2009) state that *C. oasis* (syn. *C. holocarpa* auct. Brit.) "includes most British records identified as *C. holocarpa*, on calcareous rocks, cement, mortar, asbestos, etc." This would be a possible source of the former records of *C. holocarpa* except that we failed to find *C. oasis* on any of the King's Men. Another source of confusion might be mistaking *C. marmorata* (recorded as *C. lactea* in 2000) for *C. holocarpa*. However Winchester *et al*. (2000) appear to be aware of *C. marmorata* and record both species. The majority of the former records of "*C. holocarpa*" are from the tops of the stones which is where *C. dichroa* is best developed and often fertile and so it is with some confidence that we reinterpret the previous records of *C. holocarpa* as *C. dichroa*.

Clauzadea* cf. *metzleri. A thallus on stone 16S has a morphology somewhat intermediate between *C. monticola* and *C. immersa* (both of which are confirmed as occurring on the King's Men). Unfortunately the tiny specimen (*Powell* 3191) was insufficient to confirm the presence of *C. metzleri* so we make a tentative report which could be pursued during a future survey.

Collema* cf. *fuscovirens. Winchester *et al*. (2000) reported *Collema auriforme* from four stones in the south-eastern quadrant of The King's Men where we found *C.* cf. *fuscovirens*. We are sure that our recent survey reports the same lichen but with a different tentative identification.

Lecanora horiza. Woods & Coppins (2012) provide a conservation evaluation of British lichens in which *L. horiza* is stated to have an IUCN designation of Near Threatened and a restricted distribution category of Nationally Scarce. Malíček & Powell (2013) indicate that *L. horiza* is much more common as a saxicolous species than British field lichenologists have previously realized. The separation of *L. horiza* from *L. campestris*

presents considerable problems, compounded by the inaccurate description of *L. horiza* given by Edwards *et al.* (2009). Some thalli on the vertical faces of some of the King's Men (e.g. stone 1S) conform to the typical morphology of *L. horiza* having large fruits with very glossy discs, the fruits giving the impression of almost falling out of the thallus.

Leptogium* cf. *plicatile. On stone 2S we found a small thallus which we believe to be *L. plicatile*. Gilbert *et al*. (2009) point out that this species is very variable and may be confused with other species such as *Collema auriforme* and *L. schraderi*. One strategy for the future would be to take named material of the possible species to the site to compare in situ, along with the collection of a lobe to examine its anatomy.

Ramalina* cf. *lacera. The genus *Ramalina* forms shrubby tufts and, despite being conspicuous, the species are morphologically variable and thin layer chromatography is often required for confirmation. We prefer to leave our identification tentative.

Verrucaria squamulosa. The material collected from Stone 4 of the Whispering Knights (*Powell* 3192) appears to conform to the description of *V. squamulosa*, a species which was described as new to science in 2003 but which has only recently been recognized as occurring in Britain by Orange (2013). *V. squamulosa* is currently Nationally Rare (recorded from fewer than 16 British hectads) though its true abundance is not yet known due to under-recording. This site may be a new county record for this species.

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The puzzle of the monkey puzzle tree *Araucaria aruacana* as a lichen substrate

Epiphyllous lichens that are specially adapted for life on leaf surfaces are becoming increasingly common and diverse. A decade or more ago only box (*Buxus sempervirens*) seemed to have any noteworthy species. Now any long-lived leaves are worth a search. Of all the long-lived leaves perhaps those of the *Araucaria* or monkey puzzle tree might take the prize for longevity. Their leaves seem to be able to survive for several years if not more and are a potential epiphyll paradise.

The tree was introduced to Britain from South America in 1795, so the oldest are therefore little more than 200 years old. Unfortunately as well as defeating the monkey, the viciously spiky leaves are both dangerous to inspect (particularly given the focal length of a x10 lens) and difficult to remove for collection and study purposes. Most older trees have a canopy well out of reach and cherry pickers are not current standard lichen recording gear. Even if secateurs or high-pruners and gauntlets are carried you then need an owner willing to sacrifice the symmetry of a prize specimen tree! Binoculars may be the most useful bit of equipment.