

Moulds – Information for persons with mould allergies

Moulds grow in all moist and warm locations or where there are plant materials they can use as a source of energy. Unlike plants, moulds do not have any chlorophyll and therefore cannot obtain their energy from sunlight.

A mould is made up of a cellular mesh known as the hyphae, which first colonise the surface of materials and then later penetrate further down. After longer periods of colonisation the 'energy sources' affected are destroyed: building materials and wallpapers are broken down, wood and paper crumbles, plaster and paints peel off. Another typical source of energy is potting mixture or the dead parts of pot plants and food.

Like all living organisms, fungi also need water to grow. However, if water is missing the fungi does not die, but instead forms spores. These enable the fungi to survive periods of stress. The spores, which are used for reproduction, float in the air and are either breathed in or ingested with food. They can cause allergies if an individual is sensitised to them.

Many of the approximately 10,000 known mould species are exceptionally potent allergens, although only a few of these are found indoors.

Moulds require a temperature of at least 20°C and air humidity of greater than 70% to grow. Indoor air humidity is produced from cooking, showering, washing, drying laundry, pot plants and evaporation, for example. A human 'produces' up to one litre of water each night. This is enough to increase the air humidity of a room of about 50 m² at a temperature of 20°C from 60% to 100%. This means that bedrooms may have water vapour loads that persist for too long. In kitchens and bathrooms the peak loads produced are extreme and shortlived.

Condensation forms in buildings where there are areas with cold bridges and poor external insulation. This is the case when new well insulated windows are installed in old buildings: the condensation previously collected on the cold single glazing, while with insulated glazing it now deposits on the relatively colder point. The consequences can be mould formation on roller shutter boxes or in the corners of rooms.

As a result of building defects, moulds can also develop in new buildings if the buildings are not completely dried out. The most important fungi present in living environments are the genera *Alternaria*, *Aspergillus*, *Cladosporium* and *Penicillium*. There is no typical 'wall mould'. A colourful jumble of various species reigns.

If there is a significant allergic sensitisation, that is, a higher stimulation index in the LTT or IgE antibodies to one or more of these moulds have been detected, it is advised to avoid exposure.

General rules for those allergic to moulds

The general therapeutic measures include first and foremost avoiding contact which requires systematic removal of the sources of the allergy.

Pot plants should be avoided as much as possible. They are taboo in the bedroom. Organic waste, humidifiers, indoor water features and air conditioners have no business in the home of a person allergic to moulds.

Excessive humidity, such as develops overnight in bedrooms or if several people are working in an office at the same time, must be removed by ventilating (cross-ventilation for 10 minutes at least every 2 hours).

Moulds are best controlled during construction using measures such as preventing the formation of condensation by eliminating cold bridges. Walls should be able to periodically absorb and store moisture. Plaster that can absorb moisture and release it again when the humidity has fallen prevents walls remaining constantly moist.

Preexisting contamination of building materials with mould can only be removed with difficulty. Wallpaper, plaster and jointing compounds must be extensively removed as a rule. The use of fungicides indoors should be reduced to a minimum due to their toxicity. In any case, such measures are often not a permanent solution to the problem. In the short term a 3-4% vinegar concentrate (available in supermarkets) does work, however. The site affected by mould is dabbed with a cloth soaked in the concentrate at intervals of 30 minutes and then rubbed with methylated spirits.

In addition to the above general measures, the information specific for the particular mould should also be heeded if there is an allergic sensitisation to the mould.

Cladosporium is a fungal genus that is one of the most commonly encountered moulds. *Cladosporium* species occur mostly in swampy areas, forests and gardens because they grow happily on decaying plants or on leaf litter. Particularly sensitive people should therefore avoid any work in the garden (particularly mowing lawns). The spores are released primarily in dry summer weather. They are also encountered in greenhouses, in poorly cleaned refrigerators and on fabrics, e.g., linen.

Aspergillus, the watering can mould, is found worldwide in the soil but also likes to grow on cotton and other materials, on upholstered furniture and foam mattresses, fruit, vegetables and in flour. The heat-tolerant *Aspergillus fumigatus* (optimum growing temperature 37–43°C) grows on bread, covering it with a blue-green fuzz. It later turns smoky brown. *Aspergillus* also affects spices (e.g., black pepper), cherries,

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grapes, rye and wheat bread, barley, corn, rice and fruit juices but does not always spoil the food. There are also certain foods that are intentionally exposed to *Aspergillus* or *Penicillium* during production (e.g., cheese).

Very 'good' breeding sites include warm fermenting plant matter, predominantly in manure, fertilisers, piles of leaf litter, stable litter and damp hay, silage feed and pot plants, particularly if these are placed over heaters. It also grows on animal droppings (birdkeeping!), wood, paper and wallpaper as well as in bathrooms and moist corners of the home (e.g., cellars).

Patients with an allergy to *Aspergillus fumigatus* should avoid working in the garden and compost heaps. The highest number of fungal spores in the air is on dry windy summer days. To reduce the spore load in the house, moist sites in the house should be cleaned, house dust reduced, adequate air ventilation ensured and air humidifiers and pot plants removed. Waste containers should be emptied as often as possible.

Alternaria species occur mostly in swampy areas, forests and gardens because they grow happily on decaying plants. Particularly sensitive people should therefore avoid any work in the garden (particularly mowing lawns). Indoors they are found mostly on flour, fruit and vegetables but also in wine and fruit juices, particularly if these are left open for several days. *Alternaria* also grows on various fabrics, e.g., linen, as well as damp wood (window frames, particularly those with a high condensation burden).

Penicillium chrysogenum (old nomenclature *P. notatum*) is, like *Aspergillus* and *Mucor*, one of the moulds that can be responsible for yearround allergic symptoms. House dust can be particularly rich in spores of such moulds, particularly in damp indoor environments.

All *Penicillium* species love warmth and moisture. They thrive on fruit (particularly citrus, apples and peaches), bread (bread bin!), cheese, flour, jams and fruit juices. Like *Aspergillus*, *Penicillium* is also used in the production of some types of cheese. *Penicillium* species are found in moist, dark wine cellars, in potting mix and leaf litter as well as in bathrooms, on water pipes, rubber seals, window ledges, refrigerators, wallpaper, mattresses and upholstered furniture. *Penicillium* spores can also be found in outside air (interestingly, they are more common in urban areas than rural areas).

Mucor mucedo is, like *Penicillium* and *Aspergillus*, responsible for yearround symptoms because its spores can often be detected in house dust. It is recommended to keep living areas 'dust free' (do not vacuum but wipe with a damp cloth!!!). Carpets should be banned at least in sleeping areas as it is a typical dust catcher. *Mucor* also lives on all decaying organic materials as well as on leather furniture or

leather clothing. Bread is an ideal medium for the growth of *Mucor*. When mowing lawns *Mucor* spores are released in large numbers.

Rhizopus nigricans The species *Rhizopus nigricans* is the most common of the mucorales or 'pinhead moulds'. *Rhizopus* spores are not very common in outdoor air but can be numerous in very moist indoor areas and surrounding composting vegetation. In kitchens, it is often found on leftover cooked fruit. It grows on untreated wood surfaces and is the cause of woodworker diseases in sawmills. The spores are released in hot dry weather.

Stachybotrys is a mould commonly found on plant matter and in the soil around the world. It grows on and degrades cellulose and cellulose-containing materials. This typically includes wood and ingrain wallpaper, straw, chip board, fibreboard, fibre plaster, gypsum plasterboard, dust and lint. It is isolated in above average quantities from soils in cereal crop rotation. *Stachybotrys* produces numerous biologically active metabolites that may be relevant in terms of allergens and toxicology (trichothecenes). *Stachybotrys* is an indicator of water damage in buildings! This fungi is gaining in importance in indoor areas.

Botrytis cinerea, also known as grey rot or grey mould, is a host plant parasite. It causes the dreaded grey rot on unripe grapes, but is also not uncommonly deliberately introduced on ripe grapes as noble rot to produce „Troockenbeerenauslese“ (German language wine term for a desert wine). Berries and pip fruit (particularly strawberries), lettuce, carrots, celery and cabbage can be affected, particularly if the air humidity is high. It can be significant in mildew stains in damp indoor areas.

Candida albicans is not a mould but a yeast. It is found in the mouths of 60% of all humans and almost always in the bowels. The antigen composition of *Candida albicans* is very similar to that of brewer's yeast. Cases of type I and type IV hypersensitivity have been verified, particularly with chronic urticaria, asthmas and hay fever. Type IV sensitisations detected in the LTT are to a certain degree normal and an expression of the immunity of the patient. The LTT can only suggest pathological *Candida* hypersensitivity but cannot verify them. In the evaluation of the LTT for *Candida*, the degree of sensitisation must always be estimated. Very high SI values in the LTT are often caused by heightened stimulation of the bowel immune system which in turn is the consequence of a pathologically increase in bowel wall permeability. Quantitative determination of zonulin in the blood provides evidence of increased bowel permeability (leaky gut). Measurement of zonulin in the stool has proven to be less reproducible, however.