

The Barberry War To plant or destroy? That is the question.

By Mary Jasch
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Photo by J. Ehrenfeld

Barberry: from perfect all-occasion shrub to killer in the woods, the topic is fraught with controversy.

Barberry's advance into east coast woodland from designed landscapes began in Colonial times when European barberry, *Berberis vulgaris*, spread wantonly in the Boston area (Gypsy Moth was also introduced there) until its presence as alternate host for black stem rust on wheat became known. Colonists delivered its death knell garden to garden and, later, the USDA practically eradicated it. Since then, Japanese barberry, *B. thunbergii*, and its purple garden variety, *B. thunbergii* var. *atropupurea*, continue the forest invasion.

Today, *B. thunbergii* is everywhere in New Jersey, except for the droughty habitats of Pine Barrens and ridge-tops. Hopefully, research, law and good sense will determine its fate.

But what is the real story behind this thorny topic? What, exactly, is the problem with this popular deer-resistant plant with dozens of colorful cultivars used in so many landscapes and micro-habitats?

For starters, studies show that Japanese barberry causes virtually irreversible changes in soil chemistry which promote the fast growth of weedy plants, including itself, while inhibiting the growth of native forest plants. This results in a loss of bio-diversity and habitat and, not so incidentally, supports Lyme Disease. Several ongoing studies and historical evidence show that barberry infestations found in forests come from plants used in designed landscapes.

Champion of Bio-diversity

Enter Joan Ehrenfeld, professor, Department of Ecology, Evolution, and Natural Resources, School of Environmental & Biological Sciences, Rutgers University. Her long-time interest in barberry's effects on forest soil processes and micro-organisms and how that soil, in turn, affects plant growth has led her to several barberry studies throughout New Jersey and New York.

In one study Ehrenfeld found that, because barberry tissue is high in alkaloids, or nitrogen-rich compounds, there is an increase in nitrogen cycling and a loss of organic matter in the soil. Barberry decomposes rapidly and cycles nitrogen more rapidly than most forest plants do. That produces more nitrate, creating the kind of soils that weedy plants are adapted to – the opposite of what most forest plants that use ammonium or organic nitrogen as their nitrogen source are adapted to.

“That's one of the major concerns because once you have that soil transformation taking place, it's very hard to go back,” says Ehrenfeld who often finds other exotics growing with barberry.

After removing barberry in Morristown National Historical Park and in the Delaware Water Gap National Recreation Area, Ehrenfeld tried restoring native understory shrubs: spice bush, which hazel and blueberries. They didn't make it. She found that natives, adapted to growing slowly, stand little chance against rapidly growing weedy plants in the changed barberry soil.

Just how rampant is barberry in New Jersey's woods? During a three year Citizen Science project, Ehrenfeld and volunteers walked literally hundreds of miles of trails in the New York-New Jersey

Highlands collecting data on a dozen exotic species. “Barberry was far and away the most abundant species that we found,” she says, “largely because it can grow under full canopy.” They found barberry present on 30% of their 2,000 data points. Some were infestations and others were scattered plants here and there for miles.

But, so what if it’s just a plant or two somewhere in the woods, one might wonder. As it turns out, even one plant can wreak havoc on soil function and microbes, according to Ehrenfeld and crew’s look at the question: “Do you get these changes with just a tiny bit?” They mixed small amounts of barberry litter with leaf litter from an oak-beech forest in increasingly small increments. To their surprise, data showed linear increases in decomposition rate and changes in soil biota. Result: “Even a single plant changes the environment around it where its litter falls,” says one researcher. Recommendation: remove both infestations *and* newly established individual plants.

The treachery is almost ubiquitous because barberry spreads easily: by land, by air and by water. Locally, fruits fall from bushes, underground runners sprout and stems root where they touch the ground. That’s why it makes a great hedge. Further away, birds and deer drop seed; storm water and streams carry it. And contrary to common thought, barberry is a low-quality wildlife food that does the birds no favor.

But why do we care, anyway, whether or not barberry in our gardens produce offspring in the woods? So what’s a couple purple shrubs in a backyard going to do to our world? What difference does it make if forests change? Isn’t change the natural order of things, anyway?

“It’s largely a question of preserving native diversity,” says Ehrenfeld. “We simply value the wide variety of plants that are native to plant communities throughout the region. It’s like the argument of the McDonaldization of the natural ecosystem. You don’t want to go somewhere and have only McDonalds to eat in and nothing else. You don’t want to go into forests throughout a region and see only essentially one species of plant. We value the diversity of plants that reflect different kinds of soil and environmental conditions, so it’s fundamental conservation values.”

Essentially, for our own pleasure: “for the same reasons humans take pleasure in a beautifully designed landscape,” Ehrenfeld says.

Mark Brand, professor of ornamental horticulture, Plant Science and Landscape Architecture Department, University of Connecticut, does genetic studies on feral barberry plants to determine their source. He especially looks for purple parentage. DNA fingerprinting of old, invasive populations of barberry originally showed meager evidence of purple barberry contributing genes to wild plants. “We did find a little bit but it didn’t seem as though these populations were largely produced by the purple leaf types,” he says. In another sample, however, parentage analysis of the genetics showed that plants had indeed spread from an old purple plant in an old landscape. “That study did show that a large, old, established, standard-sized purple plant could contribute seedlings to surrounding unmanaged areas.”

Ehrenfeld likens low levels of long-distance seed dispersal to a still-humongous 1% microbial resistance to anti-biotics. “In Highland Park, every third house has a barberry hedge. If we were adjacent to a natural area and even if only one percent of those seeds were moving into a natural area and only one percent of that had managed to germinate, that’s still substantial, especially because there is so much effective dispersal that’s local with bushes spreading out vegetatively and seed dispersal that’s local.

“We all (the scientists working on exotics) think that having a large seed source cultivated in a horticultural environment is a real threat. There’s a huge amount of data from other species in other situations supporting that argument. When you have a large seed source, you have a major problem. Again, a tenth of a percent of a very large number is still a large number. That’s the problem.”

That was shown in reverse, she says, by the vigorous and well-funded program of removing European barberry, *B. vulgaris*, which is almost non-existent in our woods today. Some say that historical barberry invasions have dwindled due to a change in landscape from open farm fields to closed canopy forests. But today’s invasive barberry is a different species that is able to thrive under a closed canopy.

So why do people use it? “Like many errors that are made in landscape design there’s an inexpensive availability of the plant and therefore selecting it as a path of least resistance,” says Jean Marie Hartman, department chair, Landscape Architecture, School of Environmental & Biological Sciences, Rutgers University. “People who select it because they think it’s good to be giving fruit sources to the birds are giving very low quality food choices to birds when native plants tend to have much better food sources.”

Champion of Barberry Potential

Because of barberry’s horticultural usefulness and its value in the industry, Brand aims to produce sterile barberry plants for the nursery trade. His approach is to first double the chromosomes of existing diploid barberries to make tetraploid barberries, then cross the tetraploids back to the diploids to get triploids, which are typically sterile. So far he has had little success with the crossing, leading him to think the tetraploids themselves may not be fertile or have reduced fertility.

“That would really be a great thing because then you can just take a particular form like Crimson Pygmy and make that into a tetraploid, which we’ve already done, and they’re already sterile and there’s no variation from seed reproduction,” says Brand who is making crosses now. What triploids they might get must be grown and evaluated for sterility and value as good landscape plants. “I think it will be five years minimum before any consumer might get some of these plants,” he says.

Brand is also assessing the invasive potential of about 45 barberry cultivars with yellow, purple and variegated leaves and dwarf and columnar forms to study their fruit production, seed germination, seedling vigor and how well their seeds establish in wooded areas to ultimately learn if existing commercial forms of barberry are safe to grow. Results show that barberry cultivar seed production ranges from “almost none” to “horrendous” and “unbelievable amounts.” “We’re still collecting the last year’s worth of data on the establishment in the woods and then we’re hoping to come up with a calculation for an invasiveness index that will put all of these factors together in a weighted formula by the end of this year,” he says. “Most of the popular forms produce more fruit than you would like them to.” Generally, the yellow and dwarf purple forms produce the least; standard-size green and purple forms are prolific.

“I and the whole exotic community have had a long, ongoing argument with the horticultural community, the nursery community, about whether the cultivars of barberry are a problem or not,” Ehrenfeld adds. “We tend to believe that these cultivars will eventually revert and are capable of maintaining the invasion, especially where they’re adjacent to natural areas.”

Criminal critters

What started out as trying to control barberry infestations in southern New England forests, turned into a study of the barberry-deer tick relationship for Jeff Ward, chief scientist in forestry and horticulture, Connecticut Agricultural Experiment Station. He found that deer ticks are concentrated in areas around barberry. The larval and nymph stages of the tick like to feed on white-footed mice. Mice live in the dense and thorny barberry for protection from predators such as owls, hawks and coyotes.

“We started out trying to control barberry and got covered with ticks. We found that when we got rid of the barberry we got rid of most of the ticks,” he says. The project, now in its fourth year, has shifted and results show that “barberry infestations in the woods have roughly four times more ticks with the spirochete that causes Lyme Disease.” He also found that more ticks live in barberry and multiflora rose than in leaf litter.

His advice to landscape architects? When designing commercial landscapes with a wooded area with paths that people may want to go through, Ward advises removal of nearby barberry and *R. multiflora* infestations “and other invasive plants while you’re at it. You don’t want somebody at work to get bit by a tick and lose weeks of work.”

The last word, says Ehrenfeld: “I think that it’s important to avoid plants that are known to cause problems. There are many, many other alternatives and there are many sources of information. There are lots of beautiful landscaping plants that have never been found to move out into natural areas and cause the problems that barberry causes. “

Jean Marie Hartman’s selected links:

National Park Service: www.nps.gov/plants/alien/fact/beth1.htm

And yet, people are willing to deny what the research repeatedly documents:

www.gardeningblog.net/2007/06/10/barberry-a-great-shrub-for-the-landscape/

The Nature Conservancy:

www.nature.org/wherewework/northamerica/states/connecticut/science/art23895.html

Chicago Gardener

http://featuresblogs.chicagotribune.com/chicago_gardener/2007/05/is_barberry_inv.html