NISUS®
CORPORATION

# MOLD & FUNGI

## TECHNICAL BULLETIN

**The Solution:**
**BORA-CARE®**
**with MOLD-CARE®**

# BORA-CARE WITH MOLD-CARE

Bora-Care® Termiticide, Insecticide and Fungicide is a highly effective, long-lasting concentrate that can be used with Mold-Care® in construction. When Bora-Care and Mold-Care are used together in homes they control mold growth and prevent decay and wood-destroying insects from damaging the structure. Bora-Care with Mold-Care should be used as a pretreatment to protect new construction. As a post-construction treatment, it can be used with moisture correction as part of an integrated solution for damp and moldy houses. Since its introduction to the pest control industry in 1990, Bora-Care has been successfully used against termites and decay as a better (i.e., lower toxicity and permanent) alternative to soil poisons and fumigation. When Bora-Care with Mold-Care is used to treat a whole structure at a 1+5 mixture with water, and is combined with a Bora-Care 24-inch band pretreatment at a 1+1 mixture with water, all treated components are provided with protection from mold, decay and wood-destroying insects. As a major additional feature for homeowners, general pests such as cockroaches and ants will also be significantly controlled.

Bora-Care and Mold-Care are responsibly formulated with humans, pets and the environment in mind. They can be applied to bare wood, plywood, particleboard, oriented strand board (OSB), drywall, insulation, brick, block, cardboard, paper and any other materials that mold or other pests can eat, grow on or grow in.

| DIFFERENT FUNGI THAT CAN GROW ON CONSTRUCTION MATERIALS | |
|---|---|
| **Mold Fungi** | Fungi with colored mycelium and/or spores that grow on surfaces, including wood, drywall, insulation, paper and coatings. They use free sugars and carbohydrates as a food source and can only affect structural integrity in very wet situations, causing soft-rot. |
| **Stain Fungi** | Fungi with colored mycelium that grow in freshly cut wood. They use free sugars and carbohydrates as a food source and do not affect structural integrity. |
| **Decay Fungi** | Fungi that grow within materials, typically wood, use the structural components (cellulose) as a food source. This results in the destruction of wood (rot). |


## MOLD AND OTHER FUNGI IN BUILDINGS

Fungi are a group of living microorganisms that are not related to plants or animals. Fungi digest and absorb their food from their surroundings and, in nature, carry out a useful recycling role.

Fungi, however, can also be detrimental or problematic when they try to recycle our homes or when some of their by-products are harmful to our health.

The most common fungi that grow in buildings and on construction materials include mold fungi, stain fungi and decay fungi.

## MOISTURE IS THE KEY TO FUNGAL CONTROL

The modern home environment can provide all of the elements needed for successful fungal growth. By focusing on the factors that affect fungal growth, we can take steps to prevent it.

| FACTORS AFFECTING FUNGAL GROWTH | |
|---|---|
| 01 | Fungi (fungal spores or living fungus) must be present in order to grow. These are present in the air all of the time and should be considered ubiquitous. |
| 02 | Food (a carbohydrate or food source) is needed to sustain the growth of fungi. Most construction materials we use today are good food sources for fungi. Drywall and its backing contain added starch that mold fungi love. Wood contains sugars and cellulose. Paints, sheathing and wall coverings all contain some sort of food substrate for fungi. |
| 03 | Water is needed at >20% moisture content in wood or >80% relative humidity. |
| 04 | Air is needed for respiration the same as with animals. Air, of course, is always available in a home. |
| 05 | Nutrients (vitamins and minerals) are needed by fungi. |
| 06 | Temperature (fungi grow within the temperature range of >32$^{O}$F to <100$^{O}$F). The comfortable range for our homes 60–80$^{O}$F is the absolute ideal temperature for most fungi. |
| 07 | Inhibitor (presence of natural or synthetic fungicides). Wood extractives or Bora-Care with Mold-Care, can control fungal growth. |

Now we can see it is impossible to control or remove most of what fungi require to grow, apart from water. Moisture content and humidity are therefore the most important factors in determining the rate and extent of mold and decay fungal infestation of materials.

Leaky water pipes and broken roofs are obvious sources of water that will lead to fungal growth if not remedied quickly. Less obvious is penetrating and rising damp. This is water that can come up from the ground or through exterior walls because the wall material (e.g. brick) is porous and can conduct water. The least obvious source of water is the air itself. Air can carry water vapor (you can see it over the top of hot coffee), and when it carries a lot, it has a high humidity. The amount of water held in air is dependent on its temperature. Warm air can hold much more moisture than cold air. If warm air with a high humidity is cooled, it will drop the water as condensation on cold surfaces. Areas of our homes where we use a lot of water are also much more likely to produce condensation. For this reason, we often find fungal problems in bathrooms where showers are used regularly, in laundry areas where clothes are dried, and in kitchens where we cook. Water in the air will always find the coldest surface to condense on, so it is common for water vapor to be produced in one room and for it to condense in another area without insulation.

Another issue is water production in new buildings. Large amounts of water vapor are produced as construction materials dry. Mixing water in plaster and concrete, or exposure to the weather during construction, leaves a new home with as much as five tons of water in it that can take up to six months to dry properly.

For an environment to be free of fungal problems, it is necessary to avoid excess moisture. Any problems associated with water entering the house must be corrected.

## HEALTH EFFECTS OF FUNGAL GROWTH

Obviously, wood rot and decay-fungal activity leading to structural failure and collapse of a building has a very significant cost implication, as well as possible impact on health and safety. Studies now show that non-structurally impacting mold fungi may also be associated with negative health effects.

In a damp home with active fungal infestation, spores are continually produced as part of the normal life cycle of the fungus. These spores are complex biochemical particles, the same as pollen and other antigens, and as such may potentially cause hay fever type symptoms, asthma, eczema or other types of allergies. A few fungal spores are always present, but in a damp home there can be several thousands of spores for every cubic yard of air space. Some fungi can also produce potentially harmful chemicals known as mycotoxins.

## VENTILATION

Ventilation of buildings and homes is essential for the comfort and health of the occupants. It is important for moisture removal by exchanging water carrying air within the home for dryer air outside of the home. If such water carrying air is not removed, it will lead to condensation and fungal infestation, as well as odor and potential toxin and spore build up.

Natural ventilation (open channels to the outside) should have an area of about five percent of the floor area. This can consist of open fireplaces, open windows and doors, and gaps around windows and doors. Where such ventilation is not present, it should be provided artificially by using mechanical extractor fans. Bathrooms and kitchens are ideal places to install such mechanical ventilation. If operated at the same time as showers and cooking, they will immediately eliminate moisture as it is produced.

The target for most rooms should be one complete air change per hour, but for bathrooms and kitchens three complete air changes per hour are recommended. In new construction, higher levels of ventilation may be necessary for the first six months after construction to allow for initial drying of the home. For these reasons, the three complete air changes recommended for bathrooms and kitchens should be targeted in all rooms.

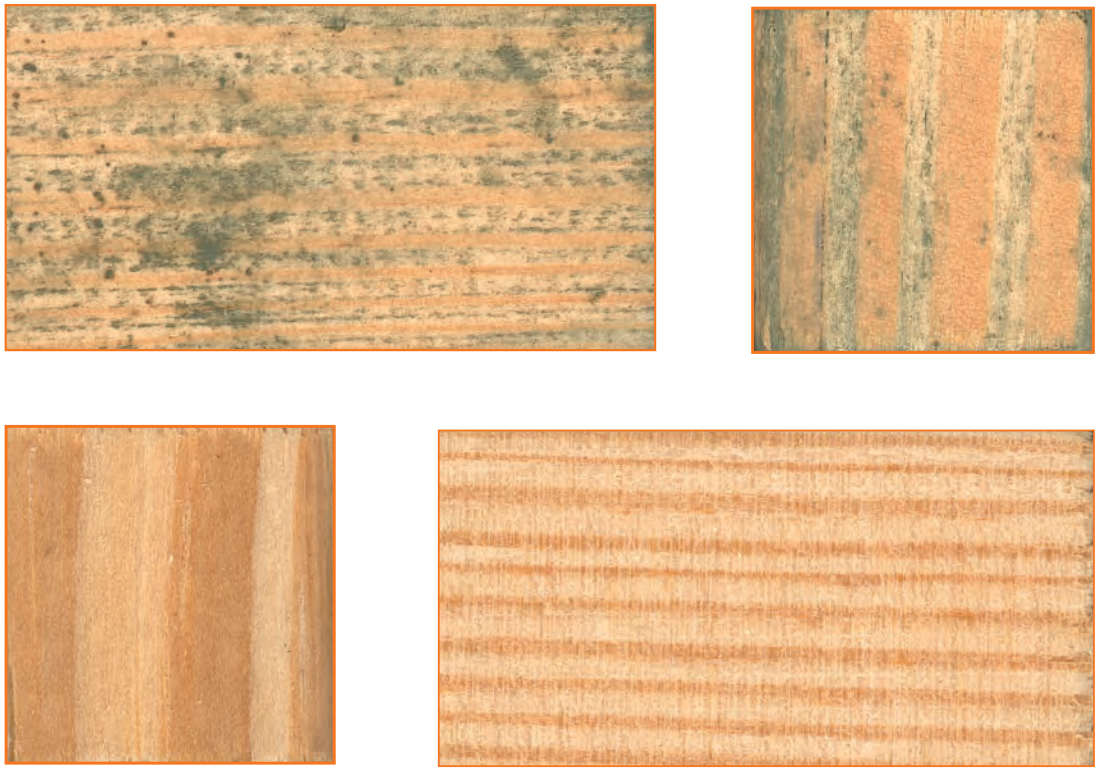
In many parts of the United States, such as Florida, the outside air naturally has a very high humidity and carries a lot of water. This can be particularly problematic, especially if the home is tightly enclosed and using air conditioning. In this type of situation, the warm air will drop all the moisture in the cooled house, leading to condensation and fungal infestation. This can be avoided if a condensing air conditioning system is used. This type of air conditioning has a cold surface within it to force the water out of the air before it cycles around the home. If dehumidification or humidification is used, make sure it maintains relative humidity to between 40% and 60%.

## MOISTURE BARRIERS

Leaking pipes, broken roofs or other lack of maintenance are obvious, and we don't need to discuss how to fix such problems here. Rising and penetrating damp occur due to poor design, construction or maintenance but can be readily fixed. Good design should recognize that sloped roofs are better than flat, and that large roof overhangs that put rain water onto the ground (or preferably into gutters) rather than onto the side of the house are also much preferred.

New houses should have a waterproof membrane built into the slab or within the foundation wall. Crawl spaces should be provided with good cross ventilation. The house itself should also be built effectively 'above grade' and above the installed moisture barrier. If any of the above are lacking, it may be difficult to remediate fungal problems without first correcting these defects.

**Virtually every building material can support mold growth. (top l to r) SYP Plywood, DF Plywood, SYP OSB (bottom l to r) Dry Wall, Cement Fiber Board, Aspen OSB**



**Untreated samples (top) vs. samples treated with Bora-Care with Mold-Care (bottom) incubated for three months in a laboratory mold chamber.**

## CONTROL FROM NISUS

Given suitable conditions for growth (water, food, etc., as described above), mold and decay fungi develop very quickly. Remedial repair to remove water problems must therefore be carried out as soon as possible, and the area should be dried properly, preferably within twenty-four hours of repair. Drying materials will kill most fungi and prevent any new growth (apart from dry rot fungi and insects), but rarely is it possible to expedite "drying fast enough." It usually takes a number of weeks and can often even take months to dry a home properly. During this drying period, the home and materials within it will remain susceptible to new fungal growth.

Bora-Care with Mold-Care treatment has proven to be fast and simple enough for use to prevent problems during this time. Mold-Care is specifically designed for use with Bora-Care. Bora-Care applied with Mold-Care bridges the gap between home construction or repair and drying, and it prevents the establishment of dry rot and insect infestation, which otherwise could continue after the structure is dry. Scientific studies have shown that the active ingredient in Bora-Care is an effective means of protecting materials against decay fungi. The specific active ingredient in Mold-Care is a special disinfectant, the same as used to sanitize restaurants and hospitals, that has been formulated by Nisus to be used with Bora-Care for even greater performance, especially against mold fungi. This combination gives optimum protection of treated materials. Bora-Care with Mold-Care was proven effective in controlling all fungi during normal drying periods in scientific studies and will help prevent mold during transient moisture such as that in a crawl space during the summer.

## NEW CONSTRUCTION TREATMENTS USING BORA-CARE WITH MOLD-CARE

Structures should be treated with Bora-Care and Mold-Care as a primary treatment during the construction process when access to all wood members is available. Normally this is at the "dried-in" stage of construction when all structural wood and sheathing is in place and, if possible, prior to installation of drywall, insulation, mechanical systems and electrical wiring. After insulation is installed, this can also be treated. For drywall treatment, it is best to spray the back face of the drywall and allow it to dry while it is standing against the wall frame. Then turn it over and nail/screw into position before spraying the front face.

As a rough guide in a 2,300 square foot residence (average house), there is approximately 13,500 board feet of lumber. One gallon of diluted solution should be used per 400 board feet of wood and one gallon of diluted solution per 400 square feet of sheathing, insulation or drywall.

It is necessary to treat all the wood framing that is to be protected from mold. Treatment of the other materials is good practice in providing protection against water damage from leaking pipes, roofs or condensation, etc. However, due to the cost and time required for treatment, builders and homeowners may choose to treat wood and other materials such as drywall only in the highest hazard areas such as in kitchens, bathrooms and crawl spaces if not also concerned with drywood termites, a big problem in Florida and California. Ensure that the structure is not closed after application until properly dried, normally 24 hours.

**Treating interior bathroom walls.**

## POST-CONSTRUCTION TREATMENTS USING BORA-CARE WITH MOLD-CARE

Homes or buildings with fungal problems should first be fully inspected and surveyed by a qualified professional for both the extent of fungal damage or colonization and the source of moisture. This may involve removal of dry wall and insulation. Such disruption can stir up or release fungal spores. To avoid any potential allergies, appropriate respirators should be used, and the homeowners should be advised that there may be a higher level of fungal spores in the air for a number of days after the work is complete. In severe situations, the advice of an industrial hygienist should be sought and a full site containment and mold remediation may be necessary.

**Treating a subfloor controls mold and prevents dry rot and insect infestation that also accompany moisture problems.**

Any structural defects must be repaired as a matter of urgency to protect the building from failure. All moisture problems should be fully rectified, and this may include the repair of the building to prevent rising and penetrating damp and/or the installation of appropriate ventilation. Education of the homeowner as to the cause and source of the problem is an important step to prevent reoccurrence.

Areas showing any signs of fungal or insect activity or any signs of dampness (use a moisture meter and moisture analysis rather than by eye for actual moisture content) should be properly treated with a combined application of Bora-Care with Mold-Care.

Properly dry out the structure, if necessary leaving off drywall or adding additional electric heating, ventilation and/or dehumidification. Kerosene and propane heaters should not be used as they produce a great deal of water as part of the combustion.

## MIXING BORA-CARE WITH MOLD-CARE

Before application, it is important to mix Bora-Care with Mold-Care properly. Bora-Care and Mold-Care are packaged in a convenient piggy-back container as liquid concentrates that contain 40% and 80% active ingredients respectively. Both are water soluble but have been specifically formulated with penetrants to provide the greatest absorption and diffusion into treated materials as well as the broadest control of pests.

Bora-Care and Mold-Care concentrates must be mixed together with five gallons of water, per label requirements. Note, for treatment of active infestations and as a pretreatment against subterranean termites, Bora-Care must be used as a 1+1 mixture with water (1 gallon Bora-Care plus one gallon water).

To mix Bora-Care with Mold-Care solution you will need the following equipment and materials:

**01** A six gallon or larger pail
**02** Clean water
**03** Drill
**04** Mixing impeller (like those used to mix paint)
**05** EPA required personal protective equipment such as skin and eye protection
**06** Bora-Care and Mold-Care concentrates

**Use a drill and impeller to mix Bora-Care with Mold-Care**

## DOCUMENTATION

It is important to graph the structure and fully document the Bora-Care with Mold-Care application. This documentation will be an important tool for future inspections.

## MIXING PROCEDURES

**01** Pour four gallons of water into a six gallon pail.
**02** Attach mixing impeller to drill and begin agitation.
**03** Gradually pour Bora-Care and Mold-Care into water and thoroughly mix solution.
**04** Use remaining one gallon of water to triple rinse Bora-Care and Mold-Care container and pour contents into mixing solution.
**05** Continue to mix until solution is fully mixed (you do not feel resistance of any remaining concentrate). Normal mixing time may be five minutes. Warm water will reduce mixing time but is not actually required.

- Mixing tip: Do not allow mixing impeller to touch sides or bottom of pail. This may create small plastic chips that could clog spraying equipment.

Use a 2–4 gallon hand held stainless steel sprayer or back pack sprayer to apply up to 2–4 gallons of solution at a time.

For larger amounts, a 10–100 gallon spray unit with mechanical pump is recommended. For best results this unit should also have mechanical agitation for proper mixing to prevent any potential clogging of spray equipment. Remember: it is recommended to mix only the amount of Bora-Care and Mold-Care 1+5 solution needed for that day's applications.

## CUSTOMER COMMUNICATION

It is not possible for any product to provide permanent protection of a structure that remains continuously wet. It is important to talk to the builder/contractor and if possible to the homeowner to explain the treatment and educate them on conducive conditions that will cause mold, decay and insect infestation. It is also important for the pest management professional to do a thorough onsite annual inspection to determine if any conducive conditions exist.

Any product is only as good as the application, and as a pest management professional we hope you will use this information to protect you, your company and most importantly the homeowner from the results of mold and pest infestation.

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## IMPORTANT: PLEASE READ

Not withstanding anything to the contrary contained herein, no warranty is made to any person or entity other than professional pest control operators purchasing product and only as expressly set forth in the Nisus Authorized Pest Management Professional Program Participation Agreement. Except as expressly set forth therein seller makes no warranty, whether expressed or implied, including, without limit, the implied warranties of merchantability and fitness for a particular purpose, both of which are hereby expressly disclaimed. The professional pest control operator's sole remedy and Nisus Corporation's liability under any warranty shall be limited solely to product replacement.

Nisus will not be liable for direct, consequential or incidental damages, including without limitation lost profits, even if Nisus is aware of the possibility of these damages occurring. Nisus Corporation specifically advises all parties that mold will continue to grow in conducive conditions. Since Nisus Corporation cannot control such conducive conditions, Nisus Corporation shall not be liable for any liabilities, claims, damages or the like in any way related to or arising in connection with the occurrence or presence of mold.