

OLD BOOK SAFARI

Have you ever met a bookworm? I mean apart from our good friend Wordworm, obviously. I'll tell you the answer, you have not. Why? Because they're very shy, and also bookworms don't exist. At least, not as a single species. Bookworms are not actually worms, but a number of worm-like insects from moth caterpillars to beetle larvae.

How does that work then! Why are they on old books, and not in the garden where they belong? Ed

Good question. The adult females lay their eggs on the edges of books (YUCK) and when the wormy babies hatch, they eat their way into the safety of the delicious book... leaving a tell-tale dusty trail of frass (poo) (double YUCK!!) on the bookshelf. They grow and mature inside the book until they pupate and the adults emerge, maybe taking years to do

Mould is the enemy of books; growing in damp conditions it can damage books and serves as a food source for other

Furniture beetle larvae (woodworm) and **deathwatch beetle larvae** both snack on paper, card and wooden bookshelves.

Carpet beetle larvae (woolly bears) and **moth caterpillars** are big fans of animal products, eating leather and glue.

Silverfish graze their way across the surface of mould, but also like paper, glue... pretty much anything.

Book scorpion ATTENTION: These actually prey upon damaging pests, yum!

Foxing is brown-orange spots caused by fungi interacting with iron in the paper.

I bet you didn't realise a slightly damp bookshelf was an ecosystem in itself!

Biscuit beetle larvae eat most plant matter, including books.

Mice - yes, you read that right - shredded paper makes a lovely

Book lice love a bit of mouldy animal - or plant-based glue!

Poop from pests can cause its own discolouration and attract more pests and mould.

HOW DO I KNOW WHAT'S LIVING IN MY BOOKS?

Sniff it! When you sniff a book, you are detecting Volatile Organic Compounds (VOCs), which could come from the book itself, outside influences, or the decomposition process. A team from University College, London (UCL used gas chromatography and mass spectrometry to identify the different VOCs coming from ancient books and relate them to descriptions of their scent. You can see them in the Historic Paper Odour Wheel.

Now imagine someone, hundreds of years ago, sitting by the fire reading a book. As they turn the pages, the paper absorbs molecules from the air - wax and soot from the candles, cooking smells, particles from the peat or coal-burning fire, the tobacco smoke from a pipe and the perfume (or less pleasant things) from their hands. The book might be placed on a sunny windowsill or trapped in a damp corner.

PAPER WORK

The distinct smell of a book also comes from within. Very ancient books might be handwritten on vellum or parchment, both made from specially prepared animal skins, but paper, made from wood pulp, has been more common for the last 600 years.

At first it was rough, and might contain cotton or linen fibres for added strength, but then we learned how to remove the long, tough lignin fibres that make trees woody, leaving a smoother paper made mostly from cellulose found in the plant cell walls.

So why is my old book yellow? Ed

Lignin breaks down over time to produce acids, which then break down the cellulose, which releases an almond-like scent and turns the paper yellow. The acids also act on the inks and binding glue to release even more VOCs for us to smell. Modern paper is mostly cellulose and is made using chemicals to bleach, smooth and waterproof it, so today's books will smell very different as they age. They'll also turn a different colour.

Get your nose ready for a thorough workout and head on over to the AQUILA website to find an AQUILAnaut challenge using the Historic Paper Odour Wheel!

