



# Spalted Wood

Sara Robinson

Anyone with a firewood pile should be familiar with spalted wood; the winding black lines, punky white pockets, and brilliant rainbow colors are hard to miss. Unfortunately, nature's artwork does not come with a manual, and working with spalted wood requires not only different tools but also a different mind-set. As many woodturners already know, spalted wood cannot be mounted on a lathe and expected to behave like sound wood. The physical properties of spalted wood have been drastically altered by decay mechanisms and, as such, special care must be taken when working with this unique material.

## Background

*Spalting* is generally defined as any penetrating color found on wood, and it is caused by fungi—very specific fungi from very specific groups. Wood-decay fungi (*basidiomycetes*) and mold fungi (*ascomycetes*) are primarily responsible for spalting, with several species in each group doing most of the work. Basidiomycetes contain two distinct subgroups, white-rot fungi and brown-rot

fungi. It is important to distinguish between these two groups, as brown-rot fungi are very destructive and are generally not used for spalting (pecky cypress excluded). White-rot fungi are responsible for the white, soft areas in spalted wood, and are often responsible for the black lines (zone lines) as well.

Mold fungi primarily cause the colors on spalted wood, although some soft-rot fungi also play a role

(*Xylaria polymorpha*, “Dead Man’s Finger,” being a prime example). Very few molds are capable of causing a penetrating color, and those that colonize and color only the surface of wood are not utilized for spalting.

Wood-inhabiting fungi rely on wood for their survival—the wood provides for the nutritional needs of the fungus. However, different types of fungi utilize different components of the wood, meaning that different types of spalting result in different surface and structural changes. All wood-inhabiting fungi initially consume the easily available surface sugars in wood. This type of colonization changes the permeability of the wood, but does not alter its strength. Once the easily available sugars have been utilized, only fungi with specific degrading enzymes can continue colonization. Mold fungi do not produce these enzymes, and thus generally cannot penetrate deep into the wood. For this reason, fungal pigment can be difficult to achieve internally. Luckily, there are two types of pigments in fungi: those that bind to the cell wall, and those that are released extracellularly. Pigments that are released (and therefore not bound to anything in particular) can diffuse through the wood independent of the fungus. Hence, a deep, penetrating color can be achieved without extended fungal colonization, assuming you chose the correct fungi!

Basidiomycete fungi can produce enzymes that degrade wood’s structural components. The degradation of structure leads to massive changes in strength. In particular, white-rot fungi degrade lignin (a feat brown-rot fungi cannot accomplish), leaving behind soft, spongy areas. This structural change is primarily what makes turning spalted wood such a headache for those unfamiliar with the process.



Basswood, blue stain, water-based finish

Basswood, blue stain, purple stain, water-based finish

Sugar maple, white rot, zone lines, green stain, wax finish

Curly birch, pink stain, white rot, zone lines, wax finish

Curly birch, pink stain, white rot, zone lines, yellow stain, wax finish

Maple burl, white rot, urethane oil finish

### Common problems

If you have ever turned birdseye maple, then you have some idea of how changes in wood density can affect turning. To begin with, changes in density create more chatter. This happens because softer areas cut more easily than harder areas, creating dig-ins. With spalted wood, you get the added joy of loose fibers. When the “glue” that holds wood components together is degraded, entire fiber sections can peel off, creating divots in the piece

that are too deep to sand out. In addition, soft, punky wood does not hold together well. Too much pressure in a weaker area can lead to a piece blowing up on the lathe.

Sanding spalted wood on the lathe can be especially tricky because of density differences. Even a piece that had no chatter when turned will probably develop chatter after extended sanding. Again, this happens because the softer areas of the wood are cut more quickly than the sound areas. Sanding spalted ►





Sugar maple, white rot and zone lines, water-based finish



Sugar maple, blue stain, white rot, zone lines, wax finish



Aspen, green zone lines, blue stain, pink stain, black zone lines, white rot, purple stain, water-based finish



Birch, pink stain, wax finish



Curly birch, zone lines, white rot, water-based finish



Birch, zone lines, white rot, blue stain, water-based finish



Basswood, zone lines, white rot, wax finish



Sugar maple, white rot, water-based finish



Beech, zone lines, white rot, lacquer finish

wood on the lathe for even two to three minutes can quickly put surface waves into a formerly round piece.

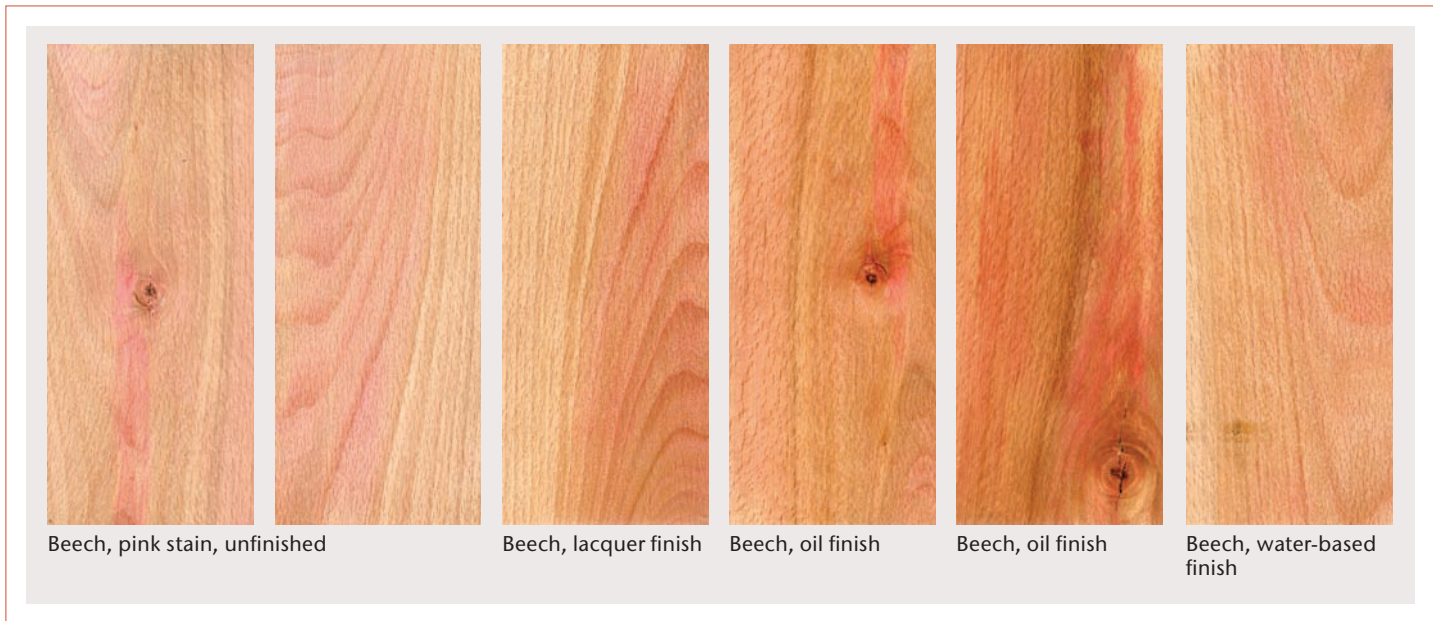
Even off the lathe, spalted wood can present problems in workability and finishing. The increased permeability of the wood in fungus-colonized areas means that more finish will be absorbed in spalted areas than in sound areas. Continuing to add coats of finish without first directly addressing the spaltling leads to pieces with differential luster between sound and spalted areas.

### Solutions

When I was learning to turn in high school, I was taught that a properly sharpened and appropriately utilized tool could create a finish smoother than anything I could achieve with sandpaper. I have no doubt that this philosophy holds true for sound wood; however, spalted wood requires some extra maneuvering.

With that said, the greatest gift you can give yourself if you plan on turning spalted wood is to always keep your tools sharp. Do not even mess around with, "it still has a decent edge" or "I can probably get another bowl out of this one." Super-sharp tools are the only things that will save you from hours of tedious sanding to repair divots. However, the tools are not going to do all of the work. Spalted wood that is only pigmented will turn well, and depending on the fungus involved, may turn almost identically to sound wood. The big difference is found in the white-rotted wood (soft and spongy), especially when it is surrounded by zone lines (hard clumps of melanin over undecayed wood). Throw a little sound wood into the mix and you have a recipe for frustration and disaster.

There are a number of options available for changing the density of wood. Solutions of methyl methacrylate, for



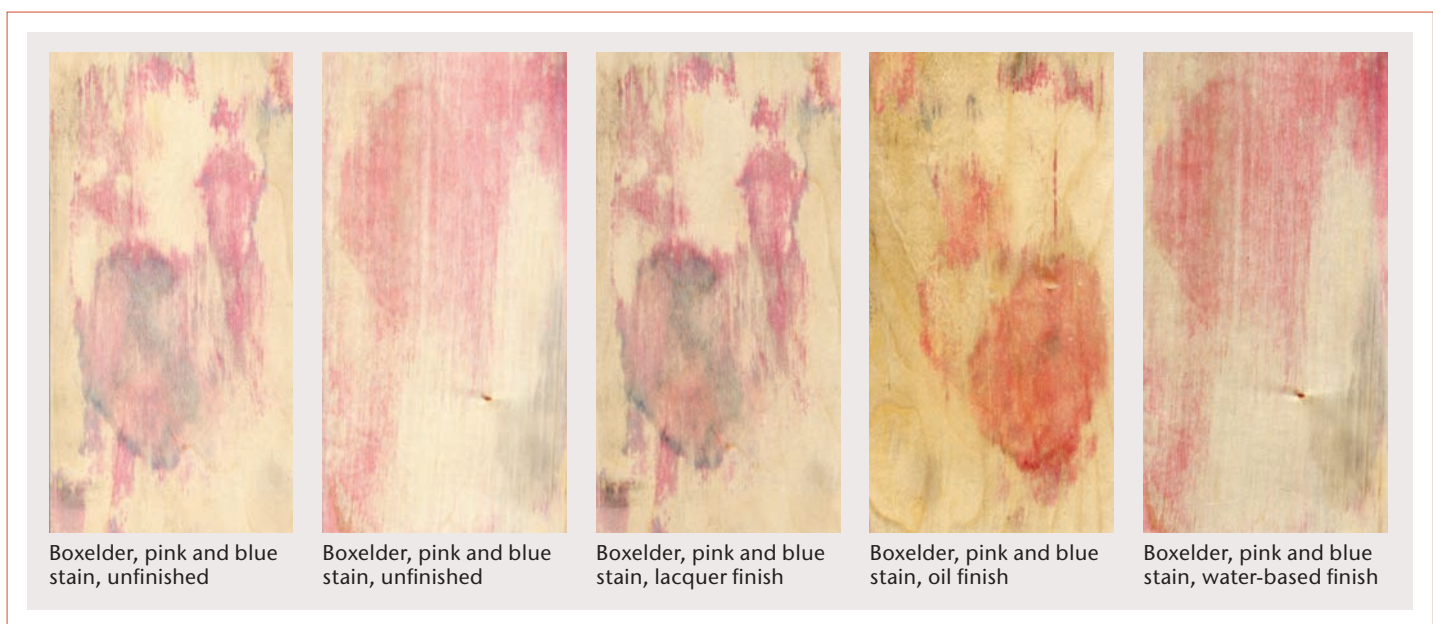
instance, can be pressure-treated into the wood to give it a more uniform density and harden the punky areas. Various types of cyanoacrylate (CA) glue can be directly applied to punky areas for an instant hardening. Epoxy can be used to fill already-made divots and keep the area from becoming worse.

Although all of these hardeners work well, their major side effect, for me, is unacceptable: They cause an

ambering or at least a darkening of the applied areas. One of the biggest joys of spalted wood is the color contrast—the blacks against the pure whites, the pinks on a pale wood. Adding yellow to the mix can ruin the contrast and, if you spalted the wood yourself, ruin months of work.

Of course, you do not have to stabilize the wood. Leaving the divots and cracks creates a textured surface—a

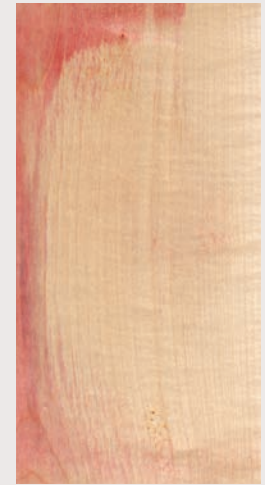
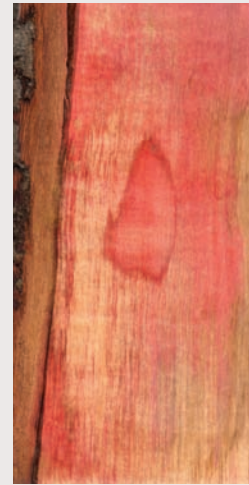
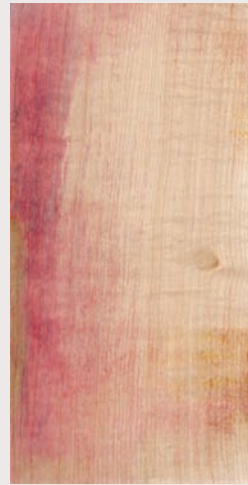
look that some people appreciate. You can also repair torn grain and divots by sanding, although sanding on the lathe will get you nowhere fast. Your best bet for repair without chemicals is to remove the piece from the lathe and sand by hand with the aid of a drill press. Sanding discs for drill presses that work with hook-and-loop-backed abrasives are easily available. The piece can be ►







Sugar maple, pink stain, unfinished



Sugar maple, pink stain, lacquer finish

Sugar maple, pink stain, oil finish

Sugar maple, pink stain, water-based finish

## Controlled Spalting

Because there is a higher market value for spalted wood, woodworkers and turners routinely search for ways to induce spalting into their clear lumber. Actual scientific research into spalting did not begin until very recently—2007 in fact—which means that conjecture and home recipes for spalting have had around thirty years to develop and grow (that would be thirty years since the Lindquists brought spalted wood to the forefront of our collective consciousness).

The advent of the Internet greatly expedited the transfer of spalting myths, with the current result being that most everyone knows someone who knows someone who has spalted wood with fertilizer, beer, negligence, and so on. The primary problems with such techniques are twofold. First, wood is meant to decay, and spalting is simply a part of the decay process. Any wood will spalt, given conditions within the tolerance range of fungi. Whether you leave your wood in the forest covered with leaves or pour beer on it in your shed makes no difference. Second, there are millions if not billions of fungi in the world. Replication of colors (even reliability of colors) is what differentiates controlled spalting from “found” spalting. Hence, just leaving your wood lying around isn’t inducing anything—it’s just moving nature’s recycling operation from one location to another.

With that said, controlled spalting is quite possible and relatively easy if you have the right tools. The next time you head to your favorite

box chain store, consider picking up the following:

- heavy-duty plastic storage tubs with snap-on lids (any color EXCEPT clear)
- two cheap spray bottles
- bleach
- rubbing alcohol (at least 91%)
- vermiculite

The trick to controlled spalting is getting the wood inside, away from the airborne fungi that could potentially land on your wood and colonize. Plastic storage tubs come in a large variety of sizes, so it should be no trouble to find one that fits your size requirements. For the spray bottles, you’ll want one filled with the rubbing alcohol, and one filled with a 10 percent bleach solution. Spraying down the inside of the tub with bleach and alcohol helps to kill the mold fungi on the surface. Any mold fungi residing on the plastic are *not* the kind you want on your wood; not only do their pigments not diffuse, but the pigments often contain antifungal properties, which will either stunt or completely hinder the growth of your fungi.

The vermiculite is optional. When wetted and used to surround your wood, it helps maintain appropriate moisture content to encourage fungal growth. If you don’t use vermiculite you will need to douse your wood with water every so often to keep its moisture content around 30 percent. Do not use soil for moisture control—the humus can leach out and cause discoloration of your wood.

## Wood prep

Once your bin is sterile and filled with wet vermiculite, you need to prep your wood. For turning, I suggest cutting the blank into the shape you plan on mounting onto the lathe, or even just rough turning the bowl. Rough-turned bowls will spalt more quickly than bowl blanks; however, bowl blanks have a lower rate of spalting failure due to their larger mass and ability to better hold moisture.

Spray all the surfaces of your bowl/blank with the alcohol, and wait for evaporation. Repeat the process again. Once the alcohol has completely evaporated (I should probably point out here that any sort of alcohol one might drink is not appropriate for this exercise), the fungus can be added to the wood and the wood can be buried in the vermiculite. Multiple pieces of wood can spalt in the same tub, and the closer you place them together, the better; it helps keep moisture inside.

## Fungi

You have two options here: the cheap option with a moderate success rate, and the expensive option with an almost guaranteed success rate. The cheap option entails going outside, picking whatever mushrooms you find growing on deciduous logs, rubbing a broken-off section on your wood, and hoping for the best. You can hedge your bets by being selective in your gathering and picking only those fungi that are known to spalt well, like *Trametes versicolor* (Turkey Tail) and *Xylaria polymorpha* (Dead Man’s Finger). It’s also helpful

held against the rotating paper and selectively sanded. This technique is particularly helpful for removing divots, since the problem area can be directly addressed without harming the rest of the piece.

An additional benefit of sanding by hand is that it takes less time than sanding on the lathe. As mentioned before, because the softer areas sand much more quickly than sound areas, a wavy surface on the wood is created when a bowl is sanded on the lathe. Sanding by hand gives you the flexibility to sand out problem areas and simply touch up the rest of the piece, without changing the intended profile of a bowl or vessel.

## Finish

Now that the wood is off the lathe and sanded, you might as well finish it by hand. (Remounting could be done, but the piece will no longer be perfectly round.) At this point, all spalt-ing types become equally challenging to finish because of the increase in permeability. Spot treatment of CA glue can take care of the problem, but again, you get color change.

Oil-based finishes can be selectively applied first to spalted areas with a pipette (eye dropper) before finishing the entire piece. It will take more coats to get a heavy luster with spalted wood, so be prepared for repeated applications. I do not, however, recommend

oil-based finishes, because an ambering occurs on the wood. If I spend several months spalting a piece of wood, the last thing I want is to change its color with the finish.

All of the problems of punky spots, surface texture, divots, and ripped grain can be dealt with using a thick water-based finish. Water-based finishes, while giving a different textural feel to the wood than oil, sit only on the surface of the wood. This means that the punky areas are not absorbing more finish. In addition, the water-based finishes tend to fill in areas of ripped grain. Also, there is the benefit of not having dangerous noxious fumes to contend with. ▶

if you select the current year's fruiting bodies instead of older, dried specimens.

If you are short on time and patience (or just really, really want spalting to work), you will need to buy an active culture of the fungus you are interested in. These cultures, which are the mycelial part of the fungus (the "root" part, not the mushroom part), will shave at least two weeks off your incubation time, since they are already actively growing. An added bonus is that you can obtain fungi that do not make fruiting bodies, which is common in many of the brightly colored molds. Unfortunately, cultures can easily run \$100 or more per plate, and must be purchased from culture collections such as the American Type Culture Collection (ATCC), or directly from universities with mycology labs. The good news is one culture will last you forever if you make copies of it before use. Guides for fungus culturing are available for free download at: [web.mac.com/kaysa\\_gabriel/Northern\\_Spalting/DIY.html](http://web.mac.com/kaysa_gabriel/Northern_Spalting/DIY.html).

## External conditions

The best way to accelerate spalting is to keep the fungi hot, moist, and in the dark. Placing the bins in your bathroom is a great way to encourage growth. If possible, you'll want to keep temperatures around 80° F, and the wood's moisture content around 30 to 35 percent. There is no magic potion for spalting—no amount of beer, fertilizer, urine, dirt, or leaves will speed the process. Nitrogen-based additives may have some positive effects, but unfortunately, they are often sold in

combination with many other "things," especially in fertilizer. In the end, the best additive for your wood is heat and water.

## Timeframe

This is a very sticky topic to discuss. The time it takes for a fungus to completely spalt a piece of wood depends on a menagerie of variables, such as wood species, type of fungus, fungus species, and the size of the wood piece. Expect a minimum of two months of incubation time under ideal conditions. If you are looking to get multiple colors, each must be put on separately, which can extend incubation time into years. Although there is no specific time for complete colonization, I can tell you that, in terms of incubation time (in general, listed from quickest to slowest growth):

- white rots
- soft rots (like *Xylaria polymorpha*)
- pigments

and for pigments:

- blue
- pink
- purple
- yellow
- orange
- green
- blue/green

for size:

- rough-turned bowls
- circular bowl blanks
- logs

## Knowing when it is time to turn

If this is your first time with controlled spalting, I recommend placing many pieces of similar size and of the same species in your tub, with only one fungus. After about two months, pull a piece and turn it. If the spalting is not sufficient, wait another two weeks, then pull another. Once you have an idea for how long your chosen fungus takes to colonize your wood species at a particular size, you will no longer have to work with replicates.

Do not rely on visual external appearance to judge internal spalting. If you are doing things right, the surface of your wood will probably turn black and slightly sludgy with time, making any sort of visual assessment impossible. Also, just because a piece of wood is green on the outside does not mean that it is green on the inside. Fungi are tricky like that.

A number of resources exist to help you both find appropriate spalting fungi and to assess the necessary length of incubation. Fine Woodworking Online runs a blog dedicated to controlled spalting ([finewoodworking.com//blog/woodworking-life/tag/spalting](http://finewoodworking.com//blog/woodworking-life/tag/spalting)). This blog covers myths, procedure, and every summer highlights different spalting fungi. Northern Spalting ([northernspalting.com](http://northernspalting.com)) contains another spalting blog, DIY guides, fungus culture information, links to scholarly work on spalting, and so on. Be warned: The Internet is rife with incorrect information about spalted wood, so be sure to check out information about the article author before taking any information you read as fact.

Good luck!



## A final word

Spalted wood is more difficult to turn than sound wood. Understanding the basic principles behind the decay and its effects on wood can facilitate an easier turning session, with more satisfactory results.

Although spalted wood is frequently used for vessels and other decorative works, I have seen it used for spindle turning as well. A note of caution: Wood spalted with pigment fungi is generally strong; however, wood with white rot and zone lines has lost a great deal of its strength. Spalted spindle turnings, no matter how well stabilized, shellacked, or reinforced, should never be used for load-bearing applications (table or chair legs, for instance).

It is advisable not to turn pieces that are spongy to the touch when wet. This type of spalted wood is unstable and has been decayed beyond the point of potential usability. These are the pieces that are very likely to blow up when turning. At the very least, wear a faceshield.

Working with spalted wood requires time, patience, seriously sharp tools, and a positive attitude. I wish you the best of luck with your next prize piece of spalted wood and hope that the science behind the craft aids in the adventure!

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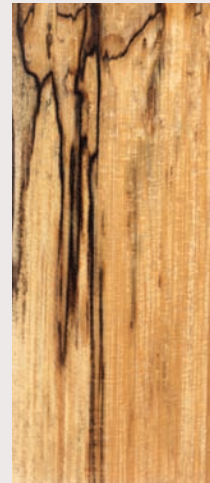
*Sara Robinson has a PhD in forestry (within the field of wood science) from Michigan Technological University and currently works as a postdoctoral research fellow at the University of Toronto. She runs her own Applied Mycology Lab, where graduate students and undergraduates from all backgrounds and disciplines can explore the interactions of fungus on wood. You can visit her website ([northernspalting.com](http://northernspalting.com)) to learn more about spalting, and stay up-to-date with the latest developments in spalting research.*



Sugar maple, zone lines, bleaching



Sugar maple, white rot, zone lines, lacquer finish



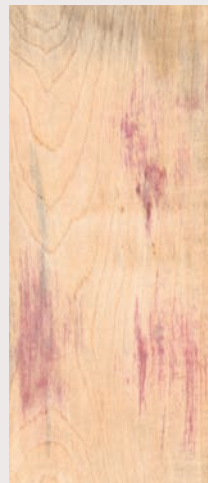
Sugar maple, zone lines, white rot, oil finish



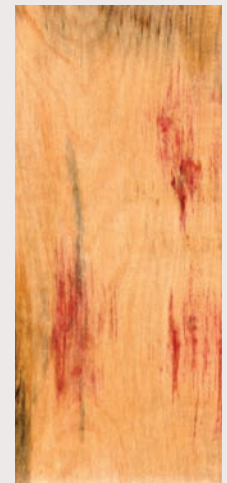
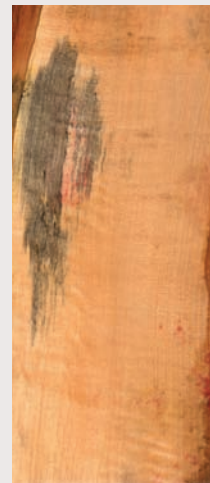
Sugar maple, white rot, zone lines, water-based finish



Sugar maple, pink and blue stains, unfinished



Sugar maple, pink and blue stains, oil finish



Sanding pin cherry with blue stain, zone lines, bleaching. The glue line on left-hand side of the bowl is cyanoacrylate.



Sanding epoxy on sugar maple with pocket white rot and zone lines



Sanding pocket white rot and zone lines on sugar maple