

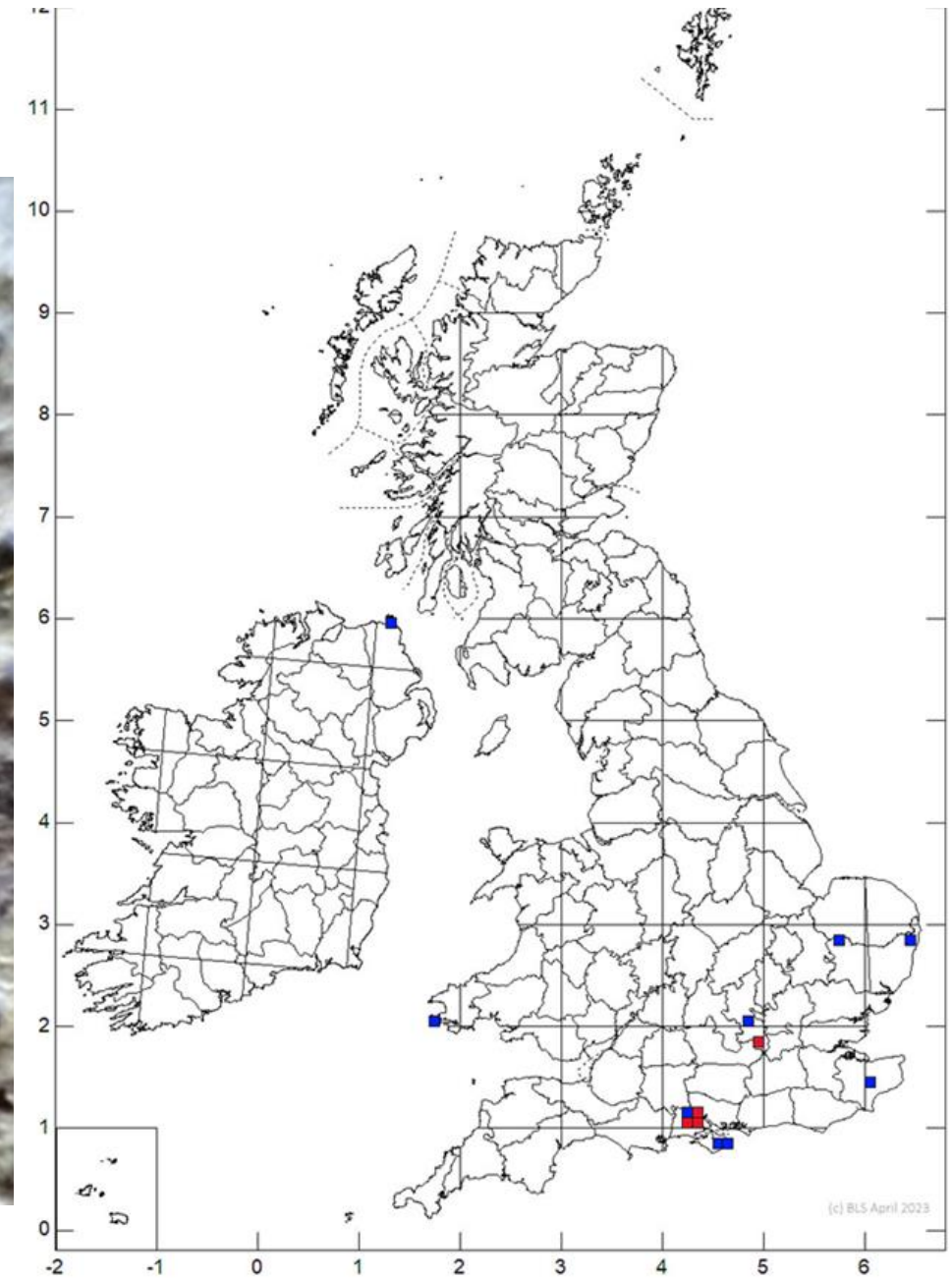


What's to *Lichen* about Lichens?

Richard Todd
and
Martin Woolner



Pyrenula nitida (Pox Lichen)



What Are Lichens?

Where Are They Found?

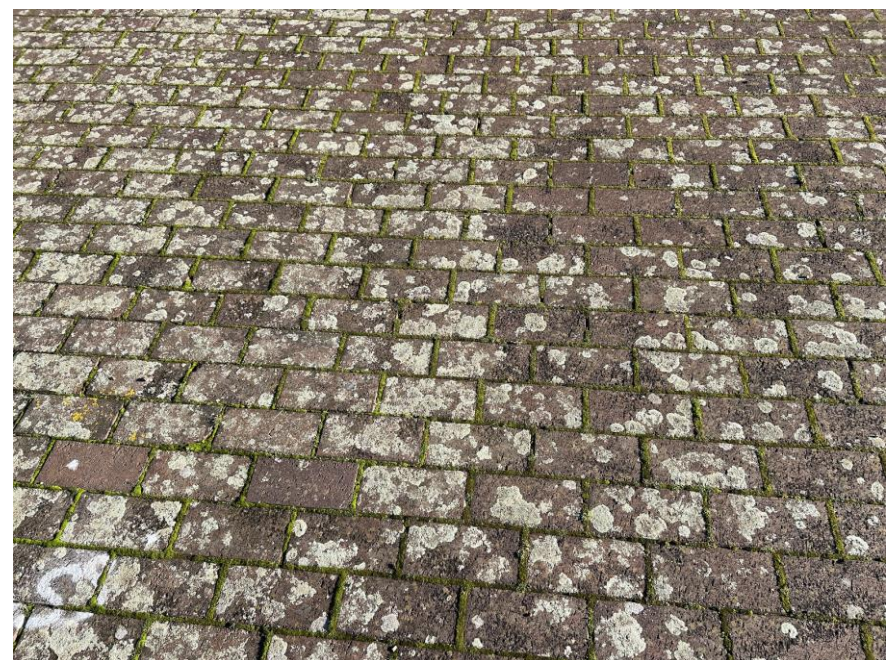
What Do They 'Do'?



What Are Lichens?

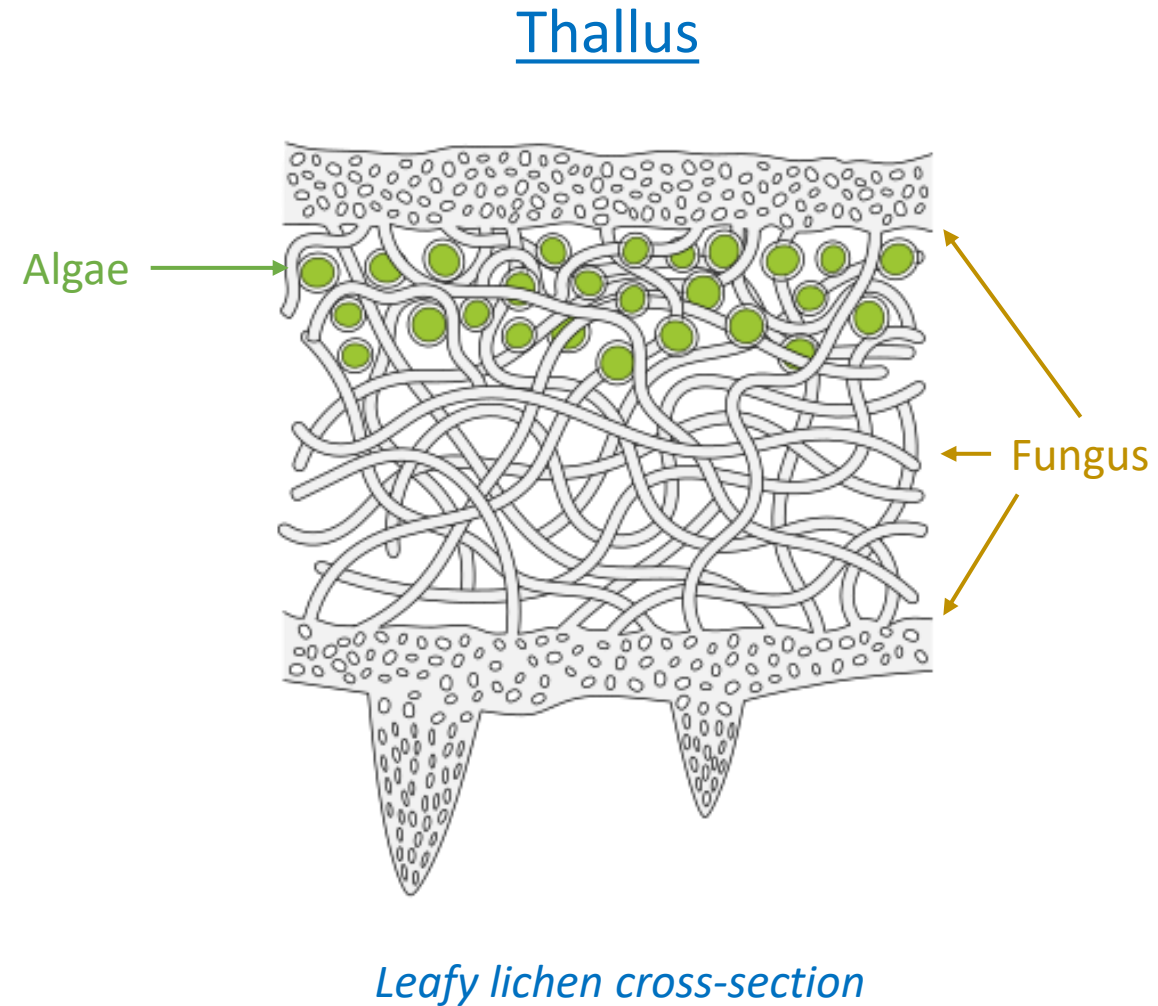






What actually are Lichens?

- *Lichens are not plants (and certainly not a moss!)*
- Lichens are a *composite organism* comprising a **fungus** and either an **algae** or **cyanobacteria**, in a '*mutually beneficial*' relationship ('symbiotic')
- **Fungus**: provides a stable and protective framework for the algae / cyanobacteria ('mycobiont')
- **Algae/cyanobacteria**: provide food (sugars) for both entities (from photosynthesis) ('photobiont')



A Few Lichens Facts...

- Lichens *do not* obtain nutrients from the *substrate* on which they exist
- Nutrients (minerals) and water obtained from the atmosphere
- Lichens do not harm trees!
- ~1800 species in the UK
- ~20000 species worldwide
- Very slow growing...



Four Main Lichen Types

- ‘Shrubby’ - *Fruticose*
- ‘Leafy’ - *Foliose*
- ‘Crusty’ – *Crustose*
- ‘Powdery’ – *Leprose*
- *Cladonia*



1. Fruticose

‘Shrub-like’ lichens, that tend to stick up or hang down from the support

Features for identification:

- single attachment point to substrate
- surfaces all same colour
- very 3D appearance

Usnea sp. (Beard Lichens)



2. Foliose

‘Leaf-like’ appearance,
generally lying ‘flat’ along
the support

Features for identification:

- upper and lower surfaces usually different colours
- more ‘2D’ appearance

Parmotrema sp.

Xanthoria sp.

Hypogymnia sp.

Parmelia sp.



3. Crustose

Flat 'crusty' lichens that are tightly bound to the support and are difficult to remove without damaging the substrate

Features for identification:

- no lower surface
- very 2D appearance



Lecidella sp.

Lecanora sp.

Arthonia sp.

Graphis sp.

Rhizocarpon sp.

4. Leprose

Features for identification:

- no 'body' or reproductive parts
- powdery appearance



Lepraria incana

Cladonia

Very distinctive and very beautiful!



Lichen Reproduction Strategies

Two main methods:

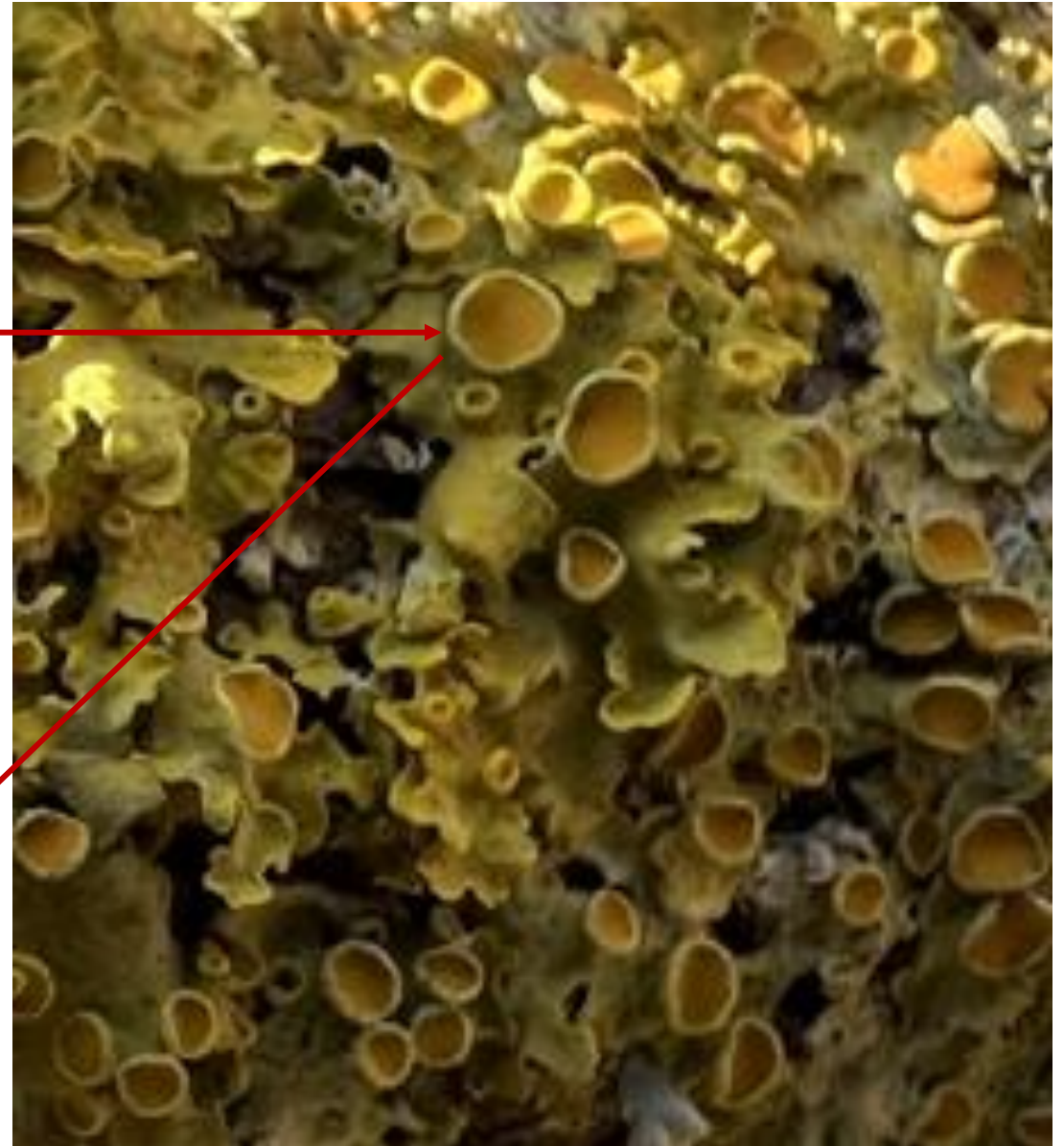
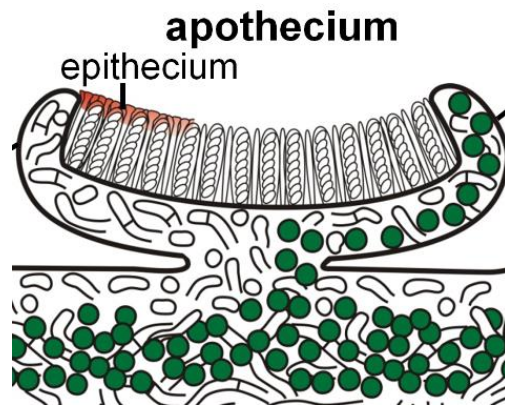
- Sexual (spores)
 - Offspring genetically different
- Vegetative, asexual (propagules)
 - Offspring genetically identical (clones)

Sexual (spores)

Spores produced in fruiting bodies called *apothecia*

'Jam tart' like

Spores are produced from the *fungus partner only*

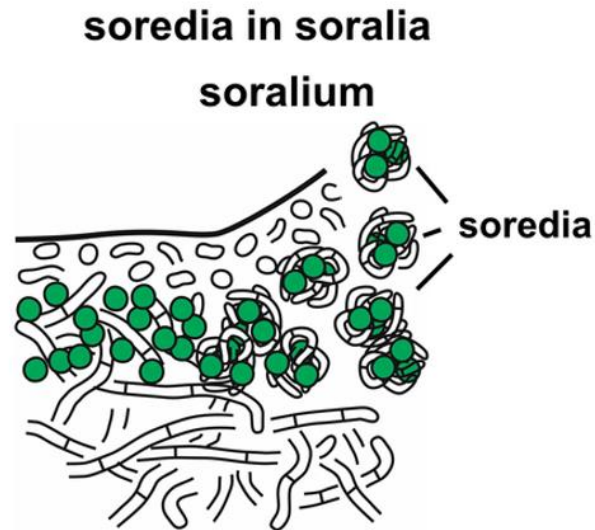


Xanthoria sp.

Vegetative, asexual (propagules)

- Two main processes – soredia or isidia
- Both processes produce small fragments of lichen material (**propagules**)
 - these contain *both fungal and algal components*
 - spread by being released or breaking off the main lichen body

Soredia



Isidia



Lichen Asexual Reproduction - *Soredia*



Parmelia sulcata



Soredia (powdery)



Lichen Asexual Reproduction - *Isidia*



Parmelia saxatilis

Isidia (finger-like)



Spores vs Propagules

- Spores:
- widespread dispersal
 - genetic diversity
 - **needs to find an appropriate alga to make a new lichen**

- Propagules:
- less widespread dispersal
 - no genetic diversity (clones)
 - **lichen can start growing immediately**

Spores vs Propagules

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*PS: reproductive features of a lichen are a **primary method for identification***



Identifying Lichens

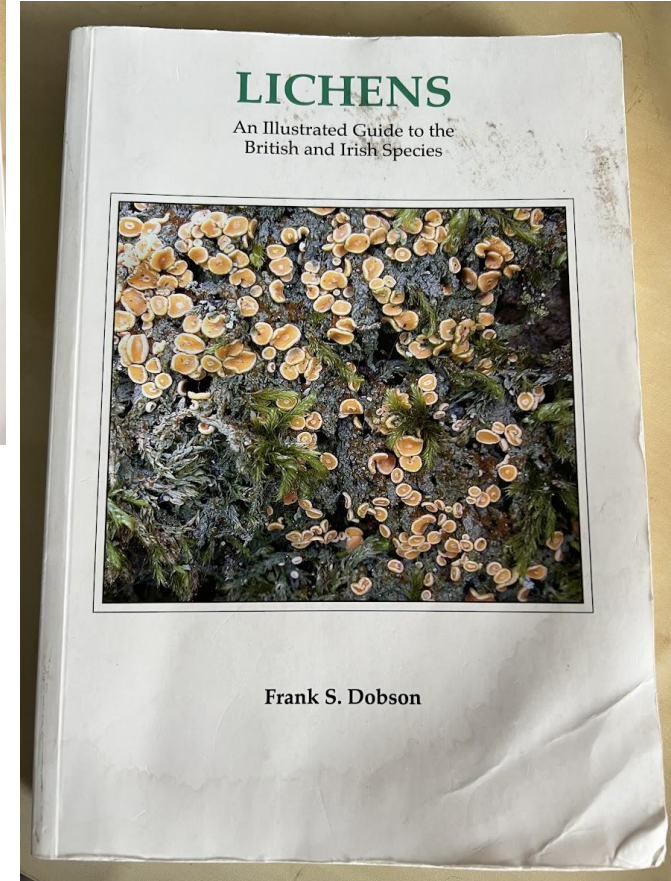
Kit for in the field

X10 hand lens - your **Best Friend!**



Identifying Lichens Kit for in the field

- FSC Field Guides
- The Bible – “Dobson”
- Small penknife
- Mobile phone for photos (and GPS)
- Ruler



Identifying Lichens

Kit for in the field

Useful additional kit:

- Chemicals
- UV torch
- Small envelopes



Chemicals

KOH solution – known as 'K'

Dilute bleach – known as 'C' (Milton is best)

[Lemon juice – for determining rock types]



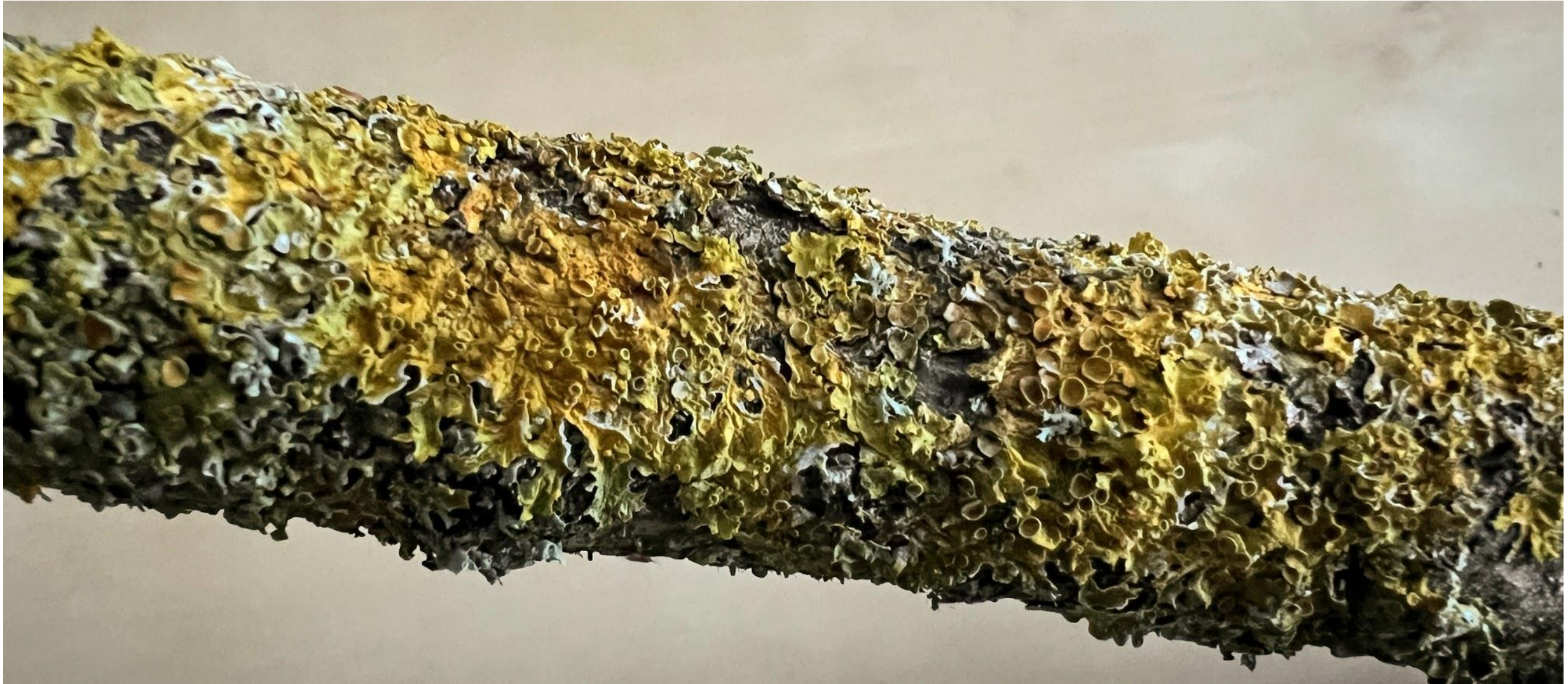
Using 'K' to help identify
Xanthoria parietina



Using 'K' to help identify *Xanthoria parietina*



Xanthoria parietina and UV Light



Xanthoria parietina and UV Light





Where Are Lichens Found?



Where are Lichens Found?

(Pretty much everywhere!)

<u>Hot</u> Deserts	<u>Cold</u> Mountains Polar regions	<u>Vacuum/Cold/UV</u> Space (ISS)
<u>'Rock'</u> Pavements Stone walls Gravestones* Brick walls	<u>Other extreme</u> Coastlines	<u>Metal</u> Fences Bridges
<u>Wood</u> Trees Fences	<u>Other (natural)</u> Rotting wood Moss Your garden!	<u>Other (man-made)</u> Rubber Plastic Leather

*Graveyards are good places for lichen study!



What Do Lichens Do?!



What Do Lichens Do?!

- Food for invertebrates (and vertebrates)
- Habitats for invertebrates (and vertebrates)
- Fix nitrogen (*cyanobacteria*)
- Store carbon
- Pollution (Air Quality) Indicators
- Produce potentially useful chemicals (eg medicines) – *unique* to lichens
- *And they just look great 😊*

Food for Invertebrates

Dew Moth *Setina irrorella*



Dew Moth *Setina irrorella*



Food for Invertebrates



Rosy Footman moth



Food for Invertebrates

Beautiful Hook-tip *Laspeyria flexula*



Larva • Netherlands • © Jeroen Voogd



Lichens as Habitats



Merveille du Jour moth



Long-tailed tit nest

Lichens as Habitats



Lichens as Habitats



Lichens and Pollution

- Slight misconception that the presence of lichens *always* indicates clean air
 - Some lichens cannot tolerate air pollution, eg *Usnea sp.*
 - Some lichens can tolerate (*and actually thrive*) in higher levels of air pollution, eg *Xanthoria parietina*
- (this lichen also likes a bit of bird poo)



Air Pollution Survey at Burnham Beeches NNR

- *Why do an air pollution survey at Burnham Beeches?*
- Burnham Beeches is an internationally important area for wildlife
 - NNR, SSSI and Special Area of Conservation
- Pollution impacts from nearby surrounding activities
 - Transport and agriculture
- *Comparing the numbers of **pollution tolerant** and **pollution intolerant** lichens can give an indication of overall pollution levels*

Air Pollution Survey at Burnham Beeches NNR (2023)

- 17 lichens in the survey: 9 pollution intolerant + 8 pollution tolerant
- 8 Areas surveyed: 40 oaks / 120 branches
- Discussions on the methods and results are currently ongoing
- Lichen Team: Gill Evans, Martin Woolner and Richard Todd


The Lichen Team



Medicines from lichen compounds

- Anti-cancer agents
- Antibacterials

Both recent publications (2023)



South African Journal of Botany
Volume 159, August 2023, Pages 155-163



Lichens: A promising source of anti-cancerous activity and their molecular mechanisms

Monika Thakur^a, Bharat Kapoor^b, Dhriti Kapoor^{c,d}, Neeta Raj Sharma^c

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Evidence for some antimicrobial properties of English churchyard lichens.



Taylor, J. A., Fourie, Tosca; Powell, Mark and Chianella, Iva (2023). Evidence for some antimicrobial properties of English churchyard lichens. *Access Microbiology*, 5(6)
DOI: <https://doi.org/10.1099/acmi.0.000536.v3>

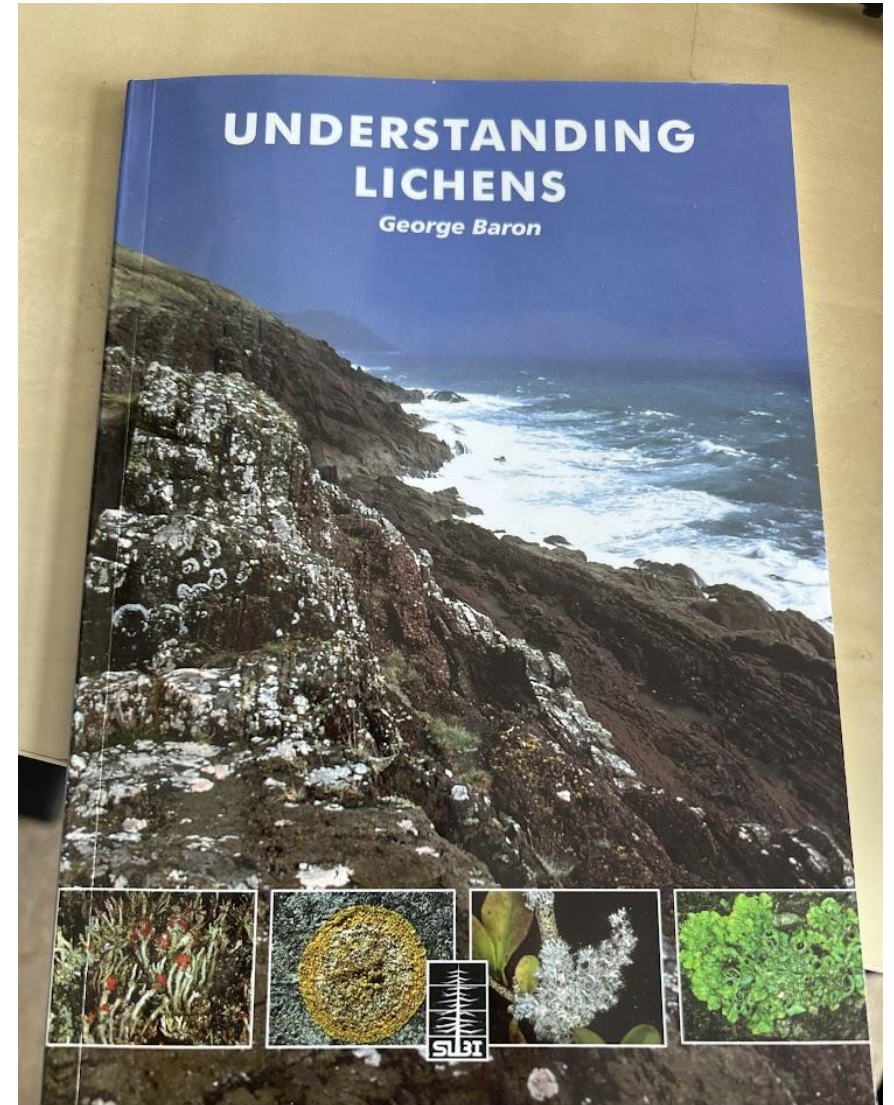
Abstract

The emergence of multidrug resistant bacteria has driven the need for novel antibiotics. Our investigations have focussed on lichens as they naturally produce a wide range of unique and very effective defence chemicals. The aim of this study was to evaluate some of the antimicrobial properties of ten common British churchyard lichens. The lichen material was sampled from 10 species, namely *Caloplaca flavescens*, *Diploicia canescens*, *Cladonia fimbriata*, *Psilolechia lucida*, *Lecanora campestris subsp. Campestris*, *Lecanora sulphurea*, *Pertusaria amara f. amara*, *Lepraria incana*, *Porpidia tuberculosa* and *Xanthoria*

Further information...

- British Lichen Society
- Many useful lichen websites
 - Dorset Lichens
 - British Lichens
 - Irish Lichens
- Social media
 - Facebook
 - Instagram

Good beginners' book



In Conclusion...

Lichens are everywhere (nearly!)

Huge diversity of shapes / sizes / colours

Habitats and food for vertebrates and invertebrates

Indicators of air quality

Potential medicines

Fascinating (and beautiful) organisms!

So, what's NOT to lichen about lichens? 😊





Thanks for listening!