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Diseases and Defects

KEYWORDS

bowing
burr

cupping
knots

shakes
waney edge

Trees get diseases and have defects simply because they are living organisms. They can also suffer damage and defects as a result of the felling and seasoning processes. Diseases and defects affect the strength and the quality of wood. Sometimes defects in wood can be made to look well and can increase its value, such as a burr, but more often a defect will decrease the value of the wood.



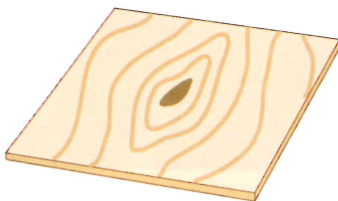
Bowl made from burr wood

NATURAL DEFECTS

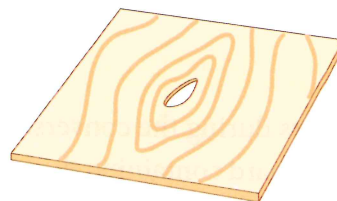
Some natural defects can be decorative and pleasing to the eye; others create many problems. Unwanted defects can be cut from the wood as it is processed.

Knots

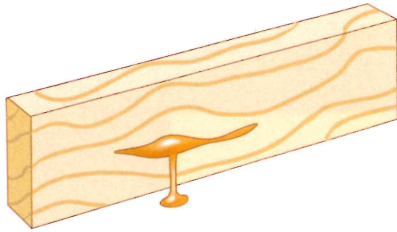
Knots form when the branches of the trees are cut off or fall off the trunk. Some knots in timber become loose and are called dead knots and they fall out eventually. Other knots remain part of the wood and are called live knots. All knots reduce the strength of the timber and affect the appearance.



Live knot



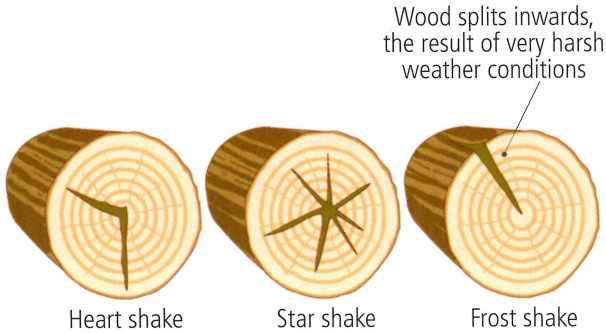
Dead knot



Resin pocket

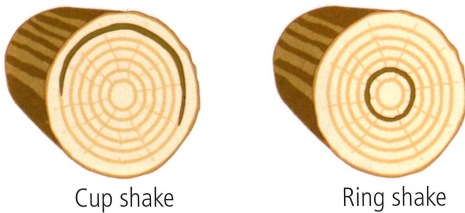
Resin pockets

Resin pockets are small cavities in the wood that are full of resin. These pockets, or canals, are often hidden from view (deep in the wood) and can cause timber to weaken. When exposed they are unsightly and sticky resin can be messy.



Radial shakes

Winter wood separates from summer wood



Tangential shakes

Tangential shakes

Tangential shakes occur in the direction of the annual rings. They occur in old age in the tree, in seasoning or in strong wind. They include cup shakes where the split only runs along the annual ring. A ring shake is when the split runs right around the annual ring.

Waney edge

Waney edge occurs during the conversion process. It is where the portion of the board containing the bark is left on. This can be quite a nice feature in some project work.

Shakes

Shakes are splits in the end grain of wood. They happen along the ray lines (radial shakes) and along the annual rings (tangential shakes). These splits are caused by tension forces that build up in wood while the tree is growing, or as a result of the drying of the felled log before conversion. When the tree is felled, or before the log is converted, the forces within the log may be released. The weaker portions of the wood break, and the split occurs. Different types of split (shake) have different characteristics.

Radial shakes

Radial shakes occur in the direction of the rays. They include heart shakes, star shakes and frost shakes. Wood splits inwards, as a result of very harsh weather conditions.



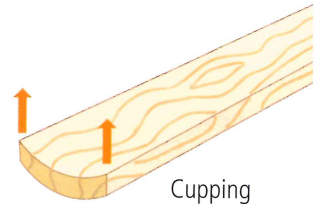
Waney edge can be an effective feature of a project

ARTIFICIAL DEFECTS

Artificial defects occur as a result of stresses caused by poor stacking or seasoning. They include cupping, bowing, twisting or warping, end splitting, case hardening, honeycomb checking, staining (including chemical) and discoloration.

Cupping

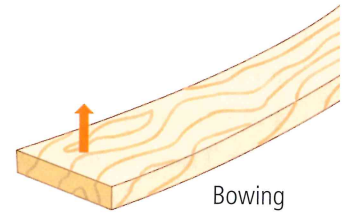
Cupping is a type of shrinkage that forms a curve if you view a plank from either end.



Cupping

Bowing

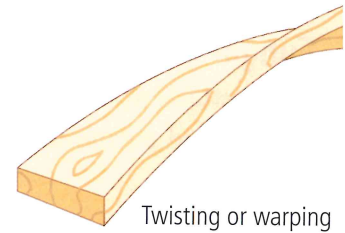
A bow takes the form of a bend along the length of the board. Both cupping and bowing defects are often due to the incorrect stacking of the boards during seasoning, where the stickers are too far apart or perhaps not directly above each other. It may also be as a result of poor stacking in a timber yard.



Bowing

Twisting or warping

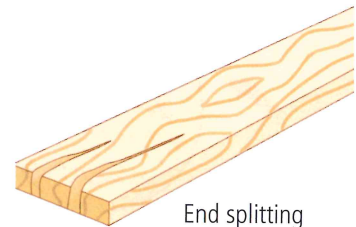
Twisting or warping occurs when the two edges of the wood remain straight, but the faces are distorted as if the two ends were twisting in opposite directions.



Twisting or warping

End splitting

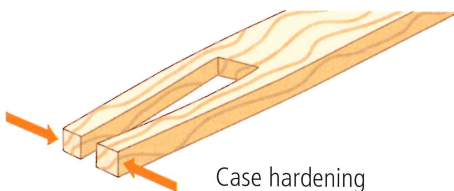
End splitting is caused if the ends of boards dry out too quickly, due to exposure to the sun or heat. It is very common in naturally seasoned timber. Painting or treating the ends during seasoning can often prevent it.



End splitting

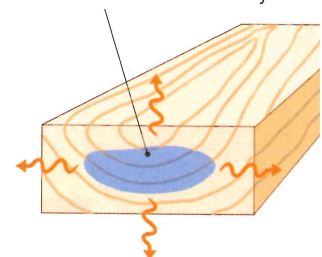
Case hardening

Case hardening happens when boards are seasoned too quickly. The surface and the centre do not dry at the same rate. This creates stresses in the wood. There is compression on the inside of the pieces and tension on the surfaces.



Case hardening

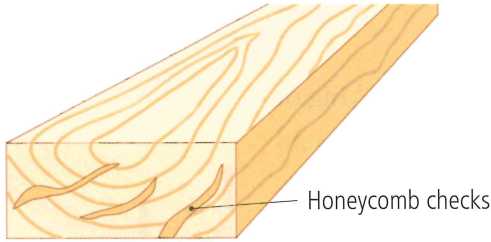
Moisture is trapped in the center of the board if surfaces dry too c



Case hardening

Case hardening – boards bend when tension is released





Honeycomb checks

Honeycomb checks

Where the inside of the wood splits is called honeycomb checks. This happens when wood dries quickly and the inside dries before the outside, tearing the wood fibres.

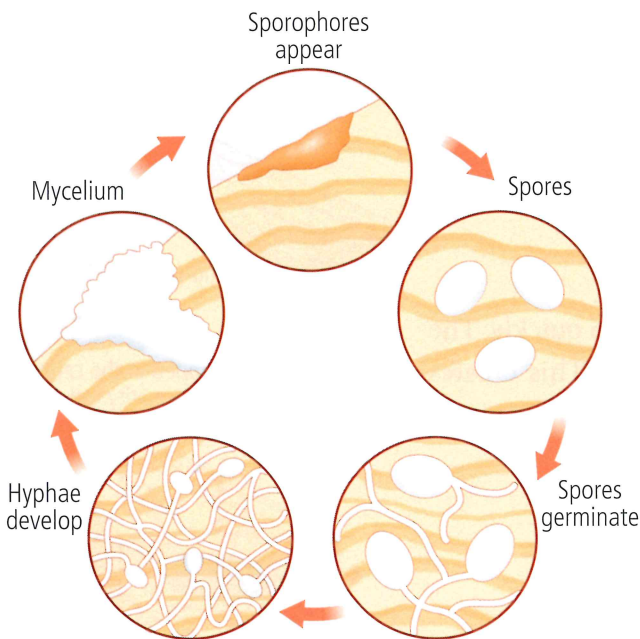
Stains and discoloration

Timber can be stained by chemicals (e.g. black bog oak), weathering and fungi. Nearly all timbers react differently to the acids or alkalis (soaps, detergents, etc.) they come in contact with.

Fungal staining is caused by fungi infecting the wood and feeding on the carbohydrates in the timber. These moulds stain the wood blue, grey, black, pink and white. Sometimes they occur on the surface and can be sanded off, but often they grow deep into the wood. Often the strength of the timber is not affected, but it doesn't look well. These stains occur due to poor seasoning. When the correct moisture content is achieved (20 per cent or below) the fungi cannot survive.

Fungal attack

Fungi attack wood and cause damage by feeding on the cells of the wood. As a result, the wood softens and eventually it decays. A fungus needs certain conditions before it can live on wood.



Life cycle of wood-rotting fungus

A fungus is made of cells called hyphae. When there are a large number of hyphae together this is called a mycelium. The hyphae penetrate the wood to feed and get moisture. Fruit bodies called sporophores are formed. They produce tiny spores, which are blown by the wind and carried to other wood. The spores germinate there to grow into more fungi.

Conditions for fungal growth	
Moisture	Moisture content above 20%
Food supply	The wood
Oxygen	Particularly air that is still and warm

There are two main groups of wood-rotting fungi:

- 1 Wet rot (white rot)
- 2 Dry rot (brown rot)

Wet rot

Wet rot usually occurs outdoors and it rots fence posts, window frames, logs, doors, etc. The affected wood becomes very moist and slimy and sometimes a white residue is present.

Dry rot

The fungi that cause brown rot can occur outdoors, but are mostly found inside, for example underneath wooden floors. This fungi attacks timber, eating the cellulose in the wood. The wood appears dry and the surface cracks in rectangular shapes (cube-like cracking), like wood that has been charred by fire, and it smells musty.

Dry rot usually occurs in damp areas with poor ventilation. When the spores germinate and start to grow, the fungi can get moisture through white silky threads called hyphae. They spread out and can even penetrate brick walls. The attack can seriously damage large areas of woodwork (floor or roof timbers, etc.), weakening infected wood.



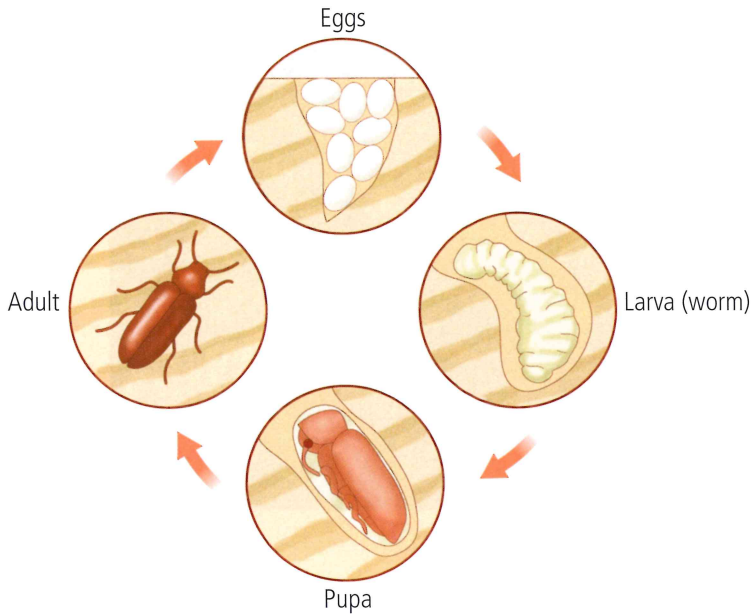
Wet rot



Dry rot

Treating dry rot

- All infected wood and uninfected timber 500 mm beyond the infected wood is cut away and burnt
- All remaining timber and blockwork must be treated with preservative fungicide to kill any remaining infections
- The cause of the outbreak must be identified and corrected (improve ventilation, for example)
- Replacement timber must be treated with preservative

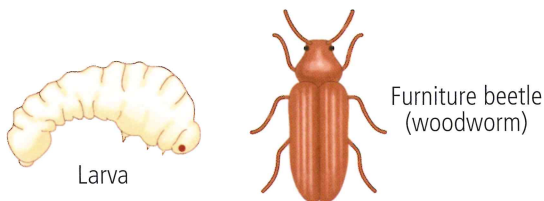


The life cycle of wood-boring insects

Furniture beetle (woodworm)

The common furniture beetle, or woodworm as it is more widely known, is probably the most common pest in Irish household wood. Woodworm attacks both hardwoods and softwoods, such as mahogany, oak and pine. However, it usually attacks only the sapwood of these timbers. The adult beetles emerge in June and July. Some tropical hardwoods are somehow immune from attack, as are modern plywood and chipboard, because the adhesives used in their manufacture are harmful to the beetle.

Timber can be coated with a preservative to prevent insects infecting the wood.



Common furniture beetle (woodworm)

Insect attack

Some insects will attack and feed on timber. They spend most of their lives living in and feeding on wood. The life cycle of many of these insects follows similar patterns.

Life cycle of wood-boring insects

- The adult lays the egg in an old insect hole, or crack, in the wood.
- The egg hatches and the larva or grub then feeds on the starch (or cellulose) in the wood. This feeding creates tunnels under the surface of the wood.
- The larva makes a cocoon-like shell around itself near the wood's surface, and then it pupates for a certain period of time. During this stage (pupa) it changes into the adult beetle.
- The adult then emerges, breaking out to the surface to continue the cycle. It leaves behind a flight hole and fine dust (waste) called frass.



The furniture beetle grows to 4–6 mm in length. In this picture it has been magnified many times

Treating timber with woodworm

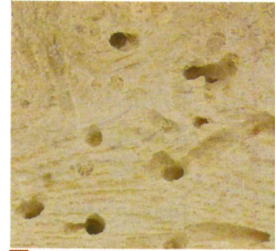
- Apply coats of insecticide following the instructions on the container
- Ensure that all surfaces and any cracks are coated with the chemical
- Use an applicator to insert insecticide into the exit holes to kill any remaining grubs

Deathwatch beetle

The deathwatch beetle is not found in Ireland very often. However, it is found in southern England. It is bigger than the furniture beetle. It attacks damp timbers usually at the ends of decayed beams, which are embedded into walls. The adults emerge during June, July and August. If timber is painted, with all the cracks and holes properly filled, it greatly reduces the risk of attack.

Powder post beetle

The powder post beetle is reddish-brown in colour and approximately 4 mm long. It generally attacks the sapwood of new hardwoods particularly during or after seasoning.



Worm holes



Deathwatch beetle



Powder post beetle



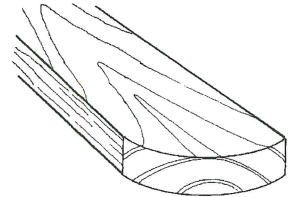
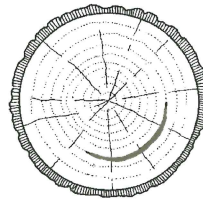
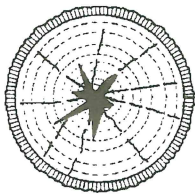
Exercises

- 1 Describe how knots are formed.
- 2 Name the two types of wood-rotting fungi.
- 3 Describe the stages of growth of a common wood-boring insect. Explain how the insect damages the wood.
- 4 Which type of wood is more likely to be damaged by wood-boring insects?
- 5 Using sketches, explain the stages of growth of a wood-rotting fungus.
- 6 Describe how you would treat dry rot and how you would attempt to prevent its recurrence.
- 7 Explain how you would recognise and then treat a piece of old furniture that had become infected by woodworm.
- 8 Name two natural defects found in timber.
- 9 Describe what a waney edge is.
- 10 What is case hardening?



Exam Questions

- 1 Dry rot is caused by a fungal attack on timber. State two conditions that are necessary for a fungal attack to occur.
(JC, HL, 2008)
- 2 Planks that are seasoned too quickly can develop several types of defect. Using notes and sketches describe any two of these defects.
(JC, OL 2006)
- 3 Name the timber defects shown in the following diagrams.
(JC, HL, 2006)



- 4 The life cycle of a wood-boring beetle comprises four stages. At what stage in the life cycle is the most damage caused to wood?
(JC, HL, 2005)

