Protox Handbook

Identification, control
and prevention of fungal, mould
and insect infestations

PROTOX

Professional fungal, mould and insect control

www.protox.pro

1. edition

Table of Contents

PROTOX HANDBOOK

This handbook is a practical working tool for craftsmen, architects, building designers, property inspectors and others who in their daily work are sometimes presented with infestations of fungi, rot, mould or insects. The handbook helps non-experts to identify what they see and what needs to be done to remedy the attack. The handbook thus helps to distinguish minor attacks from serious attacks requiring special technical assistance.

Wood-destroying fungus attack
There are over 30 species of fungi that can decompose wood in buildings. Fungi are most easily recognised by their fruiting bodies, but as these do not always appear in buildings, you often have to identify an infestation from the mycelium of the fungus and/or from the appearance of the decayed wood. With the help of the picture keys and the fungus characteristics chart, you can identify the fungus causing the infestation and then read more about the fungus and how to control it.

It is important to remember that fungal infestations can lead to serious building damage. If there is any doubt about the nature of the attack, professional technical assistance should always be sought.

Attack of mould
Mould is a generic term for a large group of fungi that do not decompose wood but can cause indoor air pollution and health problems. The Protox Handbook provides help to recognise and combat mould fungi in buildings.

Insect infestation in buildings
The handbook's section on insect infestation focuses on insects that can damage wood in buildings. Images and descriptions of the individual species help to recognise the insects from the appearance of the exit holes, frass, larvae and adult insects. Instructions on how to combat the attacks are also given.

Images
In addition to our own material, the images in the handbook have been made available by Goritas A/S, Hussvamp Laboratoriet ApS and Bøgh and Helstrup.A/S. We are very grateful for that. We are always looking for even better images for future editions, so if you have any photos that you think could help others to learn, please send them to us and you may see your own photos in future editions. We must stress that the handbook is not a complete key to wood-decaying fungi and insects, but it represents the most common species/genera found in buildings. If you have suggestions for species/issues we should mention, please let us know.

Protox – expert in fungicide, mould and insect control
Protox focuses on developing and selling products for chemical control and prevention of fungal, mould and insect infestations in buildings. Protox advises on the use of its products and offers training and courses in the control and prevention of fungal, mould and insect infestations in buildings.

If you need advice and guidance, you can always contact Protox by telephone or e-mail.

Fungi - Important characteristics

FUNGI	FRUITING BODIES	SURFACE MYCELIUM	DECOMPOSITION
Dry rot fungus	Protrudes like blocks or are pizza-like. Folded orange brown surface, edge thickened and white.	Young: Snow-white wadded, water droplets Older: Greyish loose mixed with strands, peels off in flakes, lemon-yellow spots, strands break.	Brown rot. Splinters in lengths from 5-10 cm. The wood is stained brown.
Wet rot fungus	Frequently, no fruit bodies are seen. They are small and flat, 50-200 mm in diameter. Worted brown surface, edge flat and white.	Light brown to very dark-brown sessile and serpentine strands.	Brown rot. From small (rot damage) and up to approx. 40-50 mm crack-blocks, the tree leaves in the grain rings (fungal damage). Intact wooden surface.
Mine fungus	White to light brownish, chalky and efflorescent, sessile, small pores (large variation) .	Young: Snow-white wadded. Older: Strands white curved and cottony, mycelium possibly efflo-rescent.	Brown rot. Small to very large crevice blocks. Easily dislodged with dry rot fungus.
Serried crust fungus	In darkness: cauliflow-er-like, often with reddish spots. In light: like white timber fungi growing in rows above each other.	Sparse but white coatings on fracture surfaces of fissure blocks. Possibly tight woollen.	Brown rot. 5-20 mm crevice blocks.
Tapinella	Curry yellow/brown hat sponge with suede-like upper surface, descending slats and lateral stick.	Whitish to curry yellow spider-web-like mycelium. Hair fine whitish to curry yellow strings.	Brown rot. 5-50 mm crevice blocks. The wood dark brown.
Contiguous aspen bracket fungus	Brown , 10-20 mm thick flat pressed tough with irregular dense pores	Curry-yellow wad-like tufts in the decayed wood. Fluff ball partially coated with brown coating.	White rot. The wood fluffs in the direction of the grain.
Gilled polypore	In light, tough corky consoles on the wood. Light brown pores on the underside, upper side brown bristly, in dark, sterile brown pads.	In the dark: Adhesive whitish fan-shaped – brownish corky, indistinct adherent strands. In light: Small whitish tufts between crevices.	Brown rot. The tree's annual rings leaf up. Often small (2-20 mm) crevices on leaves.
Bark fungus	Flat, few mm high stearin/ waxy coating.	Very large variation.	White rot. The wood fluffs in the direction of the grain.

DEFINITIONS OF DECOMPOSITION OF WOOD

Brown rot, white rot and grey rot
Refers to various forms of decomposition caused by wood-breaking fungi. The 3 main components of wood are cellulose, lignin and hemicellulose. Cellulose, which is made up of long twisted fibres, has the function of creating the breaking strength of the wood. A bit like how you give breaking strength in concrete by casting an iron net. When the wood-degrading fungus degrades the cellulose fibres, the breaking strength is removed and this degradation is called brown rot. In the case of brown rot, the wood turns brown and cracks in blocks along and across the grain (grain direction). Examples of brown mould-forming fungi are dry rot fungus, wet rot fungus, mine fungus, gilled polypore and tapinella.

Lignin, on the other hand, is the "filler" of wood – like the cement in a concrete casting. If the wood-degrading fungus breaks down the lignin in the wood, the cellulose threads will remain as distinct wood fibres. This decomposition is called white rot. With white rot, the wood is frayed and soft, and it does not crack. Softwoods do not change colour, darker hardwoods become bleached. White rot fungi include bark fungi and aspen bracket fungi.

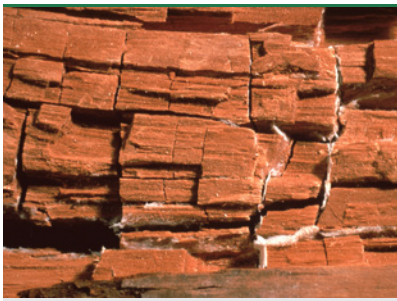
With grey rot (surface rot), the wood turns grey and loses weight, but retains its shape. Wet wood can be compressed; but regains its shape when the pressure is relieved. In case of severe drying, small cracks are formed. Grey rot is caused by special fungi which, when decomposing, form tunnels inside the cell walls of the wood.

Insurance cover – rot and fungus damage
Insurance companies distinguish between rot and fungus.

Decay is defined as a slow process that takes place over several years (typically at least 10 years), during which the wood is decaying and gradually forming dense cracks or becomes frayed..

Fungus is a term for a relatively rapid decay process, manifested by discolouration, darkening, fluffing or shrinkage of the wood and cracking across the grain.

Both rot and fungal damage are caused by fungi. Many fungal species are only weak decomposers, so decomposition is slow (10-20 years) and is defined for insurance purposes as rot. Other fungal species decompose the wood in a few years, which is why the decomposition is defined as fungal. If you have any doubts as to whether the damage is covered, contact your insurance company and/or send a sample to a fungal laboratory.

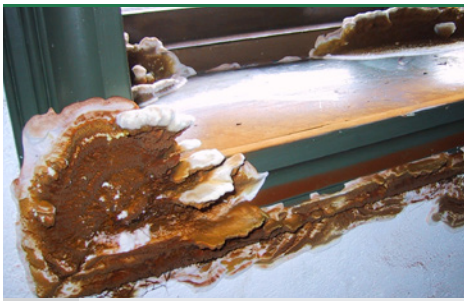


Brown rot – the fungus breaks down the cellulose fibres, leaving the lignin.

White rot – the fungus breaks down the lignin in the wood, leaving the cellulose threads. This frays the wood.

Grey rot (Surface rot) – dripping on old window.

svn 1 Dry rot fungus – fruiting body. (Photo: Bøgh & Helstrup)



svn 2 Dry rot fungus – fruiting body in window sill of summer house. (Photo: Protox)

svn 3 Dry rot fungus – young fruiting body. (Photo: Goritas)

svn 4 Dry rot fungus – fruiting body, cocoa-like spore powder and mycelium on Leca under floor in conservatory. (Photo: Protox/customer photo)

svn 5 Dry rot fungus – reddish-brown spore powder on the floor. (Photo: Protox)

svn 6 Wet rot fungus – fruiting body on brick. (Photo: Goritas)

Wet rot fungus – fruiting body.
(Photo: Goritas)

svn
7

Mine fungus – fruiting body.
(Photo: Protox/Goritas)

svn
8

Mine fungus – fruiting bodies and
mycelium on decayed wood with crevices.
(Photo: Bøgh & Helstrup)

svn
9

Serried crust fungus – sterile, cauliflower-like
fruiting bodies growing in the dark.
(Photo: Protox/Gori)

svn
10

Tapinella fungus – fruiting body with
sideways stick. (Photo: Protox/Goritas)

svn
11

Cohesive aspen bracket fungus – fruiting
bodies. (Photo: Protox/Goritas)

svn
12

svn 13 Gilled polypore – fruiting bodies. (Photo: Protox)

svn 14 Gilled polypore – sterile fruiting body developed in the dark. (Photo: Goritas)

svn 15 Serried crust fungus (Mine fungus – fruiting body). (Photo: Protox/Goritas)

svn 16 Ditiola radicata – fruiting bodies on stern board. (Photo: Protox)

svn 17 Oyster mushroom – fruiting bodies. (Photo: Wikimedia)

svn 18 Cellar cup fungus – fruiting body on wall by skirting board. (Photo: Bøgh & Helstrup)

Cellar cup fungus – fruiting body on wall by skirting board. (Photo: Bøgh & Helstrup)

svn 19

Firerug inkcap – fruiting bodies (hat and stick) and orange-brown, tough, coconut mat-like surface mycelium. (Photo: Protox/Goritas)

svn 20

Common jelly spot fungus – fruiting bodies on painted wood veneer. (Photo: Protox)

svn 21

Common jelly spot fungus – fruiting bodies on painted, outdoor woodwork. (Photo: Goritas)

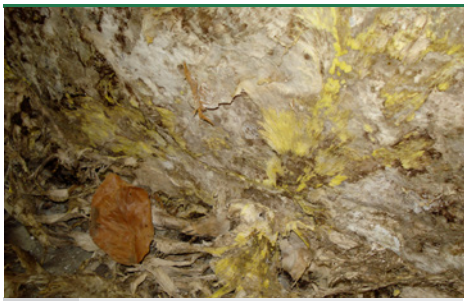
svn 22

Slime mould – mature, broken fruiting body with spore powder. (Photo: Protox)

svn 23

Slime mould – young fruiting body in door. (Photo: Protox)

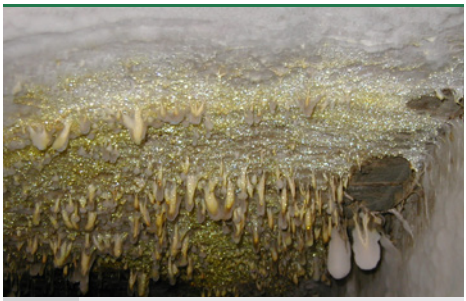
svn 24



svn 25 Dry rot fungus – surface mycelium with characteristic yellow spots. (Photo: Protox)

svn 26 Dry rot fungus – older, grey surface mycelium with stringy mycelium. (Photo: Protox)

svn 27 Dry rot fungus – young mycelium with string formations, slatted in conservatory. (Photo: Protox)



svn 28 Dry rot fungus – surface mycelium with water droplets. (Photo: Bøgh & Helstrup)

svn 29 Dry rot fungus – young surface mycelium, 2 weeks. (Photo: Protox)

svn 30 Dry rot fungus – surface mycelium with characteristic yellow spots. (Photo – Protox)

Wet rot fungus – characteristic dark and light string mycelium. (Photo: Protox/Gori)

svn 31

Wet rot fungus – brown stringy mycelium on glulam beam. (Photo: Protox)

svn 32

Mine fungus – attack in roof construction. Calcareous fruiting bodies, young, white mycelium and flexible strands. (Photo: Bøgh & Helstrup)

svn 33

Mine fungus – white surface mycelium on decomposed wood with fissure blocks. (Photo: Protox/Goritas)

svn 34

Tapinella fungus – curry yellow surface mycelium. (Photo: Bøgh & Helstrup)

svn 35

Cohesive aspen bracket fungus – surface mycelium as curry-yellow tufts (blue-green part is mould). (Photo: Protox/Goritas)

svn 36

svn 37 Gilled polypore – surface mycelium in a flat roof made of plywood. (Photo: Protox/Gori)

svn 38 Bark fungus – mycelium in frame wood. (Photo: Goritas)

svn 39 Gilled polypore in outer covering. Note small tufts of surface mycelium on fracture surfaces (Photo: Protox)

svn 40 Dry rot fungus – surface mycelium with water droplets. (Photo: Bøgh & Helstrup)

svn 41 Bark fungus – Star hair Bark fungus on wood in basement. (Photo: Protox/Goritas)

svn 42 Wet rot fungus – brown rot, leaf decomposition. Assessed as fungal damage. (Photo: Protox/Goritas)

Serried crust fungus (Mine fungus) – decomposition. (Photo: Protox)

svn 43

Dry rot fungus – old attack. Weak mycelial remains and clear transverse fissures. (Photo: Protox/Goritas)

svn 44

Mine fungus – decomposition and white surface mycelium on fracture surfaces. (Photo: Goritas)

svn 45

Gilled polypore – decomposition in a log house. (Photo: Protox)

svn 46

Gilled polypore – degradation in wooden cladding in holiday homes. Attack 3-4 years old. (Photo: Protox)

svn 47

Gilled polypore – leaf decomposition in log house. (Photo: Protox)

svn 48

svn 49 — Dry rot fungus – broken down wooden beam. Brown rot with large fissure blocks and surface mycelium. (Photo: Protox/Gori)

svn 50 — Dry rot fungus- crevice blocks. (Photo: Hussvamp Laboratoriet)

svn 51 — Cohesive aspen bracket fungus – stringy decomposition and blue-green coating is a mould attack. (Photo: Protox/Goritas)

svn 52 — White rot decomposition – unknown fungus. (Photo: Protox)

svn 53 — Bark fungus in window frame (white rot). (Photo: Goritas)

General advice – eaves broken down. (Photo: Tryg Forsikring)

svn 55

Common advice in exposed ceiling beams. (Photo: Protox)

svn 56

General advice. (Photo: Protox)

svn 57

Surface rot (grey rot) – dripping on old window. (Photo: Protox)

svn 58

Blue stain fungus – attacked softwood in pith rays from the surface to the core of the tree. (Photo: Protox)

svn 59

Blue stain fungus and black mould on conifers. (Photo: Protox)

svn 60

Image key · Mould

skn 1 — Mould growth (Trichoderma sp.) on a water-damaged beam in the basement. (Photo: Protox)

skn 2 — Mould growth (Trichoderma sp.) on formwork board in water-damaged crawl space. (Photo: Protox)

skn 3 — Mould growth (Penicillium sp.) on roof rafters as a result of insufficient ventilation. (Photo: Protox)

skn 4 — Black mould on skylight – insufficient ventilation. (Photo: Protox)

skn 5 — Black mould in living room – caused by a thermal bridge. (Photo: Protox)

skn 6 — Black mould on moisture-laden basement foundation. (Photo: Protox)

Mould growth in living room after water damage. (Photo: Protox/customer photo)

skn 7

Black mould on the roof due to lack of ventilation of the roof space (valves retrofitted). (Photo: Protox)

skn 8

Mould growth on diffusion-tight sub-ceiling (felt surface). (Photo: Protox)

skn 9

Mould growth (Stachybotris chartarum) in light plaster wall after flooding. (Photo: Protox)

skn 10

Black mould on skirting board – insufficient ventilation. (Photo: Protox)

skn 11

Mould growth on a newly built wall in an industrial hall as a result of construction moisture. (Photo: Protox)

skn 12

6-10 mm — House longhorn beetle (p. 44)

6-10 mm — Violet tanbark beetle (p. 46)

5-8 mm — Red-brown Longhorn Beetle (s. 50) · Wood Wasp (p. 59)

2-3 mm — Hadrobregmus pertinax (p. 52) Common Boring beetle (p. 51)

1-2 mm — Powder-post beetle (p. 54) Common Boring beetle (p. 48)

in 1 Exit holes from various insects. Shown in natural size.

in 2 House longhorn beetle – adult insect. (Photo: Protox)

in 3 House longhorn beetle – larva and frass. (Photo: Hussvamp Laboratoriet)

in 4 Red-brown Longhorn Beetle – adult insect. (Photo: Protox)

in 5 Violet tanbark beetle – adult insect. (Photo: Biopix)

Common furniture beetles – adult insect. (Photo: Protox)

in 6

Deathwatch beetle – adult insect. (Photo: Wikimedia)

in 7

Hadrobregmus pertinax – adult insect. (Photo: Wikimedia)

in 8

Wood wasp – adult insect. (Photo: Biopix)

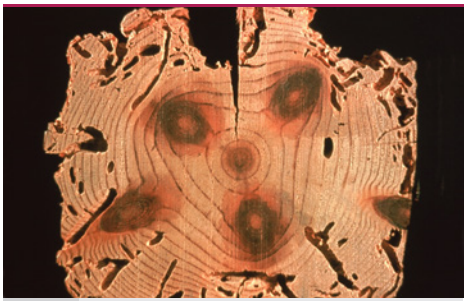
in 9

Hercules Ant. (Photo: Dreamstime)

in 10

Plasterer bees – adult bees. (Photo: Christophe Quintin, Fr.)

in 11



in 12 House longhorn beetle – larval passages in beam cross-section. (Photo: Protox/Gori)

in 13 House longhorn beetle – exposed larval passages. (Photo: Protox/Goritas)

in 14 Red-brown Longhorn Beetle – exit holes in door frame. (Photo: Protox/Goritas)

in 15 Red-brown Longhorn Beetle – larva, frass and decomposed wood. (Photo: Protox/customer photo)

in 16 Common furniture beetles in floorboard - exit holes and larva passages exposed due to planing. (Photo: Protox)

in 17 Common furniture beetles – exit holes in table legs. (Photo: Protox)

Violet tanbark beetle – gnawing tracks in conifers between the bark and the tree's outermost annual rings. (Photo: Hussvamp Laboratoriet)

in 18

Deathwatch beetle – exit holes in beam. (Photo: Protox)

in 19

Orange ants – decomposed floorboards. (Photo: Protox/customer photo)

in 20

Ant nest – typical cardboard ant nest. (Photo: Protox/Goritas)

in 21

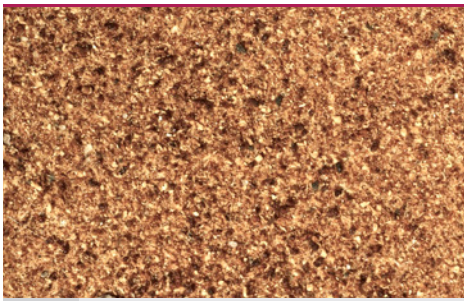
Hercules ants – decomposition (galleries) of wood. (Photo: unknown)

in 22

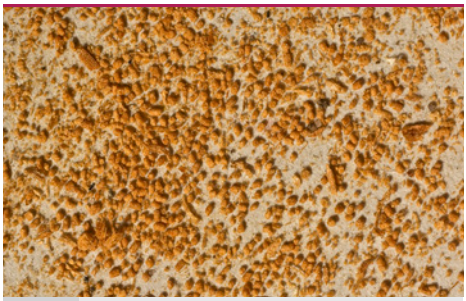
Plasterer bees – joints in masonry partially broken down. (Photo: Protox)

in 23

in 24 House longhorn beetle – frass, note characteristic plug-shaped excrement. (Photo: Protox/Goritas)

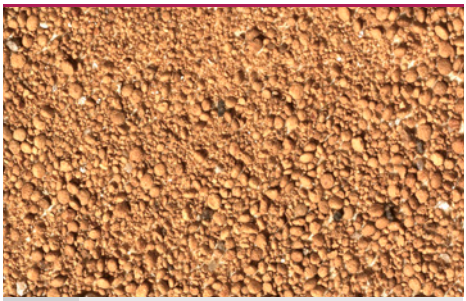


in 25 Violet tanbark beetle – dark frass from the bark mixed with light particles from the tree's outer rings. (Photo: Protox/Goritas)



in 26 Red-brown Longhorn Beetle – frass. (Photo: Protox/Goritas)

in 27 Common furniture beetles – frass. (Photo: Protox/Goritas)



in 28 Deathwatch beetle – characteristic lenticular excrement. (Photo: Protox/Goritas)

in 29 Hadrobregmus pertinax – frass. (Photo: Protox/Goritas)

sv 1

Dry rot fungus – fruiting body in window sill/clearance – note shrinkage in window frame/pos.

sv 2

Dry rot fungus – young fruiting body. (Photo: Goritas)

sv 3

Dry rot fungus – older greyish surface mycelium with stringy mycelium. (Photo: Protox)

DRY ROT FUNGUS (Serpula lacrymans)

Occurrence

Dry rot fungus can occur anywhere in the building in connection with brickwork and woodwork, concrete, plasters, insulation, etc. Attacks by dry rot fungus typically occur in connection with leaks in roof coverings, worn-out gutters and downspouts, leaky wells and infiltration of ground moisture.

Once the house fungus has started, it can use its special stringy mycelium to pick up and transport water over greater distances and thereby moisten new parts of the construction. This allows it to continue its growth and eventually spread from the basement to the attic. Dry rot fungus can spread far into the hidden structural parts of the building, for example behind panels, in the cavity wall, in the joints in the brickwork, behind the built-in joists, etc., before the attack is discovered.

Dry rot fungus forms oxalic acid to break down the hard hemicellulose coat of the wood cells so that it has access to the cellulose fibres. To regulate the acid balance, the fungus needs lime from joints, bricks, plaster or mineral wool, even polyurethane foam.

Dry rot fungus prefers stagnant moist air, a wood moisture percentage of between 20-30% and a temperature below approx. 25°C. Growth stops when the temperature rises above 25°C, and the fungus dies when the temperature passes 37°C. On the other hand, it can grow even at freezing point.

Dry rot fungus is, under optimal conditions, a very aggressive wood-decomposing fungus. Where other wood-decomposing fungi can take many years to break down the wood, in the case of an attack by dry rot fungus, total breakdown of the attacked wood is often seen within a few months, even with heavily dimensioned wood.

Fruiting body

Fruiting bodies from dry rot fungus are frequently seen during attacks in buildings. When the fruiting bodies are seen, the attack is usually well advanced. Even if the attack is found in dark structures, the mycelium seeks light where the fruiting body is formed – for example at a basement window, on a step, a skirting board or around a fluorescent tube. The fruiting body is often shaped like a flat disc, orange or cocoa brown in the middle and with a thickened white border around it. In some cases, bracket formations are also seen. The brownish colour is due to the many millions of spores that the house fungus produces to reproduce. Therefore, brown to orange-brown, dusty coatings are often seen around skirting boards, panels etc. deposited by a fruiting body somewhere in the construction.

Mycelium
In completely fresh infestations, strong development of a wadded, snow-white mycelium is seen, often with lemon-yellow water droplets. When the mycelium becomes slightly older, the colour changes to greyish. Gradually thicker strands form. In well-developed house fungus attacks, metre-long, pencil-like strings are often seen. Characteristic of the string mycelium is that when it dries out it becomes stiff and hard and can be broken with a snap. String mycelia from other wood-decomposing fungi do not have this property.

Sometimes, instead of stringy mycelium, a greyish, parchment-like mycelium is seen, which can be pulled from the wood or masonry in flakes. This surface mycelium is typically seen on the underside of floorboards, panel backs, etc.

Decomposition
During decomposition, the wood loses most of its weight and it cracks across the fibre direction (brown rot, see page 5) with 5-10 cm large crack blocks as a result, often mixed with greyish mycelium and strings. Both splinter and core break down.

Fighting
Method B (see page 40).

WET ROT FUNGUS (Coniophora puteana)

Occurrence
Wet rot fungus is the most common fungus species among the wood-decomposing fungi in buildings. Wet rot fungus occurs in both softwood and hardwood and in virtually all types of wooden constructions. However, the fungus is particularly common in joist layers above basements and in built-in wooden parts, e.g. straps, rafters and joist ends. Yellow wood fungus is often to blame for a slow breakdown and weakening of strength, but with optimal temperature and moisture conditions, the breakdown happens quickly. Bricked-in beam ends can be completely broken down, so that structural failure occurs.

Wet rot fungus prefers a temperature of 23°C and moderate wood moisture (22–30%), but it can also break down wood with a moisture content down to 15–18%. Wet rot fungus can survive for several years in drought dormancy. If the humidity exceeds 15%, the fungal attack can start again. Wet rot fungus can withstand wood moisture of up to 80% before it drowns.

Fruiting body
Fruit bodies are rarely seen in buildings. It is pressed onto the

Dry rot fungus – spore powder on floor (from fruiting bodies on wall). (Photo: Protox)

sv 4

Dry rot fungus- crevice blocks. (Photo: Protox/Gori)

sv 5

Wet rot fungus – fruiting body. (Photo: Goritas)

sv 6

sv 7 Wet rot fungus – dark brown serpentine string mycelium on glulam beam. (Photo: Protox)

sv 8 Wet rot fungus – leaf decay (fungal damage). (Photo: Protox/Goritas)

sv 9 Wet rot fungus – log broken down with an intact surface. (Photo: Goritas)

substrate, 0.5-2 mm thick. At first yellowish with a white border, later warts appear in the middle of the fungus, which are gradually coloured brown by the spores.

Mycelium

Surface mycelium is often found where the humidity is high on the back of cupboards, baseboards in basements, wooden laths in front walls, etc. The mycelium is typically serpentine string-shaped or thin fan-shaped. First light cream-coloured, yellowish, later brown to almost black. The older, string-shaped mycelium is dense, pressed against the substrate and is quite firmly attached to the wooden or masonry surface. At low humidity, the mycelium is not visible on the surface. If wood attacked by wet rot fungus is in contact with masonry, surface mycelium is often seen in the form of light to dark brown strings in the joints right around the infested wood. The bright stringy mycelium can be confused with infestation by dry rot fungus and should be examined by specialists.

Decomposition

Wet rot fungus can take several different forms of decomposition. It always forms brown rot, (see page 5) where the wood cracks across the fibre direction, but the appearance of the crack blocks varies depending on the growth conditions. Often rectangular 10-50 mm fissure blocks are formed, largest at high humidity and smallest at low humidity. Under particularly optimal conditions, the decomposition can cause a characteristic, leafy structure, where the wood splits lengthwise along the annual rings. It often happens that wet rot fungus breaks down the wood from the inside, but leaves the surface of the wood intact. This is often seen in beams in older crawl spaces, poorly ventilated beams above ground (summer houses) etc. This type of attack can be revealed by dents and depressions in the surface if you shine a light along the beam. If you knock on the beam or stick an awl into the beam, you will be able both to hear and feel that the beam is weakened.

Insurance

At a temperature of around 23°C and a wood humidity of 30-50%, brown rot with shrivelling cracks can form at a distance of 1-2 cm, alternatively leafing of the annual rings. The wood breaks down relatively quickly, and the damage is covered by fungus insurance. With low, but year-long exposure to humidity, wet rot fungus forms smaller, rectangular fissure blocks with 3-10 mm between the shrinkage cracks. This type of decomposition will typically be characterised as rot.

Fighting

Method A (see page 40).

WHITE WOOD FUNGI IN GENERAL

White wood fungi include several species of fungi with some characteristic features in common. They belong to a group of fungi that form porous fruiting bodies. The designation of mine fungus is used for 2 species. In buildings, the most frequent species are mine fungus (Antrodia sinuosa), another mine fungus (Antrodia vaillantii), serried crust fungus (Antrodia serialis) and pale yellow fungus (Antrodia xantha).

MINE FUNGUS (Antrodia vaillantii)

Occurrence
Attacks conifers. Often seen in connection with heavy moistening of e.g. floor separations under bathrooms, around leaky water installations in wet rooms, downspouts and other moistened cavities. Prefers high humidity, i.e. 40-50% wood moisture in closed structures and a temperature of 28°C. Can handle up to 35°C.

Fruiting body
The fruiting body is white, calcareous, contagious and crusty. It is formed in the strong, white stringy mycelium. It is up to 4 mm thick with round or angular pores, 2-4 per mm, 3 mm deep.

Mycelium
The surface mycelium is strong, fan-shaped, velvety, snow-white. At high humidity, stringy mycelium is formed, which grows on the decomposed wood and between crevice blocks. In addition, the mycelium can overgrow brickwork and thereby be easily confused with dry rot fungus, which is why it should be examined by specialists. However, the strands retain their elasticity when dry and cannot be broken with a bang.

Decomposition
Brown rot is formed (see page 5) with strong fissure blocks of 3-5 cm.

Insurance
Decay caused by Antrodia vaillantii would normally be considered a fungal injury. However, often the fungus grows over an old rot damage, and it will then be the one that counts.

Fighting
Method A (see page 40).

Mine fungus – fruiting bodies, surface mycelium and crevice blocks in floor joists. (Photo: Bøgh & Helstrup)

sv 10

Mine fungus – fruiting body. (Photo: Protox/Goritas)

sv 11

Mine fungus – crack bricks. (Photo: Goritas)

sv 12

sv 13

Mine fungus – decomposed wood (brown rot) and surface mycelium. (Photo: Protox/Goritas)

sv 14

Mine fungus – fruiting bodies and surface mycelium. (Photo: Bøgh & Helstrup)

sv 15

Serried crust fungus – sterile fruiting bodies developed in the dark. (Photo: Protox/Gori)

MINE FUNGUS (Antrodia sinuosa)

Occurrence
Attacks conifers. Often seen on exterior wood, e.g. in window wood and wood in roof constructions. They thrive best at 35-55% wood moisture and a temperature of around 28°C, but can also grow at low temperatures. Can handle up to 40°C. Can survive desiccation up to 7 years.

Fruiting body
The fruit body is pressed flat against the tree with approx. 5 mm wide elongated pores, first whitish, later light brown. The pores are round or angular, 1-3 per mm and 5 mm deep, sometimes toothed.

Mycelium
Does not normally form surface mycelium, but in areas with high wood moisture a weak fan-shaped mycelium may form.

Decomposition
Forms brown rot with smaller fissure blocks of 1-1.5 cm.

Insurance
In the case of rapid decomposition, the attack is termed fungal damage. Often the fungus grows over an old rot damage, and it will then be the one that counts.

Fighting
Method A (see page 40).

SERRIED CRUST FUNGUS (Antrodia seralis)

Occurrence
Attacks conifers. Often seen on wood in roof structures, crawlspaces, etc. It thrives best at 35-55% wood moisture and a temperature of around 28°C. Can survive desiccation up to 7 years.

Fruiting body
Fruiting bodies developed in light are console-like with pores of 0.5-2 mm. They often sit in rows above each other. The colour is whitish to light brownish. See also page 15, photo 8. When the fruiting body develops in the dark, cauliflower-like sterile fruiting bodies are formed instead.

Mycelium
Does not normally form surface mycelium, but in areas with high wood moisture a weak fan-shaped mycelium may form.

Decomposition
Forms brown rot with smaller fissure blocks of 1-1.5 cm

Insurance
Decomposition caused by serried crust fungus would normally be considered a fungal injury.

Fighting
Method A (see page 40).

GILLED POLYPORE

- Common gilled polypore (Gloeophyllum abietinus)
- Rusty gilled polypore (Gloeophyllum sepiarium)
- Brown-rot fungus (Gloeophyllum trabeum)

Occurrence
Attacks conifers, where brown mould forms in both sapwood and heartwood. Can grow at temperatures from 5-35°C, tolerates up to 70°C. Optimal wood humidity is 30-50%. Tolerates many years of drying out, but growth stops at wood moisture below 15%. Often seen on sun-kissed dark-coloured wood and, as the only fungus, can survive on black-painted wood and in wood veneer, ridges and under-roof boards coated with roofing felt. Seen on (dark-painted) window frames, protruding beam ends, round logs in houses and playground equipment, in build-uptake, etc. Also seen in pressure-treated beams, where rainwater through drains on the upper side leads fungal spores to the untreated heartwood.

Fruiting bodies
The fruiting body is corky, compressed or console-shaped, 2-10 cm in diameter. As a young orange/light brown with a lighter edge, the surface striated, later smooth, striated. The pores are labyrinthine, 5-20 per cm. The fruiting body is annual, but remains in place for several years. In the dark, sterile, sponge-like sterile fruiting bodies can form.

Mycelium
Tough, warm brownish surface mycelium may occur. Often seen on the underside of the wood veneer in roofing felt. In closed constructions, e.g. build-up roofs, brown-rot fungus forms cork-like mycelial cushions.

Decomposition
Both splinter and core break down. It is often only discovered when fruiting bodies break out on the surface of the tree. During the breakdown, 2 types of breakdown are often seen: Small/medium-sized fissure blocks and leafing of the tree's annual rings. During leafing, the wood dissolves in the annual rings, so that the decomposed wood appears as layered leaves. Very small fissure blocks are visible on the leaves.

Insurance
In good growing conditions, the breakdown of the wood takes place relatively quickly and this is fungal damage.

Fighting
Method A (see page 40).

Gilled polypore – fruiting bodies on covering tree, holiday home. (Photo: Protox)

sv 16

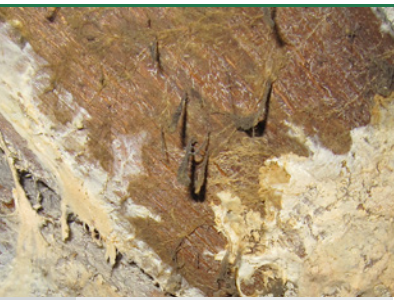
Gilled polypore – sterile fruiting bodies/brown surface mycelium developed in darkness in flat roof. (Photo: Protox/Gori)

sv 17

Gilled polypore – decomposition with typical leafing of the annual rings, log house. (Photo: Protox)

sv 18

sv 19 Tapinella – fruiting bodies. (Photo: Protox/Goritas)



sv 20 Tapinella – curry-yellow fine-stranded surface mycelium. (Photo: Bøgh & Helstrup)

TAPINELLA (Paxillus panuoides)

Occurrence
Tapinella rarely occurs in buildings. When an attack by this fungus occurs, it occurs in connection with heavily moistened wood, e.g. leaky gutters, floor timbers over damp, poorly ventilated crawl-spaces, areas with leaking water pipes or heavy condensation. Outdoors, for example, railway sleepers, wooden bridges, damp balcony wood and wooden garden furniture are attacked. The tapinella fungus usually attacks conifers, but can occasionally attack hardwoods.

Its development is dependent on high wood moisture, but the temperature is also an important factor.

The fungus's living conditions are optimal at a wood humidity of 50-70% and in a temperature range between 23°C and 26°C. However, growth is possible between 5°C and 29°C, and even below 5°C some growth may occur. That is why tapinella can also occur in wooden constructions with very low temperatures, for example in cold stores. In dry wood (8% wood moisture), the fungus can survive for over a year, depending on the temperature. Tapinella belongs to the slow-growing wood-destroying fungi which, under favourable living conditions, cause considerable wood destruction. At 23°C, tapinella grows approx. 2 mm per Day.

Fruiting body
In the final stage of the attack, fruiting bodies may appear in a clam/fan shape. The fruiting bodies produce spores and in this way ensure the spread of the fungus.

Mycelium
Normally, tapinella forms only a sparse surface mycelium, from which thread-fine strands can develop. Masonry in contact with infested wood can become infected by mycelium.

Decomposition
Infested wood gradually becomes discoloured according to the colour scale yellow, reddish, dark brown, after which the decomposition becomes visible with the formation of elongated fissure blocks.

Insurance
Attacks caused by tapinella will usually be referred to as fungal damage.

Fighting
Method A (see page 40).

COMMON JELLY SPOT FUNGUS

(Dacrymyces stillatus)

(Ditiola radicata)

Occurrence

The common jelly spot fungus and ditiola radicata belong to the Dacrymycetaceae group, which consists of several species. In buildings, it is most often the common jelly spot fungus or ditiola radicata fungus that we come across. The two fungal species occur on wood in the open, e.g. windows, stern boards, wooden cladding, etc., which are exposed to changing moisture levels over a longer period of time.

Fruiting body – decomposition

Common jelly spot fungus breaks down the wood from the inside and only makes itself known late in the form of small orange/red blisters (fruiting bodies) on the surface of the wood. In dry conditions, the fruiting bodies shrink and are rarely detected – it is therefore a frequent occurrence that old overpainted fruiting bodies can be found on decomposed wood.

Ditiola radicata also breaks down the wood from the inside and only makes itself known late in the form of small yellowish and stemmed fruiting bodies on the surface of the tree. The infested wood has a very characteristic and sharp, chewing gum-like smell.

Decomposition

The two fungi break down the wood into very small fissure blocks and sometimes have a character like "potting soil".

Insurance

Decompositions caused by these rotting fungi usually take place so slowly that in terms of insurance they must be assessed as rot damage. In special cases, however, the fungus can in a very short time cause a breakdown and weakening of the strength of the construction wood, which is why the breakdown is characterised as a fungus.

Fighting

Method A (see page 40).

Common jelly spot fungus on exterior woodwork. (Photo: Goritas)

sv 21

Common jelly spot fungus – fruiting bodies on exterior woodwork. (Photo: Goritas)

sv 22

Ditiola radicata – fruiting bodies on exterior woodwork. (Photo: Protox)

sv 23

sv 24 Cohesive aspen bracket fungus- fruiting body. (Photo: Protox/Goritas)

sv 25 Cohesive aspen bracket fungus - decomposed wood (white rot) and tufts of curry yellow surface mycelium. (Photo: Protox/Goritas)

sv 26 Cohesive aspen bracket fungus - decomposed wood (white rot) with a brownish coating. (Photo: Protox/Goritas)

COHESIVE ASPEN BRACKET FUNGUS
(Phellinus contiguous)

Occurrence
Cohesive aspen bracket fungus is found both in buildings and freely in nature, where it attacks both hardwood and conifers. In buildings, it occurs in connection with leaks and leaks in roof constructions, floors, half-timbering, windows and doors. If there is heavy moisture, serious and deep decomposition damage is often seen. Withstands drying out. It thrives best at 28°C.

Fruiting body
The fruiting body is seen as a thin brownish crust with irregular elongated pores. Relatively rarely seen in buildings.

Mycelium
Forms a characteristic light brownish rockwool-like mycelium which can be seen in the decomposed fibrous wood.

Decomposition
The affected wood decays in a light brown, stringy structure (white rot, see page 5).

Insurance
Decay caused by Cohesive aspen bracket Fungus would normally be considered fungal damage.

Fighting
Method A (see page 40).

CRUST FUNGUS
(Physisporinus vitreus)

Occurrence
Physisporinus vitreus occurs freely in nature and was common in wooden overhead line masts. It has caused major problems in wooden foundation piles, e.g. in central, historic Copenhagen after groundwater lowering. The fungus attacks wood with high wood moisture up to 120%. The mycelium dies when it is flooded with groundwater, but the resting bodies of the fungus remain alive for many years and sprout again if the stake is laid dry. Physisporinus vitreus thrives best at 28°C, but can grow at 8°C. Suspicion of physisporinus vitreus attack may only arise when a pile-based building begins to settle and crack. At this point, the attack is so advanced that repair becomes very costly. In areas with pile foundations and the risk of groundwater subsidence, it will therefore be advantageous to check the foundation and the groundwater level by digging down through the basement floor. Due to the location of the damage, fighting and repairing an attack is difficult and expensive.

Fruiting body
Fruiting bodies are sometimes seen on basement walls and in drains above infested pile foundations. The fruiting body is 3-6 mm thick, whitish and waxy when young, ochre-coloured when older. Pores round, 3-6 per mm.

Mycelium
In the orange rot stage, many mycelial formations are seen, initially white, eventually brown and hard.

Decomposition
The infested wood first becomes pale, gradually becoming reddish

cavity rot (chambered rot), the texture is like orange flesh. The wood thereby becomes highly water-absorbent and eventually breaks down completely into a fibrous, later gel-like mass. This destroys the bearing capacity of the foundation piles.

Insurance
Fungal insurance policies usually have reservations for fungal attacks in pile foundations.

Fighting
Depending on the state of the attack, there are different methods for combating it, e.g. cutting off the piles below the water table and casting concrete columns between the piles and the foundation, establishing new concrete piles, etc.

Methods have been developed for post-impregnation of piles.

Crust fungus – Fruiting body.
(Photo: Frank Abrahamsson from fugleognatur.dk)

sv
27

Crust fungus –Decayed wood.
(Photo: Protox)

sv
28

sv 29 Bark fungus (white rot) in window frame. (Photo: Protox)

sv 30 Bark fungus (white rot) in the window sill. (Photo: Goritas)

BARK FUNGUS (Corticeaceae)

Occurrence
Bark fungi are a very large group of fungi. Common to a number of bark fungi is that they prefer constant high wood moisture and are therefore mainly found in building constructions with a high moisture content due to poor ventilation or leaks. For example, in poorly ventilated attics and in window areas with leaky corner joints, leaky glass strips, etc.

Most bark fungi thrive best at a temperature of around 28°C or lower. Therefore, in contrast to gilled polypore, which prefers a temperature of around 35°C, they are rarely seen on windows with dark paint.

Fruiting body
Fruiting bodies are typically quite thin to a few millimetres thick, waxy or stearinous, whitish to ochre-coloured.

Mycelium
A whitish, thin cobweb-like mycelium is often seen in poorly ventilated roof spaces. It can be confused with mould growth.

Decomposition
All the bark fungi form stringy white rot and some species can cause severe decay, whereas other species cause only minor damage to the tree.

Insurance
With high wood moisture, some bark fungi can break down wood very quickly. The damage is then assessed as fungal damage. In less than optimal conditions, the decomposition occurs slowly, and the damage is assessed as rot damage.

Fighting
Method A (see page 40).

Characteristics
In the following, the characteristics of different species of bark fungi are reviewed.

- Downy Limeskin
- Found in both softwood and hardwood.
- Typically seen in wind sheaths, stern boards, windows and doors as well as in floor constructions. Often occurs together with other fungus species.
- No surface mycelium is formed. Membranous fruiting bodies are seen in summer and autumn. The colour can be from whitish to

light ochre. The surface weakly hairy. Stringy white rot.

- (Hyphoderma praetermissum)
  Found in both softwood and hardwood. Seen in the same places as Hyphoderma puberum. No surface mycelium is formed. Fruiting body smooth, thin and waxy. First whitish, later yellowish. Fibrous white rot.
- (Hyphodontia alutaria)
  Attacks spruce and pine. Rare in hardwood. Found in poles and wood with ground contact. In buildings, frequent in windows and exterior woodwork. Hyphodontia alutariapresumably prefers lower temperatures than the other bark fungi. No surface mycelium is formed. The fruiting body is membranous with a finely spiky surface, light to dark ochre. Chambered and stringy white rot.
- (Resinicium bicolor)
  Common on conifers, rare on hardwoods. In buildings, it is found on moist wood, often in contact with the ground. Typically by thin, chalky stringy mycelium surrounded by a bright trace of calcium oxalate crystals. Fruiting body white, finely prickled, appressed. Fibrous white rot.
- (Phlebiopsis gigantea)
  Attacks conifers. Common on green building timber and often seen on stacked wood. When drying out, the fungus dies before the tree is damaged. In buildings, Phlebiopsis gigantea is seen in poorly ventilated floor constructions made of green, damp timber. Conspicuous, greyish-white, woolly mycelium that is highly absorbent. Can often be wiped off by drying out, but if there are yellow or brownish streaks, the wood must be discarded. Fruiting bodies large, up to 0.5 m long, transparent, waxy, pale yellow, surface irregular. The fresh fruiting body is pressed against the substrate, when it dries out it rolls backwards along the edges. Where the mycelium is found inside the tree, fibrous white rot is formed.
- Star-haired bark fungus
  Found on both coniferous and deciduous trees, on dead leaves and on clay soil. Star-haired bark fungus is more temperature tolerant than other bark fungi and thrives both in cold, damp basements and under roofing felt. Common in damp roof constructions as well as in damp basements, where it can grow over masonry and break down joists in decks. Occurs most often together with other fungi, e.g. Common Rot, Wet rot fungus, Blue stain fungus, Hindesvamp and Hadrobregmus pertinax. The membranous, cream or ochre-yellow fruiting bodies are seen

Bark fungus in frame wood. (Photo: Goritas) sv 31

Star-haired bark fungus. (Photo: Hussvamp Laboratoriet) sv 32

Star-haired bark fungus. (Photo: Protox/Goritas) sv 33

sv 34 Trechispora farinacea. (Photo: Hussvamp Laboratoriet)

sv 35 Osterhat – fruit bodies. (Photo: Wikimedia)

on timber and masonry. The stringy mycelium, which can grow over masonry, is light brownish, 1-2 mm thick and resembles the stringy mycelium of dry rot fungus – however, it cannot be broken with a blow. White rot.

- (Trechispora farinacea)
  Attacks all types of wood, but mostly conifers in buildings. Common in connection with leaks in roof constructions, e.g. rafters and behind gutters. Also found on exterior woodwork. White stringy mycelium on the wood surface and cavities. The mycelium is completely pressed to the surface, diameter up to 1.5 mm. Reminiscent of string mycelium from dry rot fungus. Together with the mycelium, fruiting bodies are usually seen as white, finely gritty/spiky coatings. White rot.

COMMON OYSTER MUSHROOM
(Pleurotus ostreatus)

Occurrence
In the wild, Common Oyster mushroom is common on poplar, willow, birch and beech. It is quite rare on conifers. In buildings, it can be found in roof constructions under leaky gutters, in poorly protected facade cladding made of chipboard and similarly moisture-laden places.

Fruiting body
The fruiting bodies, usually formed in light, are oyster- or clam-shaped caps, 5-30 cm in diameter, sitting on a short, juxtaposed cane. The caps are smooth, ash grey to grey brown. The lamellae white. Also considered a good edible fungus.

Mycelium
Forms a tough white surface mycelium.

Decomposition
The wood decays to a fibrous structure, sometimes with a leafy structure. Typical white rot (see page 5).

Insurance
Decomposition caused by Common Oyster Hat is usually assessed as fungal damage.

Fighting
Method A (see page 40).

FUNGI THAT DOES NOT DECOMPOSE THE WOOD

You sometimes see the presence of various non-wood-decomposing fungi in buildings. Like all fungi, they require moisture, and even if they do not damage the construction, they can be signs of leaks or inappropriate constructions.

FIRERUG INKCAP (Coprinellus domesticus)

Occurrence
In buildings, firerug inkcap lives in the pipe layer behind plastered skunk walls and ceilings. It requires moisture and is only found directly under leaks.

Fruiting body
The first thing you see about the firerug inkcap is usually the fruiting bodies. The small, whitish-yellow, stalked cap fungi with 5-7 cm high thin sticks appear on the moist plaster surface. The cap is initially egg-shaped, gradually it opens and becomes bell-shaped, and finally rolls up from the edge as it releases the black spores as an ink-like liquid.

Mycelium
When the plaster falls down, you see a dense, coconut mat-like tough and orange-brown mycelium, sometimes with black strings. It is an asexual stage of the fungus called Ozonium.

Decomposition
Firerug inkcap does not degrade wood, but it weakens the pipe layer used to hold the plaster, which can fall off.

Insurance
Attacks by firerug inkcap are not covered by fungus insurance.

Fighting
Method C (see page 41).

CELLAR CUP FUNGUS (Peziza cerea)

Occurrence
Cellar cup fungi are very common in nature. They require high humidity, and in buildings they can be found in connection with leaks and improperly constructed wet rooms, often with leaking downspouts. They can grow on carpet, plaster, wood or brick substrates.

Fruiting body
Cartilaginous brittle fruiting bodies up to 10 cm high, cup-shaped, split laterally, grey-white to yellowish-brown. The upper side matte. Attaches to the substrate with a small stalk.

Firerug inkcap – fruiting body and orange-brown tough asexual ozonium. (Photo: Protox/Goritas)

sv 36

Firerug inkcap – dried fruiting bodies on a plastered wall. (Photo: Goritas)

sv 37

Cellar cup fungus
- fruiting body on plastered wall.
(Photo: Bøgh & Helstrup)

sv 38

Mycelium
Does not form visible surface mycelium.

Decomposition
Cellar cup fungus does not decompose wood. But it is a clear sign that there are moisture problems.

Insurance
Cellar cup fungi are not covered by fungus insurance.

Fighting
Method C (see page 41). It is important to check for signs of other fungal species in nearby wood.

SLIME MOULD (Myxomycetes)

Occurrence
Seen in buildings most often on moistened internal door and window frames. The laminated wooden sections on sliding doors are typically attacked by slime mould when the glue escapes between the wooden staves and moisture can penetrate the construction.

Fruiting body
Fruiting bodies can develop in a short time and appear as egg-like structures. After a short time, the fruiting body bursts and the coffee powder-like spores sprinkle out.

Mycelium
Does not form visible surface mycelium.

Decomposition
Slime mould does not degrade wood. But it is a clear sign that there are moisture problems.

Insurance
Slime moulds are not covered by fungus insurance.

Fighting
Method C (see page 41). It is important to check for signs of other fungal species in the wood. Decomposition caused by, for example, bark fungi is often seen (see pages 34-35).

sv 39 Slime mould – ruptured fruiting body with spore powder. (Photo: Protox)

sv 40 Slime mould – young fruiting body in delaminated window frame. (Photo: Protox)

BLUE STAIN FUNGUS

Occurrence
Blue stain fungus is a common term for several discoloured fungal species, which typically belong to asexual (moulds) and sexual stages of the ascomycetes. The moulds normally grow on the surface, which can become discoloured, but in special cases they can grow deep into the wood's cells and be the cause of the discolouration known as blue stain fungus due to the characteristic blue colouring of the wood. The blue splinter fungi live on moistened wood, e.g. has been lying for a long time in the forest before cutting, water-stored or rafted wood. Certain species of blue mould attack newly felled wood, others grow on cut wood, and sooty mould (Aureobasidium pullulans) is found on processed wood in buildings. Certain species have developed resistance to copper and other toxins and thrive on pressure treated wood.

Fruiting body
The moulds do not form fruiting bodies, but ascomycete of the genus Ophiostoma form small (< 0.1 mm in diameter) spherical fruiting bodies with a beak-like stalk.

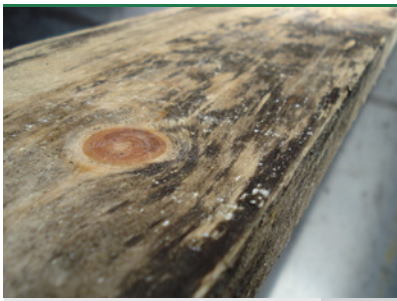
Mycelium
On the surface of the wood, mycelia can arise from dark colonies of mould species.

Decomposition
Blue stain fungus does not break down the wood, but makes it more water-absorbing and thus more exposed to wood-destroying fungi and rot. When vacuum impregnating wood with blue stain fungus, the affected areas can absorb so much turpentine that it becomes flammable and the paint does not bond well.

Identification
The dark cells of the fungi shine through the light sapwood in a bluish colour from the surface and towards the core of the tree across the rings. Often, the fungi are seen as coatings that look like soil erosion.

Insurance
Fungal insurance policies do not cover attacks by blue spot fungi

Fighting
Method C (see page 41).



Blue stain fungus.
(Photo: Protox)

sv
41

Blue stain fungus – note profound discolouration across annual rings.
(Photo: Protox)

sv
42

See www.protox.pro or use the QR code and get more information about Protox Svamp.

See www.protox.pro or use the QR code and get more information about Protox Kombi Aqua.

METHODS FOR REMEDY OF FUNGAL ATTACK WITH PROTOX

Method A – wood-decomposing fungi, which depend on a constant supply of moisture.

Control/prevention with Protox Svamp/Protox Kombi Aqua
Remove the moisture source and reduce the wood's moisture percentage to max. 15% before the structure is closed again.

Degraded wood is cut away and replaced with new – possibly pressure impregnated wood (NTR class AB). Cut surfaces and surfaces of old and new wood are impregnated with Protox Svamp or Protox Kombi Aqua. Superficial infestations can be cut off and treated with Protox Svamp or Protox Kombi Aqua.

Ensure that all masonry in contact with wood in the risk area is saturated with Protox Svamp.

Valve impregnation
In special cases, deep impregnation can be carried out in wood and masonry with post-impregnation valves. Contact us for further information.

Method B – ungi which are partially self-sufficient in water – especially dry rot fungus

Living mycelium from dry rot fungus can transport water to a dry area in the building and there moisten the wood and then attack and break it down.

It is therefore very important to find the total extent of damage before you can start the actual fight against the house fungus attack. If an area with an attack of dry rot fungus in the building is overlooked, the entire remediation may end up being wasted. It is therefore necessary to carry out a systematic investigation of the extent of the attack and draw up a treatment plan based on that. To ensure that all occurrences of mycelium are combated, is included a safety zone of 1 metre. It is recommended to contact a consulting firm specialising in scoping Dry rot fungus.

In woodwork:
The most common control method is probably still that all infested woodwork is removed from the building and then destroyed. It is replaced with new pressure-treated wood (NTR class AB). Cut surfaces of old and new wood are impregnated with Protox Svamp. Saturation is best done by injecting with impregnation valves. Alternatively, dipping and/or repeated ironing or spraying is carried out.

In masonry:
Heavily attacked and weakened masonry is removed. On brickwork to be treated, plaster layers are knocked off. On heavily attacked walls with wood contact, eg beam ends, straps, window frames and stairwells, joints must be scraped out to a depth of 2-3 cm. Possibly. the brickwork is now set on fire with a blowtorch, whereby remnants of house fungus mycelium in the joints glow. Then treat with Protox Svamp and the brickwork is immediately grouted again. The treatment with Protox Svamp is repeated, after which the wall can be plastered or plastered. In the case of less in-depth attacks, scratching of joints may is omitted. If heavily infested masonry is not removed, a protective membrane with Protox Svamp must be placed around the infested area – either by treating masonry removed in strips, or by impregnation with impregnation valves.

Method C – Fungi that do not decompose the wood

The source of moisture is found and removed. Fungal growth is removed by brushing with a stiff brush or similar and the surface is saturated with Protox Svamp or Protox Kombi Aqua.

sk 1 Mould infestation – Trichoderma sp. in basement beam after pipe damage. (Photo: Protox)

sk 2 Mould growth on wallpaper – thermal bridge in north-west facing corner. (Photo: Protox)

sk 3 Mould growth in single-family house after extensive water damage. (Photo: Protox/customer photo)

MOULD

Occurrence

Moulds originate from nature and are found everywhere. Moulds are primitive fungi that are unable to form fruiting bodies. Under favourable conditions, the mould spores will germinate, grow out as hyphae (cell thread) and thus form a mycelium (fungal tissue) which can typically be seen as black, whitish, brownish or blue-green plaques on building materials, foodstuffs etc. Millions of new spores are formed in the mycelium and spread with the wind. During the winter months, the concentration of mould spores in the outdoor air is very low. During the spring, mould spores can again be detected in the outdoor air. In late summer, the highest concentrations of mould spores are seen, where many thousands of spores/m3 of outdoor air can occur. The mould spores are brought into the homes with the outside air and if the right conditions are present in the home, the spores will germinate and mould growth has started. Moisture is a prerequisite for mould growth. Damp is typically caused by poor living habits, condensation as a result of thermal bridges, leaky water installations, leaky climate screen, flooding and fire extinguishing water. Finally, combinations may occur. When the relative humidity in the home exceeds 75-85% over a long period of time, mould growth can occur. The temperature is also important. Most moulds grow best at 15-28°C. Some types can grow at low temperatures (5-10°C) while others can grow at high temperatures (50°C).

Mould growth can occur anywhere in the building as long as the right conditions are present. Building materials consisting of organic materials such as plasterboard, wallpaper, wood, veneer etc. are particularly exposed, but mould can also thrive on wet concrete and masonry. Ground rot, which is caused by black-pigmented mould, is typically seen at lower temperatures of e.g. thermal bridges, window openings, cold water pipes, etc. Insufficient cleaning in the home can also provide fertile ground for mould growth. The house dust consists of organic materials that the moulds can live on.

At elevated levels, moulds can be very bothersome to hypersensitive residents (read more at www.protox.pro).

Insurance

Unlike most building fungi, moulds cannot break down wood in buildings. On the other hand, moulds can discolour building parts and they can deteriorate the indoor climate in the home. Therefore, there will normally not be insurance cover for damage caused by mould, unless it is consequential damage or there is cover via transfer of ownership insurance.

CONTROL OF MOULDS WITH PROTOX

Cleansing with Protox Hysan

1. The surface is thoroughly vacuumed with a vacuum cleaner with a pollen filter (microfilter)
2. A solution of Protox Hysan and water is mixed in a flower or garden sprayer.
3. The mould-infested surface is sprayed with Protox Hysan the solution and the surface are worked thoroughly with a nylon brush until the mould attack is loosened from the surface. Consumption approx. 1/2 litre of working solution per m².
4. The processed surface is now rinsed clean with the solution from the flower/garden sprayer. This removes as much as possible of spores, particles and dirt from the surface.
5. If there is a musty smell from the mould attack, the "wet" Protox Hysan-treated surface must now stand for up to 1 day and work in the surface, whereby residual odours are oxygenated (oxidised). If there is no musty smell, skip to point 6.
6. The surface may be wiped off. with clean water.

If there is a risk of regrowth due to persistent or repeated wetting, to avoid regrowth, it can be post-treated with Protox Protect, Protox Akvagrund 2 or Protox Kombi Aqua. Read our product catalogue or contact Protox for further recommendations in the specific case.

Ensure good ventilation during treatment. For further instructions see www.protox.pro.

Prevention
Protox Protect is sprayed, painted or applied to the previously infested surface. On non-porous surfaces, Protox Protect can form a film. Therefore it is most suitable for absorbent surfaces, such as plastered surfaces, untreated wood, etc. Read more on page 71.

Sealing
In some cases, it is not possible – or it does not make sense – to remove the mould growth. In that case, a seal could be appropriate. Here, a surface film is applied that effectively retains the mould growth and prevents it from releasing particles and spores into the ventilation air.

Recommended in attics and generally in cavities outside the vapor barrier Protox Akvagrund 2 as a sealer, as Protox Akvagrund 2 is an approved wood preservative that, in addition to sealing existing mould growth, prevents new mould growth and wood-degrading fungi.

Inside the vapor barrier, "old" dry mould attacks can be sealed with Protox Sealer, which does not, however, have a preventive effect against new mould growth.

See www.protox.pro or use the QR code and get more information about Protox Hysan.

See www.protox.pro or use the QR code and get more information about Protox Protect.

See www.protox.pro for more information about Protox Akvagrund 2 og Protox Encapsulator.

i 1 House longhorn beetle – adult insect. (Photo: Protox)

i 2 House longhorn beetle – exposed larval passages with frass. (Photo: Protox/Gorita's archive)

i 3 House longhorn beetle – frass with characteristic wine cork-shaped excrement. (Photo: Protox/Goritas)

HOUSE LONGHORN BEETLE (Hylotrupes bajulus)

Occurrence

The house longhorn beetle occurs in Denmark mainly in the south-eastern part of the country (Bornholm, Lolland, Falster, South Zealand, South Jutland). In southern Sweden/Norway it is commonly found. For its natural spread, the house longhorn beetle needs warm summer days, where it can spread from house to house, but we ourselves can risk carrying "contagion" with the help of already infected timber, packing boxes or furniture. The house longhorn beetle can live in and on dry conifers (spruce and pine), but as these are the two preferred types of wood for structural timber (ceilings, floor partitions, etc.), our houses are vulnerable to attack. Timber in roof constructions is a favourite place for the house longhorn beetle, as temperatures are usually high in the summer. House longhorn beetle attacks most often occur in wood with a high moisture content, and the house longhorn beetle is most active at a wood moisture content of around 30%, but it can live in wood with a moisture content of between 10 and 60%.

Life cycle

The adult insects emerge in mid-summer to mate. After mating, the female seeks out deep crevices or cracks in the timber where she lays her eggs. It lays up to a few hundred eggs over a period of a few weeks, after which it dies.

When an egg hatches after 2-3 weeks, the larva bores into the tree through a very small hole. It lives in the wood zone of the timber for 3-6 years (in rare cases up to 10 years depending on temperature and humidity), but stays below the surface all the time, and does not attack the heartwood in pine.

As the larva eats its way through the wood, it packs the passage behind it with excrement (called frass) and small shavings. When the corridor crosses old corridors and exit holes, some of the frass may sprinkle out.

When the larva is fully developed, it seeks out near the surface, where it pupates, and transforms into an adult beetle within 1-2 weeks, gnaws the last little bit out through the surface and leaves the tree through the characteristic relatively large, frayed and oval exit hole.

The actual mating flight and thus the spread of the house longhorn beetle takes place on hot summer days, but if the right conditions are present, the house longhorn beetle is a good flyer and can therefore spread from house to house.

The first exit holes start to appear approx. 5 years after the attack has begun, when the adult insects leave the infested timber, and it is usually only then that it is established that there is an attack. Therefore, it can also be difficult to detect the attack before the exit holes appear. On a hot summer day, however, it will often be possible to hear the larvae gnawing in the wood.

The older the house (timber) becomes, the less likely it is that new infestations will occur, and after 70-80 years it is very unlikely that new infestations will occur in the old timber.

Damage effect

House longhorn beetle infestations can cause serious and profound damage to the timber. Often, only the heartwood will remain, and if the sapwood part of the timber is large, this will usually lead to a weakening of the strength of the construction.

Characteristics

- Adult insects: Large insect, body 10-20 mm long with 30 mm long antennae. There are 2 black shiny spots (bumps) on the front body and a grey hairy spot on each covert.
- Larvae: The larva is up to 30 mm long and 10 mm wide over the front part. It is light cream coloured. In the main part you can see 2 strong jaws with a tuning-iron style and on each side of the jaw part 3 small black dots.
- Frass: When the larva gnaws in the sapwood of the tree, it produces excrement in the form of light frass mixed with wine cork-like pellets run off at the ends and small pieces of flayed wood fibre.
- Exit holes: Characteristically oval-shaped approx. 6-10 mm long with a frayed edge at one end.

Fighting

If you have insect insurance on the house, it is important to contact the insurance company as soon as you suspect an attack by a house longhorn beetle, as such attacks are eligible for cover.

The control consists in removing the attacked and decomposed wood (dislodge the wood with the insects' walking systems). The preserved timber is then treated with Protox Insect in accordance with the treatment instructions. New timber, which is used to replace damaged timber, is also processed. In the case of very large timber dimensions, impregnation of the valve with the agent must be considered.

House longhorn beetle – adult insect. (Photo: Hussvamp Laboratoriet)

i 4

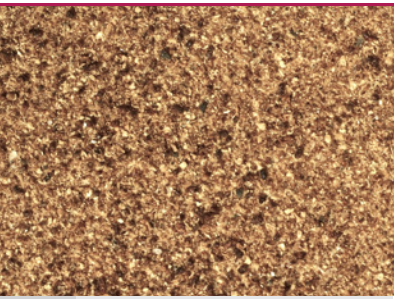
House longhorn beetle – larva in exposed larval passages, frass. (Photo: Hussvamp Laboratoriet)

i 5

See www.protox.pro or use the QR code and get more information about Protox Insekt.

i 6 Violet tanbark beetle – adult insect. (Photo: Biopix)

i 7 Violet tanbark beetle – gnawing marks in the tree's outer rings. (Photo: Hussvamp Laboratoriet)



i 8 Violet tanbark beetle – light and dark (salt and pepper) frass. (Photo: Protox/Goritas)

VIOLET TANBARK BEETLE (Callidium violaceum)

Occurrence

The violet tanbark beetle is very common and occurs everywhere in Denmark, Norway and Sweden, except in the northernmost regions. The violet tanbark beetle is only seen in conifer logs with bark, and only in the trap or extinct tree. The violet tanbark beetle therefore very often occurs in firewood stacks made of softwood, and is thus often dragged into the house. Likewise, bark-edged structural wood (posts, rafter fences, firewood shelters, etc.) will be exposed to attack. In the old days, attacks were often seen in thatched roofs, where full-barked timber was used for the roof construction. Debarked wood is not attacked by the violet tanbark beetle.

The violet tanbark beetle lives in (and off) the growth layer of the tree, which is the nutrient-rich layer immediately below the bark, the corridors are therefore seen largely equally in the bark and in the appendage just below the bark. In general, the violet tanbark beetle only causes very limited damage, as the attack does not go deep into the wood and therefore does not weaken the timber's strength. Since the violet tanbark beetle also only attacks timber with the bark on, it is normal not a problem in modern construction. Where bark-edged timber is used, the attack will stop when the entire growth layer under the bark is eaten or when the bark is removed.

Life cycle

The adult, sexually mature insects emerge in the middle of summer when the weather is warm and good, but can be lured out if the infested firewood for the stove is stored in the living room next to the stove or otherwise warm.

After mating, the female seeks out cracks in the bark of dead conifers, where she lays her eggs.

When the larva comes out of the egg, it gnaws its way down through the bark and continues in the growth layer just below the bark where it gnaws its way. If you remove the bark, you will be able to see that the aisles are like characteristic furrows in the wood, but with a corresponding "counterpart" in the underside of the bark.

The passage is filled up behind the larva with frass, and since the larva gnaws both in bark and wood, the sawdust is a mixture of undigested parts of both wood (light yellow particles) and bark (dark particles), in contrast to the house longhorn beetle's frass, which consists entirely of wood (solid light yellow).

The violet tanbark beetle larva gnaws in the tree for 1 to 2 years, after which it gnaws once 5-10 cm diagonally downwards in the wood and make a slightly larger passage there. This "pupal passage" is blocked off with roughly gnawed shavings, after which the larva pupates.

The adult violet tanbark beetle gnaws its way out through the bark layer, leaving a very regular and even, oval exit hole of approx. 4 x 6 mm.

Damage effect

Violet tanbark beetle attack does not cause the timber to weaken, as it only lives in the growth layer between bark and sapwood.

Characteristics

- Adult insects: The violet tanbark beetle is easily recognised by its beautiful violet-blue colour and its long, powerful antennae. The insect itself is 10-15 mm long, and the two sensing horns can each be up to the same length.
- Larvae: The larvae of the longhorn beetle are generally similar, they are pale, usually round in cross-section and slightly wider at the front than at the back, the body looks like it is made up of rings stacked on top of each other. In the head they have a pair of dark, powerful cheekbones.
- Frass: Light yellowish, but mixed with darker particles (from the bark).
- Exit holes: Characteristic oval approx. 4 x 6 mm, but in contrast to the house longhorn beetle's "sloppy" exit hole, the violet tanbark beetle's is smooth and very regular.

Fighting

The easiest way to fight the violet tanbark beetle is to remove the bark from the timber, thereby stopping the attack immediately. Alternatively, you can let the attack die out by itself, this happens at the time when there is no longer food for the violet tanbark beetle larva, i.e. when the entire growth layer under the bark has been eaten.

An attack of violet tanbark beetle is considered to be harmless, unless plates etc. have been attached. like directly on top of the infested bark area, in which case the violet buck could risk gnawing through this material on its way out of the timber.

i 9 Common furniture beetles – adult insect. (Photo: Protox)

i 10 Common furniture beetles – exit holes in table legs. (Photo: Protox)

i 11 Common furniture beetles – floorboard with exposed larva passages as a result of planing. (Photo: Protox)

COMMON FURNITURE BEETLES
(Anobium punctatum)

Occurrence

Common furniture beetles – also called furniture worm – occurs everywhere in Scandinavia, except in the very northernmost regions. Is more frequent in coastal areas with high humidity than in, for example, dry mountain areas. The furniture beetles larvae can live and develop in practically any kind of wood, except the hard tropical varieties and heartwood of our domestic species. They can live in plywood, fibreboard and they love willow. Even books that are kept moist can be home to the furniture beetles, which are then called "bookworms"!

The furniture beetles larvae thrive best in sapwood, where development is fastest at temperatures between 20oC and 25oC, and at a wood moisture content of 30% – corresponding to an air humidity of 100%. If the temperature rises above 30oC or below 14oC or the moisture content falls below the 10-15% that is normal in rooms heated all year round, the attack stops. The strongest attacks are therefore seen in damp but "warm" rooms such as kitchens, cellars, attics, stables, barns etc. Inside the house, furniture, skirting boards, picture frames etc. near cold/damp outer walls and floors are most exposed. In our climate, the furniture beetles also thrives outdoors in fences, planks, posts and other woodwork with a suitably high moisture content.

Life cycle

The adult, sexually mature insects hatch and gnaw their way through the surface from mid-June until early August. They are most active at night, when they crawl or, to a limited extent, fly around to mate. After mating, the female lays 20-60 eggs in cracks or old exit holes in the wood. The adult furniture beetles live only a few weeks and therefore die shortly after mating and laying eggs. 3-4 weeks after laying, the eggs hatch and the small larvae gnaw their way into the wood. At first, the larvae gnaw along the annual rings, but soon they gnaw criss-cross in the sapwood. Heartwood of e.g. pine and larch is not normally attacked.

The larvae live in the wood for 3-8 years, depending on the type of wood, temperature and humidity. As the larvae gnaw their way through the wood, they fill up the corridor behind them with densely packed frass, and if on their way they cross a passage leading to an old exit hole, the frass sprinkles out and lands as characteristic small piles on the nearest substrate under the woodwork .

When the larva has fully developed, it will only gnaw its way up just below the surface in the summer, and there it will make a "pupae chamber", where it pupates and, over the course of a few weeks,

completes the transformation into an adult insect, which then gnaws a circular hole and through it leaves the woodwork.

The spread of the attack takes place exclusively through the movement of the adult insects, the larvae are not able to spread from wooden object to wooden object unless the wooden objects are really connected.

Characteristics

- Adult insectsr: Small (3-5 mm long) normally chocolate brown insect, with longitudinal stripes on the coverts and a "v" shaped elevation on the forebody.
- Larvae: The larva is 5-6 mm long, curved and white.
- Frass: Lightly flour.
- Exit holes: Very regular circular holes with a diameter of 1-2 mm.

As the larva's entrance hole is so small, it is very difficult to recognise a fresh attack. The first exit holes start to appear approx. 3-5 years after the attack has begun, and it is usually only then that it is established that it is an attack.

Insurance

Attack by furniture beetles is only eligible for cover if it has caused the wood to weaken.

Fighting

Infestations can be controlled with heat, but this requires temperatures above 46oC for more than 2.5 hours or above 52oC for more than 5 minutes. Cold can also be used, but it requires temperatures below -31oC for more than 2 days to ensure a 100% effect. These two methods are therefore normally only used for smaller items.

Normally, you fight furniture beetles with chemical methods, and here it must be stated once and for all that the old advice of using kerosene is completely ineffective (unless you actually succeed in drowning the larvae in it).

The recommended course of action is to replace weakened parts and to apply Protox Insekt to the remaining parts. It is also recommended to prevent the attack from spreading to parts not yet infected and to the new timber. This is done by treating these areas with Protox Insekt or Protox Kombi Aqua. The application must take place in accordance with the application description at www.protox.pro.

In lacquered and painted smaller items, the treatment can be carried out with an injection syringe and a needle, injecting the product into all exit holes and thereby achieving a penetration independent of the surface treatment.

Common furniture beetles in wicker furniture in conservatory.
(Photo: Protox)

i 12

Common furniture beetles – frass.
(Photo: Protox)

i 13

See www.protox.pro or use the QR code and get more information about Protox Insekt.

i 14 Red-brown Longhorn Beetle - adult insect. (Photo: Protox)

i 15 Red-brown Longhorn Beetle – exit holes 5-8 mm sharp-edged and round. (Photo: Protox/Goritas)

i 16 Red-brown Longhorn Beetle in door-post – larva and larval passages with frass. See also page 18. (Photo: Protox)

RED-BROWN LONGHORN BEETLE
(Stictoleptura rubra)

Occurrence
The red-brown longhorn beetle occurs over most of Europe except in the northern regions. The red-brown longhorn beetle as a larva exclusively in sapwood which is already attacked by rot and fungus. The larva therefore normally only occurs in external woodwork that is very moist and therefore already partially decomposed – stern wood, posts, poles, fences etc. The adult insect emerges in mid-summer and can be seen on flowers, where they eat pollen and nectar.

Life cycle
The adult insects, which emerge in the middle of summer, lay eggs in cracks and crevices in damp dead wood, tree stumps and similar decomposed wood – and therefore also in decomposed damp wood on and around the house! When the larvae hatch, they gnaw their way into the tree, where they live in the sapwood for usually 2 years, after which they pupate and subsequently gnaw their way out through the surface as adult insects.

The larvae's passages, which normally run lengthwise in the tree, are filled up behind the larva with frass.

Characteristics
- Adult insects: Relatively large brightly coloured and easily recognisable insects, the female is up to 18-20 mm and the male 12-16 mm. Like all "beetles", the adult insects have antennae that are as long as the body. The female has reddish-brown coverts and the outermost joints of the legs are also reddish-brown, just as the chest has the same reddish-brown colour. The male has more yellowish-brown coverts, the outermost joints of the legs have the same yellowish-brown colour, but in contrast to the female, the male has a black chest area.
- Larvae: The larva is up to 30 mm long and, like most wood-boring larvae, pale, and widest at the front.
- Frass: Lightly flour.
- Exit holes: Round nicely shaped, diameter 5-8 mm.

Fighting
An attack of red-brown longhorn beetle is a sign that the attacked woodwork should have been replaced long ago!

An actual control is only necessary if you want to postpone the time for the replacement, in which case it must be ensured that the woodwork becomes dry, after which it can be treated with Protox Insekt.

DEATHWATCH BEETLE (Xestobium rufovillosum)

Occurrence

The deathwatch beetle occurs in large parts of Europe. As it is closely related to oak, the northernmost distribution is only up to the height of southern Norway.

The deathwatch beetle occur naturally in dead hardwood, mainly oak. In houses, attacks are seen almost exclusively in oak timbers. It only attacks wood that is already attacked by rot and partially decomposed. Because of the beetle's way of signalling, where it knocks its pectoral shield against the sides of the corridor, it was nicknamed "dead clock" in the old days. When the team kept vigil over a deceased, in the quiet hours of the night you could be (un) lucky to hear the ticking of the furniture beetles, which – if you were a little superstitious – sounded like a clock counting down to the next death!

Life cycle

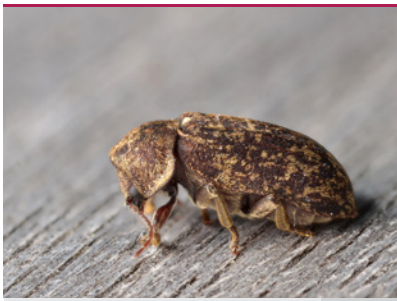
The deathwatch beetle has a life cycle where pupation takes place in late summer, and where the adult insects overwinter in the tree before gnawing their way out in early summer.

The adult insects mate, after which the female lays approx. 50 eggs

in cracks and crevices in the wood. When the egg hatches, the larva immediately burrows into the tree, where it lives in the spring wood for the next few years. Larval development normally takes 2 years outdoors, but indoors can take as little as 1 year, but conversely it can also extend over 10 years if the conditions are bad.

Characteristics

- Adult insects: The deathwatch beetle is the largest furniture beetle in Denmark, and as an adult it is approx. 6-9 mm long, grey-brown and has many irregularly placed small bright spots on the coverts. The antennae are relatively short, as in the other furniture beetles.
- Larvae: The larva is up to 10 mm long, pale, curved and has a darker head with dark brown mandibles.
- Frass: Since the deathwatch beetle, like the rot-boring beetles, attacks wood that is already attacked by rot, and since they mainly eat the spring wood, the woodwork can almost be turned into powder with only a few parts of harvest wood remaining.
- Exit holes: Round nicely shaped, diameter approx. 3-3.5 mm and thus twice as large as the standard drill bit approx. 1.5 mm large exit holes.

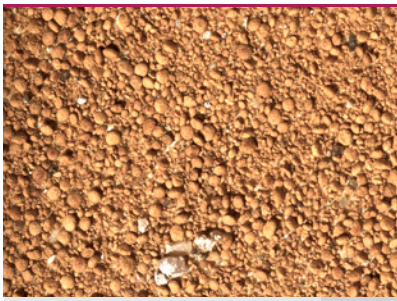


Deathwatch beetle – adult insect. (Photo: wikimedia)

i 17

Deathwatch beetle – exit holes in an old beam. (Photo: Protox)

i 18



Deathwatch beetle - lenticular excrement in frass. (Photo: Protox/Goritas)

i 19

Fighting
An attack by the deathwatch beetle is a sign that the attacked woodwork has been exposed to moisture and is therefore already attacked by rot, a replacement must therefore be considered.

An actual control is necessary if you want to postpone the time for the replacement, in which case it must be ensured that the woodwork is dry, after which it is treated with Protox Insekt.

As the deathwatch beetle normally attacks oak timbers, and as oak timbers form the load-bearing construction in a half-timbered house, special care must be taken if an attack is found in such a construction.

HADROBREGMUS PERTINAX
(Hadrobregmus pertinax)

Occurrence
Hadrobregmus pertinax occurs throughout Europe, even in the northernmost parts. In Norway it is also called "monk's hood" because of its head that looks like a hood on a monk's coat. In Denmark and Sweden it is sometimes called "dead clock", as the male lures the female to him by knocking the chest against the wooden surface, and it makes a ticking "ghostly" sound in an infested house. However, the name woodworm is usually most often used for the oak furniture beetle.

The larva of the Hadrobregmus pertinax lives, as the name suggests, in wood that has already been attacked by rot. In nature, it is dead wood, while in our houses it is typically walled-in wood (timber) and otherwise moisture-exposed wood (beam ends, roof footings, etc.) and, of course, posts, pickets, etc. The larvae do not like waterlogged wood, so it is typical wood that is attacked by rot and then dried up is attacked.

Removing the source of moisture and ensuring that the wood remains dry is therefore no guarantee that it cannot be attacked by Hadrobregmus pertinax once it has been attacked by rot.

The Hadrobregmus pertinax was included on the Ministry of the Environment's "red list" as a "vulnerable" species in 1997 and therefore could not be combated, but luckily it is not mentioned on the current list!

i 20 Hadrobregmus pertinax – adult insect. (Photo: wikimedia)

i 21 Hadrobregmus pertinax – exit holes in lath. (Photo: Goritas)

Life cycle

The larva pupates in the autumn and develops into the adult insect that overwinters in the tree before gnawing out at the end of May or the beginning of June – in heated houses, however, much earlier. The adult insects mate, after which the female lays approx. 10 eggs in cracks and crevices in the wood. When the egg hatches, the larva immediately gnaws its way into the tree. It lives in the spring wood for the next 2 years, after which it pupates and develops into the adult insect.

Characteristics

- Adult insects: The fully grown Hadrobregmus pertinax is approx. 5-6 mm long, black and has a yellow spot at the back on each side of the chest. The head is characteristically round and sits close to the body (like a monk's cut or more contemporary like Darth Vader's helmet in the Star Wars films!). The antennae are relatively short, 1⁄4 part of the body length.
- Larvae: The larva is up to 6-7 mm long, yellowish and curved.
- Frass: Since Hadrobregmus pertinax attacks wood that is already attacked by rot, and since they only eat the spring wood, it can be completely turned into powder, while the harder autumn wood rings remain.
- Exit holes: Round, nicely shaped, diameter 2-2.5 mm and thus larger than the general furniture beetle's approx. 1.5 mm large exit holes.

Fighting

An attack by Hadrobregmus pertinax is a sign that the attacked woodwork is already attacked by rot, a replacement must therefore be considered.

Hadrobregmus pertinax – frass. (Photo: Protox/Goritas)

i 22

i
23

Powder-post beetle – decomposed wood with frass and exit hole. (Photo: Hussvamp Laboratoriet)

POWDER-POST BEETLE

(of the genus Bostrichidae and the family Lyctus)

Occurrence

Powder-post beetle occur everywhere except in the very coldest regions. In Denmark, the European lyctus beetle (Lyctus linearis) occurs naturally, but also other powder-post beetle such as the North American Lyctus bruneus are brought into the country with hardwoods such as ash, oak, walnut, elm, eucalyptus and a wide range of tropical woods , which are all attacked by the powder-post beetle in the country of origin, and which therefore already contain eggs/larvae on arrival in Denmark.

The powder-post beetle also likes to attack plywood and "furniture boards", where the "inner wood" used is typically sapwood from fast-growing hardwoods.

The powder-post beetle attacks hardwood which is characterised by relatively large pores and which has a high content of starch (minimum 3%). Only the sapwood is attacked, but in return all sapwood can be reduced to talc-like dust only covered by a very thin "veneer-like" surface – hence the name "powder-post beetle". The larva is unable to digest cellulose, but feeds only on the starch and protein contained in the wood material.

Usually only relatively fresh wood is attacked, so normally no new attacks are seen in wood that is more than 15 years old.

Life cycle

The adult insects emerge when it is warm (under natural conditions in June-August), but where the wood is used indoors in heated surroundings this can happen for most of the year. After mating, which takes place immediately after the insect has flown out, the female lays up to 50 eggs. The eggs are laid directly into the pores in the wood, and usually 2-3 eggs are laid at a time. The eggs usually hatch after 8-12 days and the larvae begin to gnaw in the wood, first along the pores, later criss-crossing the sapwood, but never in the starch-poor heartwood.

The powder-post beetle normally lives as a larva for 1 year – if the wood is dry and/or low in starch for 2 years – before it gnaws its way up near the surface and pupates. The pupal stage usually lasts 12-30 days before the sexually mature insect burrows its way to the surface.

Under good Danish conditions, a life cycle usually lasts 1 year, but in Australia, for example, there are examples where the life cycle can be as short as around 60 days, and 4 generations can be produced in a year!

Characteristics

- Adult insects: A fully grown powder-post beetle is approx. 4-8 mm long, brownish with small, short antennae which, in the female, end in a small "tassel" of yellowish hairs.
- Larvae: The larva starts as 1 mm long, thin and straight, but ends up being up to 5 mm long, white and curved – almost like a "u", with distinct legs.
- Frass: The frass is fine like talc, and as all the sapwood is gnawed into pieces, it ends up that only a thin shell of wood is left over this powder.
- Exit holes: Circular holes with a diameter of approx. 1 mm.

Fighting

Fight with Protox Insekt. Since attacks are often seen on surface-treated wood, it can be difficult to get a sufficiently large uptake of the product. It is therefore recommended that the surface treatment is removed by sanding or planing before treatment.

See www.protox.pro or use the QR code and get more information about Protox Insekt.

i 24 Longhorn beetle in rotted wood. (Photo: Protox)

i 25 Common timberman (Acanthocinus) – Longhorn beetle at the lumber yard. (Photo: Biopix)

LONGHORN BEETLE IN FIREWOOD STACKS

Occurrence

There are a total of 35,000 longhorn beetle species known throughout the world, the approx. 75 occur in Denmark.

In addition to the ones already described separately – House longhorn beetle, violet tanbark beetle, red-brown longhorn beetle and brown longhorn beetle – the others can be seen approx. 70 species not as actual pests in our homes, with the financial consequences that such entail.

There are many interesting species that can be linked to certain types of trees, such as beech buck, aspen buck, poplar buck, they can be beautifully coloured like the metallic green musk buck, the yellow and black-striped wasp buck, or have impressive sizes like the 2 cm long lumberjack with up to 10 cm long antlers or the up to 45 mm long Garver, which is Denmark's largest longhorn beetle.

Many of these beetles are seen as adults in flowers, where they search for nectar or pollen during the flight season.

The place where you will most often come across these exciting insects is in the firewood stack, where relatively freshly cut wood of many different types of wood, usually with the bark on, is a true gourmet eating place for these insects, whether they are looking for completely fresh wood, or more easily rot-infested tree.

You often become aware of the visit when, on a quiet evening, you can hear someone gnawing on the wood that has been brought in next to the wood-burning stove, or when an "unknown" insect suddenly flies around the living room. You also often see that there are gnawing marks under the bark on the pieces of firewood, or that there are exit holes in the bark from previous attacks.

Life cycle

The adult insects emerge when it is warm (under natural conditions in Denmark most often in June-August), but where the tree is brought indoors in heated surroundings this can happen for most of the year. After mating, which takes place immediately after the insect has flown out, the female lays her eggs in the type of wood on which the species is specialised. After the eggs have hatched, the larva gnaws its way into the tree – possibly only just in the growth layer under the bark, or in the rotted wood.

The beetle normally lives as a larva for 1 year before burrowing up near the surface and pupating. Out of the pupa comes the sexually mature insect, which gnaws its way to the surface.

Characteristics

- Adult insects: The Danish species of longhorn beetle forms a large and motley assemblage of brightly coloured and highly patterned insects. What they have in common are the long antennae, which for the male are usually almost as long as the body, and sometimes much longer. Names such as four-banded longhorn beetle, banded longhorn beetle (see photo), black-tailed longhorn beetle, blood-red longhorn beetle, tobacco-coloured longhorn beetle, heart-spotted longhorn beetle, blank-spotted longhorn beetle, say something about the diversity of colours and patterns that are within the longhorn beetle family.
- Larvae: The larvae are generally pale and usually look like they consist of a series of discs stacked on top of each other. The sizes vary greatly from the small millimetre-sized larvae that have just hatched to the Tanner's up to 8 cm large "giant larvae". Usually the head and jaws of the larvae are distinctly darker than the rest of the body.
- Frass: The appearance of the frass is very different, depending on whether the larvae only gnaw in sapwood, or if they also gnaw in bark or decomposed wood.
- Exit holes: Very different in size and appearance.

Fighting

Normally, there is neither the opportunity nor the need for fight this. Most often, the beetles live freely in nature and only attack trees there, which is why they do not cause real damage. There are, however, "brought in" beetles, for example the Asian longhorn beetles, which are believed to have arrived in Chinese wooden packaging. The Asian longhorn beetle is completely undesirable in the Danish nature, as it causes great damage to deciduous trees such as maple, beech, birch, poplar and willow, where the larva lives inside the growth layer just under the bark of the living tree. It can cause the trees to reach the top and have to be felled.

The introduction of longhorn beetles (and other insects) can only be combated through precautions when sending and receiving e.g. wooden packaging, and the most important thing here is that the packaging is burned as soon as possible and not, as it might otherwise be tempting, reused.

i 26 Orange ants – floorboards broken down by orange ants. (Photo: Protox/customer photo)

i 27 Cardboard nest built by orange ants. (Photo: Protox/Goritas)

i 28 Hercules ant. (Photo: Dreamstime)

ANTS

Occurrence

Ants are one of the most successful insect families, there are known to be approx. 9,500 different species (mostly in the tropics) and approx. 50 species occur in Denmark. Ants occur everywhere in the world except Antarctica. Most Danish ant species are annoying but basically harmless. Some of those we are most familiar with are:

- Red Wood Ant (Formica rufa) – a very large ant, also called the Horse Ant, it is known all too well from trips in the forest.
- Black garden ant (Lasius niger) – it's everywhere! Under tiles, by plinths, inside our houses, but basically they don't destroy anything.
- Pharaoh ant (Monomorium pharaonis) – a native tropical ant that was introduced inland and only thrives indoors. in an infested property they can be a great annoyance.
- Yellow Ant (there are several species in Denmark: Lasius umbratus, L. flavus and L. mixtus) – live in large underground nests and only come to the surface as winged ants in connection with mating.

Most ants only damage the building if they make a nest where excavated sand and soil block the ventilation under, for example, a floor, or where the excavated material directly fills up against wood, so that it becomes damp and thus susceptible to rot and fungi. attack.

However, there are two ant species in Denmark that can directly cause damage to woodwork: The Orange Ant and the Hercules Ant.

The orange ant (Lasisu fuliginosus) is closely related to the common garden ant, but unlike the latter is shiny black. The name Orange ant comes from the characteristic orange/lemon flavor that the ant has, a characteristic that the world-famous Danish restaurant Noma exploited when they made dishes with prepared or live ants!

Typically, the orange ant builds a nest in an extinct, hollow tree, but they can also build nests under the floor of the home, where they can create such a moist environment that the wood rots, but where they also gnaw the spring wood of the moist wood, in order (just like the wasp) to use the cellulose material to build the nest from .

Hercules ant (Camponotus herculeanus), which as the name suggests is a very large ant (up to 15 mm long), is the most destructive of our domestic ant species. In nature, it builds its nest in a tree stump, a felled tree, a pole or the like. Attacks in houses seen most frequently in holiday home areas in North Zealand and North Jutland, where the home is typically built in hidden timber. As the

ant prefers healthy conifers for its nest, there are plenty of options in a summer house.

The affected tree is completely hollowed out, with all the spring wood removed, so that only the harder harvest wood remains, albeit with holes for passage. The gnawed away crumb is removed from the nest, as the ant does not eat the wood, but simply hollows it out to live in it. Like most other ants, the Hercules ant lives on insects and other small animals, and doesn't miss a sweet treat either.

Fighting
Attacks by Hercules ants and Orange ants, where damage occurs to woodwork, can be treated with Protox Insekt. Especially in the case of Hercules ant attacks, it may be necessary to replace larger or smaller parts of the woodwork. When replacing it, it is important to provide preventive treatment for the new wood at the same time as the preventive treatment in the remaining old wood.

In the case of other ant attacks, it is important to remove the parts of the nest that create moisture in the house's woodwork, ensure drying and provide the necessary protection against fungal attacks with Protox Svamp or Protox Akvagrund 2.

WOOD WASP

Occurrence
There are known approx. 90 species of wood wasps, of which 7 species occur in Denmark. The most common wood wasp species here at home are the **giant wood wasp** (Urocerus gigas) and the **steely-blue wood wasp** (Sirex juvencus).

The adult wood wasps only appear outdoors in the summer and are most active on warm summer days. The adult insects feed on pollen and insects. The insects, despite their size, lethal appearance and long broods, are harmless to humans, and they can neither bite nor sting! They can also seem scary because of the humming sound they make when they fly.

Life cycle
During the summer, the female lays 3-400 eggs in diseased or dead trees or in freshly felled damp wood. She drills holes with the ovipositor and lays 3-7 eggs in each hole.

3-4 weeks after the egg is laid, it hatches and the larva immediately begins to gnaw its way through the wood. It is aided by the digestion of a wood-decomposing fungus, which the mother injected into the tree along with the egg. The larva gnaws its way through both sapwood and heartwood, leaving a tunnel that is so hard filled with frass that it doesn't even come out when the wood is sawed up at the sawmill.

Hercules Ants – Gallery of corridors formed by leaving only the hard harvest wood. (Photo: Unknown)

i 29

Giant tree wasp – adult insect. (Photo: Biopix)

i 30

Wood wasp – larval stage with hard packed frass. (Photo: Protox/Goritas)

i 31

i 32 Wood wasp – frass. (Photo: Unknown)

i 33 Plasterer bees – adult bees. (Photo: Christophe Quintin, Fr.)

The larva normally lives inside the tree for a few years, but under unfavourable conditions it can take up to 10 years to reach the pupal stage. After developing in the pub, the adult insect gnaws the last bit to the surface and leaves the tree through a circular hole with very sharp edges. In nature, the exodus takes place in the summer months, but in heated houses it can happen at other times of the year.

Characteristics

- Adult insects: Giant wood wasp is up to 40 mm long and can, with its black and yellow colours, look like a giant goat ham at a fleeting glance. However, it can be recognised from the goat's horn on the long calf. Steely-blue wood wasp is up to 30 mm long. The colour is grey-brown with a metallic bluish tinge.
- Larvae: The larva is white, has very small legs, and the body ends in a black thorn.
- Frass: The frass is so tightly compressed that it usually does not fall out of the way.
- Exit holes: Perfectly shaped round holes with sharp edges – almost look like they are drilled holes.

Fighting

Control is not necessary or possible, as wood wasps do not breed in building timber, but only occur where already infected timber is used in construction. On the other hand, it is essential to prevent by NOT using timber that is already infected with larvae in the forest.

Normally, there are no such massive attacks that the timber is weakened, but the escape holes can allow access for moisture, and at the same time they can be an aesthetic problem.

PLASTERER BEE (Colletes daviesanus)

Occurrence

There are around 20,000 different bee species, they are found everywhere on earth – except Antarctica – and wherever there are insect-pollinated flowers.

The plasterer bees, which is a relatively small bee of 7-9 mm, belongs to the "solitary" bees that do not live in colonies like the honey bee, however, there can be places with such a massive presence of plasterer bees that it almost feels like a colony, but there is not a "community structure" like in a honey bee nest or a wasp's nest.

The plasterer bee lives in nature on chalk and clay slopes, but also has a penchant for making its characteristic round holes in bad/tender/damaged joints in our brick houses. The plasterer bee is able to gnaw its pencil-shaped holes and fold up to 20 cm into the joints, but it never invades a possible. hollow wall.

If the masonry is so bad that a hole has appeared all the way to the cavity wall, there is a risk that wasps or bumble bees can move in and make their nest inside the cavity wall. However, the animals look different, and it is also clear that the flight activity during the different types of attack is very different.

A plasterer bee makes a hole at a time, then flies back and forth to fill the cells with pollen for the larvae. In an active wasp or bumble bee nest, there is lively traffic in and out of the same hole by many different individuals.

When the plasterer bee has made a sufficiently deep passage, it lines the inside of the passage with a very fine paper-like layer and divides it into up to 8 cells, which lie one after the other and fill the entire width of the passage. Each cell is filled with pollen and honey, after which the bee lays an egg in the cell and closes it off.

When the egg hatches, the larva feeds on the supply that the plasterer bee has filled in the cell. The larva overwinters in the cell and pupates, so that the following summer it is ready to emerge as an adult insect. The activity of plasterer bees is greatest on a sunny wall in July/August.

Fighting

An attack by plasterer bees usually has no effect on the strength of the building, but it is a sign that the strength of the mortar is not sufficient. The reason may be that there has not been enough cement in the mortar at the building, that there has been frost while the mortar hardened or that the mortar has subsequently been broken down by moisture and frost.

An attack by plasterer bees is therefore a sign that it is time to have the joints repaired, as holes from plasterer bees can in the long term be a contributing factor to moisture penetrating the masonry and thereby weakening it.

The repair consists of scraping out the weak joints and jointing again with a strong mortar.

The repair itself should be carried out outside the bees' flight time, and in enough time that the mortar has a minimum of 1 month to harden, as the bees will be able to make new holes in not fully hardened mortar. If the repair must necessarily take place during the bees' flight time, it will be necessary to kill the bees with a suitable insecticide.

It is irrelevant that there may be overwintering larvae in the holes. As long as the new mortar is properly cured, the new plasterer bees will not be able to gnaw their way out.

Plasterer bee – broken joints in brick gable. (Photo: Protox)

i 34

k 1 Mould

k 2 Wood-destroying fungus

k 3 Insect

PREVENTION IS BETTER THAN CURE

This old truth applies to a large extent in our buildings as well.

Timely prevention will save a lot of expenses and annoyances during a building's lifetime.

Prevention can be approached in many ways; the safest (and cheapest) is the constructive prevention – in other words, make the construction so that no problems arise, or so that problems that can be foreseen can be remedied in a simple and inexpensive way.

The examples of constructive prevention are many, and so are the examples of what happens if the construction is not thought through.

Wooden houses, for example – in the countries around us (in Sweden and Norway in particular), wooden houses have been built for centuries, which are adapted to the local climate. A Swedish wooden house for the coastal area is traditionally a "panel" house, where the facade cladding consists of panels that can be replaced relatively easily when they are "worn out". Combined with large overhangs that keep the wall dry as much as possible and preferably a fairly high plinth made of granite, ensures that the house can survive for centuries, as the individual facade elements are only replaced when the lower one – after all – has rotted away. Look, it is constructive wood protection.

We have seen many examples of the opposite in this country. Just before the financial crisis in the early 2000s, American log houses were all the rage in this country. They are built from round timber – popularly said to be 'stacked' on top of each other, so that the timber forms the load-bearing element in the house. This type of house has managed for many years in the dry climate of the Midwest in the USA (and on the mountains in Sweden, Austria, etc.), but when you import this construction method to the humid Danish climate, it is NOT an example of constructive wood protection – on the contrary. The protruding beam ends guide the rainwater into the logs with unfailing certainty and this has one and only one consequence – fungal attack and breakdown of the wood material. Since the construction does not immediately enable the replacement of the individual logs, you end up with a problem. Unfortunately, similar problems are also seen with log houses of Danish origin.

The examples of a lack of constructive consideration can be seen in many other places – in attics with a lack of ventilation, in new buildings with a lack of dehumidification, in the construction of internal front walls, in the inclusion of basements for living, etc. And when

the challenges are not taken into account during the construction phase , then there is only the chemical prevention (wood protection) to resort to try to prevent the problems from occurring.

What are the possibilities with chemical wood protection?

We cannot correct all the follies with chemistry, but in the long run, sensible preventive treatment will be able to save a lot.

Attic room
The use of plywood sub-ceilings carries a built-in risk of mould attack if there is the slightest lack of ventilation.

Yes, quite often, even if the ventilation is sufficient, then comes outbreaks of mould. A roof plywood that is attacked by mould turns black and is, to say the least, unappealing to look at. That can of course be cleaned off with Protox Hysan, but it will not make the veneer look like new again, and at the same time, mould removal in an attic is often a tedious task. By pre-treating the boards with Protox Akvagrund 2 or possibly Protox Kombi Aqua, then you don't have to for mould growth – as well as wood-decomposing fungi and during use of Protox Kombi Aqua also for wood-destroying insects – it's timely care!

Cold exterior walls
mould growth in apartments is often localised on the cold outer wall in the bedroom – the basic problem is very often insufficient heating and insufficient ventilation, but when the mould growth appears on that particular wall, it is also because the wall is cold due to insufficient insulation, and perhaps it is directly north-facing. The right solution is, of course, to change user behaviour so that heat is applied and ventilation is provided, but together with that, a treatment with Protox Skimmel will help ensure that even an elevated moisture level will not lead to renewed mould growth on the surface.

The basement
In general, basements in older houses are NOT intended for living, but many still fall for the temptation. In many cases, it can be done if you choose the right materials and install permanent moisture-controlled dehumidification, but it often goes wrong. Here, a cleaning of the wall and a treatment with Protox Svamp or Protox Kombi Aqua, before painting with a silicate paint and improved dehumidification, could save the situation in many basements.

Get the right advice
Thus, there are many situations where a timely preventive treatment with Protox Svamp, Protox Akvagrund 2, Protox Insekt or Protox Kombi Aqua will be able to prevent the problems from occurring. Call us and have a chat about when and how you can best prevent in your construction.

Window section with clear fungal attack

k 4

Mould infestation in basement

k 5

Decayed wood with insect infestation

k 6

See www.protox.pro or use the QR code and get more information about Protox Svamp.

PROTOX SVAMP

Protox Svamp is an effective, aqueous fungicide for combating fungal attacks in wood, masonry and concrete. Protox Svamp fights active attacks of wood-destroying fungi and prevents new fungal attacks. The agent has been developed as a professional agent for indoor use against e.g. dry rot fungus, wet rot fungus, mine fungus, gilled polypore, bracket fungus and other wood-decomposing fungi. Protox Svamp can be used as a universal fungicide both inside and outside.

Protox Svamp contains a UV tracer that lights up when illuminated with UV light – used where documentation of application is required.

See www.protox.pro or use the QR code and get more information about Protox Hysan.

PROTOX HYSAN

Protox Hysan is a special agent for cleaning and disinfecting mould. The agent can also be used to remove odours and disinfect bacterial growth and viruses, e.g. after cloudburst damage and flooding with infected sewage. Protox Hysan is indoor climate neutral and leaves no harmful residues.

Protox Hysan has no preventive effect and if the source of moisture cannot be removed, the treatment should be completed with a treatment with Protox Protect.

See www.protox.pro or use the QR code and get more information about Protox Biox.

PROTOX BIOX

Protox Biox is an effective agent for disinfecting all types of bacteria, fungi, protozoa and the like. Protox Biox is a quick, easy and cheap agent for mould removal compared to other, commonly used, mechanical methods. Effective disinfection is achieved with very limited physical effort and a contact time of only approx. 60 seconds.

Protox Biox is used on horizontal surfaces – concrete floors, all-terrain decks, basement floors, etc., where there is mould growth due to moisture.

Protox Biox is only sold to professional practitioners with the necessary training.

Protox Biox is food approved (2012-29-5409-00321).

PROTOX PROTECT

Protox Protect is an effective primer for professional prevention against the attack of mould on thermal bridges in the home, on damp building materials and building parts that periodically get wet – e.g. roof rafters and roof veneers in attics with poor ventilation, damp and uninsulated walls, etc. Outdoors, it can be used to prevent and combat discolouration on wood, wooden decks on boats, etc.

Protox Protect can be used on wallpaper, plaster, plaster, masonry, concrete, wood and veneer and forms a film on which mould will not grow.

Protox Protect is applied with a brush, spray or by immersion.

See www.protox.pro or use the QR code and get more information about Protox Protect.

PROTOX INSEKT

Protox Insekt is a professional means of preventing and combating attacks by wood-boring insects such as borers, woodpeckers etc. Protox Insekt can be used on new and old woodwork. In buildings where people stay for a long time, Protox Insekt may only be used for the treatment of new and old wood in places where people only come briefly and occasionally in contact with the tree, e.g. roof structures, skunk rooms and beams in basements and under floor structures. The agent has been approved by the Norwegian Environment Agency in accordance with the rules in the Biocide Regulation.

Protox Insekt is applied by brush, spraying or dipping. Fluorescent substance can be added, which lights up when illuminated with a UV lamp – this can facilitate quality assurance.

See www.protox.pro or use the QR code and get more information about Protox Insekt.

PROTOX AKVAGRUND 2

Protox Akvagrund 2 is a professional water-based wood preservative for the initial treatment of new and old, untreated woodwork that must be protected against rot, fungus, blue stain fungus and mould. Protox Akvagrund 2 is also extremely effective at sealing mould deposits. A seal may be the only (best) way to prevent the spread of mould spores from mould attacks in inaccessible places, e.g. roof constructions with sloping walls, under bricked-up floors, in cable ducts, etc.

Protox Akvagrund 2 is a colourless water-based wood preservative. It has a low MAL code (00-1 and is not classified as hazardous, harmful to health or similar. By choosing Protox Akvagrund 2, you fully comply with the requirements of the working environment legislation to choose the least dangerous product.

See www.protox.pro or use the QR code and get more information about Protox Akvagrund 2.

See www.protox.pro or use the QR code and get more information about Protox Kombi Aqua.

PROTOX KOMBI AQUA

Protox Kombi Aqua is a professional and effective aqueous agent for the prevention of attacks by wood-destroying fungi and insects and mould. Protox Kombi Aqua may be used by EVERYONE – both professionals and private individuals.

Protox Kombi Aqua effectively prevents new attacks and the spread of ongoing attacks by all types of wood-destroying fungi and insects. Protox Kombi Aqua also prevents mould attacks.

Protox Kombi Aqua is tested and approved according to European standards. Protox Kombi Aqua is approved as a wood preservative in PT8 by the Danish Environmental Protection Agency with approval number 578-26. Protox Kombi Aqua has MAL 00-1 and contains no solvents.

PRODUCT GUIDE

What should I use

Read more about the areas of application of the individual products at www.protox.pro.

		PROTOX SVAMP	PROTOX AKVAGRUND 2	PROTOX INSEKT	PROTOX PROTECT	PROTOX ENCAPSULATOR	PROTOX KOMBI	PROTOX HYSAN	PROTOX BIOX	PROTOX ABSCENT	PROTOX ODOURFREE
USED FOR	Prevention and control of rot/fungus	☐									
	Prevention and control of real house fungus	■									
	Prevention and control of wood-destroying insects			☐							
	Prevention of rot/fungus	■	■				■				
	Cleaning of mould							☐			
	Cleaning of mould on horizontal concrete								■		
	Prevention of mould	☐	☐		☐		☐				
	Sealing of mould		■			■					
	Removal of bad odour							☐	☐	☐	☐
	Removal of bacterial growth							■	■		
	Control of wood-destroying insects			☐							
	Prevention of wood-destroying insects			■			■				
APPLIED TO	Glass, plastic and other non-absorbent surfaces							☐			☐
	Tiles, concrete, bricks etc.	■	■		■	■		■	■		■
	Wallpaper				☐			☐			☐
	Plaster and masonry	■	■		■	■		■			■
	Plasterboard		☐		☐	☐		☐			☐
	Wood, plywood etc.	■	■	■	■	■	■	■			■
	Textiles										☐
Can be used in	Denmark	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Norway and Sweden	■		■	■	■	■	■	■	■	■
	Germany				☐	☐		☐	☐	☐	☐
	Australia				■	■		■	■	■	■

PROTOX

Professional fungal, mould and insect control

PROTOX APS

Fabriksvej 19 · DK-6000 Kolding · Denmark
Tlf: +45 75 50 40 22 · info@protox.dk
www.protox.pro

ISBN: 978-87-996756-0-9

5 708350 003386