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Elderberries: A promising new crop for West Virginia

Elderberries are gaining interest among West Virginia gardeners. Known in traditional folk medicine for its many dietetic and medicinal values, elderberry has been held in high regard.

The black European elderberry is rich in vitamins, minerals and antioxidant compounds (mainly anthocyanins). Flowers and fruits contain flavonoids that serve as a base for medicinal and cosmetic uses. These compounds have a soothing effect on psoriasis and other skin conditions. Black elder also has anti-inflammatory and antibacterial properties. Due to the high content of vitamins and polyphenols, elderberries are used as an overall immune system booster, especially in preventing the flu and other winter ailments.

Elderberry species

There are two black elderberry species of interest for West Virginia growers: European native *Sambucus nigra* and eastern North American native *Sambucus canadensis* (also known as *Sambucus nigra* subsp. *Canadensis*). European red elderberry (*Sambucus racemose*) is also found in the north eastern U.S. In West Virginia, black elderberries are common across the state, while the reds are more concentrated along the mountain ranges of Barbour, Fayette, Grant, Greenbrier, Hampshire, Hancock, Mercer, Mineral, Monongalia, Nicholas, Pendleton, Pocahontas, Preston, Raleigh, Randolph, Summers, Tucker, Upshur and Webster counties.

Black elderberries (*Sambucus canadensis*) are used for commercial production, and they are of particular interest with potential for product diversification,



Figure 1. Flavonoid and mineral-rich fruits are best consumed as jams, juices or wines. (Photo credit: Lewis Jett, WVU Extension Service)

development of cottage industry and providing high potential for higher economic return. Red elderberries are highly toxic to humans and not recommended for commercial fruit production. Their main use is as attractive landscaping plants, keeping in mind that they are highly toxic. The stems, leaves, seeds and roots contain the chemicals cyanogenic glycoside (sambunigrin) that metabolize within the digestive tract with the help of bacteria into hydrogen cyanide leading to serious illness. Eating too many raw berries can lead to the buildup of cyanide in the body; therefore, the best way to use them is in tea, jam, jelly, wine, syrup or pies. – continued on page 2 –

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Commercial market potential

Glancing through reports from Fancy Food Shows makes it obvious that the elderberry presence is growing – and with it product recognition, high demand and market potential. This is one of the high-value, nutrient-dense super foods with exceptionally high potential as a cash-crop in West Virginia. Elderberry grows wild along roadsides, riverbeds, moist areas and can be used in riparian zones. It does not require perfect soil, which makes it an ideal candidate for reclaimed soils where coal mines once stood.

Currently, there is no organized elderberry marketing in West Virginia. Nationally, a few cooperatives have emerged with processors in the Midwest. One of the first and better organized companies is River Hill Harvest from Jefferson City, Missouri. The company buys crop from their members, processes it into herbal cordials, juice and jelly, and then sells it. Their plan is to have 2,250 acres in commercial cultivation by 2025 with a potential yield of 10 million pounds of frozen berries, which would be about 10% of the projected U.S. market potential. Another successful cooperative exists in Minnesota under the name of Minnesota Elderberry Cooperative. The group buys



Figure 2. Aromatic and flavonoid-rich flowers have medicinal and cosmetic uses. (Photo credit: Mirjana Bulatovic-Danilovich, WVU Extension Service)

crops from their members, processes it and markets the product to institutional buyers.

In addition, there is excellent potential for direct marketing of berries (fresh or frozen), juices, cordials, wine, candies, baked goods, etc. West Virginia growers have a great opportunity to develop similar infrastructures that would not only facilitate a revival of elderberry production but would bring it to a higher level.

Hot Topic

Cucumber disease alert: Downy mildew and anthracnose

Cucumber downy mildew has now been reported in neighboring states (Virginia, Pennsylvania, Ohio and Kentucky). It is predicted that the disease can be in West Virginia within a few days (cdm.ipmpipe.org). Therefore, this is the best time to take preventative measures. If cucumber plants are treated with either mancozeb (Manzate, Dithane, Penncozeb, Fore, Roper, etc.) or chlorothalonil (Bravo, Daconil, Fungonil, etc.) on a weekly basis prior to the arrival of the pathogen, it can be effective in delaying the disease onset or completely preventing infections.

However, another foliar disease called anthracnose is more prevalent this year compared to previous years. Thus, it is important to understand the difference of the disease symptoms and treat plants accordingly. Symptoms of anthracnose and downy mildew are

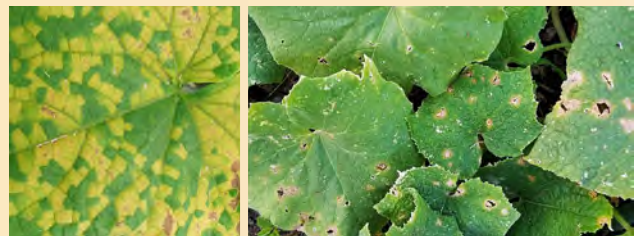


Figure 3. Cucumber downy mildew showing angular chlorotic lesion (left); anthracnose showing roundish lesions with a shot-hole appearance due to the drop of tissues from the lesions' centers (right). (Photo credit: M.M. Rahman, WVU Extension Service)

shown side by side in the photos. Please send suspected samples to the WVU Plant Diagnostic Clinic (extension.wvu.edu/plant-diagnostic-clinic).

The invasive garlic mustard

Garlic mustard (*Alliaria petiolata*) can be found invading wooded areas, rail trails, roadsides and backyard gardens throughout West Virginia during spring months. It is one of the first plants to emerge and bloom producing numerous white flowers. It belongs to the mustard (Brassicaceae) family and has a biennial life cycle.

Life cycle

During the first year's growth, it stays relatively dormant producing a rosette of circular leaves that can be mistaken for ground ivy or wild violet. During the early spring of the second year, it grows at the rate of almost 1 inch per day with leaves that are triangular to heart-shaped with coarsely toothed margins.



Figure 4. Garlic mustard can displace native plant communities and reduce floral diversity of forest floors. (Photo credit: R.S. Chandran, WVU Extension Service)

Unlike most mustard species, flowers of garlic mustard are white in color and are produced in small clusters with four petals on each flower. Seeds are produced by summer when the weed completes its life cycle.

Garlic mustard seeds are dormant and require a winter in soil before germination, and they can stay viable in the soil for three to five years with successful management for up to ten years for eradication.

Growth habits

This invasive weed originating from Eurasia was introduced to North America in 1868 and is now

prevalent in the Midwest and north eastern states of the U.S. and in Canada.

Being a prolific seed-producer capable of shedding 1,500 seeds per square foot in a year and producing biochemicals (allelopathy) that can discourage the growth of other plants, this invader can displace native plant communities and reduce the floral diversity of forest floors. It also is known to increase the fertility (nitrogen and phosphorus) levels and the soil pH of invaded areas, a phenomenon used to proliferate the weed.

Uses

Secondary metabolites produced in the leaves of garlic mustard can form volatile cyanide molecules used to deter predatory insects and fungi, and can be toxic to vertebrates in large quantities.

However, the leaves of garlic mustard during the second year's growth is known to be a substitute basil when making pesto. Take advantage of the inherent garlicky flavor, all while cutting down on the garlic used.

It also is considered to possess medicinal attributes, such as in the treatment of wounds and as a diuretic.

Control

If hand-weeding garlic mustard, it is recommended to begin with the leading edge and work backward to more established areas. Removal of the flower stalks before seed production also can help reduce its spread.

Other physical control methods may include applying effective mulches prior to seed germination and controlled burns during the dormant season.

Biological control options being researched with two weevils belonging to the *Ceutorhynchus* genus are showing promise; however, widespread releases have not been carried out yet.

Chemical control options are limited to direct application of glyphosate or application of selective herbicides, such as 2,4-D amine + dicamba (Weed-Master), triclopyr (Garlon, Turflon) or bentazon (Basagran), prior to bloom. The herbicides oryzalin (Surflan) and indaziflam (Specticle, Marengo) are effective to control this weed when applied prior to emergence.

Biology and control of bagworms

Bagworms, *Thyridopteryx ephemeraeformis*, are common landscape pests that belong to the order Lepidoptera. They prefer to feed on juniper, arborvitae, spruce, pine and cedar, but they also attack deciduous trees. The insects produce distinctive, 1.5- to 2-inch long, spindle-shaped bags composed of silken threads and bits of foliage. The bags look so much like a part of the tree that bagworms may go unnoticed until extensive damage has occurred.

Life cycle

Bagworms undergo complete metamorphosis (egg, larval, pupal and adult stages). Bagworms overwinter as eggs inside the bag constructed by the female. Each bag contains about 500 to 1,000 eggs. When the eggs hatch in late May through mid-June, larvae crawl out of the bottom of the bag and spin down on a thin strand of silk (this is known as ballooning). Larvae, also known as caterpillars, settle to feed on the lower branches or may be blown to nearby plants during the ballooning stage.

Once larvae begin feeding, they produce silk to construct individual bags around their bodies for camouflage and protection. Young larvae carry their bags in a snail-like manner for a short time. They feed through openings at the top of their bags. In early fall, the mature larvae transform into pupae before becoming adults. Adult males emerge as moths and search for females to reproduce with. Adult females are flightless and stay in their bags. After mating, the females lay eggs, leave the bag and die.

Plant damage and scouting

These pests can cause severe damage to landscape plants by defoliating branches that alter plant shape and foliage density. High numbers of bagworms can result in branch dieback or even death of the plant due to injury. New bagworm infestations often go unnoticed until late summer when caterpillars are large and consuming a lot of plant material and branches begin to appear defoliated. In winter, the brown bags are easy to see against evergreen foliage.

Control

If only a few small trees or shrubs are infested, mechanical controls, such as hand-picking and destroying bags anytime during the growing season, winter or in spring before eggs hatch, can be very effective in eliminating a localized infestation. In



Figure 5. Silk strand produced by bagworm larva. (Photo credit: Cliff Sadof, Purdue University)

addition, removal of infested trees within and around the area can diminish dissemination.

Several species of predators (wasps, hornets and birds) and parasitoids (wasps and flies) serve as biological controls for bagworms. No species are commercially available at this time. Also, diseases (fungus, viruses and bacterium) can control bagworms. For example, *Bacillus thuringiensis* (Bt) is a bacterium that is commercially available, kills bagworms and is safe for non-target organisms. Bt is most effective when used against young larvae. Larvae must consume Bt on the plant material; therefore, coverage and timing are critical.

Chemical control is the use of insecticides to manage bagworms. Timing of insecticide application is important for effective management because only small larvae are susceptible to insecticides. The best time to apply insecticides is while the larvae are still small (less than ½ inch long) usually in early June.

Several insecticides with different active ingredients kill bagworms. Reduced-risk insecticides, such as azadirachtin, chlorantraniliprole, indoxacarb and Spinosad, are recommended because of their efficacy and compatibility with beneficial insects. Other active ingredients, such as bifenthrin, carbaryl, malathion, lambda-cyhalothrin, deltamethrin, dinotefuran and acetamiprid, also kill bagworms; however, these products are harmful to beneficial organisms and can occasionally cause spider mite outbreaks. Many products are commercially available with the mentioned active ingredients, but federal laws indicate that the site of application must be listed on the pesticide label.

Is that a woodchuck, groundhog or whistle pig?

Whichever name you use, the woodchuck (*Marmota monax*) is a rodent and is the largest representative of the ground squirrels. Woodchucks are brownish in color with a grizzled appearance because their guard-hairs are tipped with buffy white. They are large and stocky weighing 5 to 13 pounds and are between 18 to 24 inches long. They also have a short, fully furred tail.

Habits

The whistle pig name originates from the animal's stature and its "whistle" or "chuck" vocalizations. Woodchucks are found throughout West Virginia in old fields, along brushy edges, woodlots and grassy banks. They are herbivores that feed on clovers, grasses, agricultural crops, ornamentals and other woody plants. Woodchucks are active during the day and are most often seen on the ground; however, they are actually good climbers. They are solitary except when a female is found with her pups.

Woodchucks will dig their own burrows, which can be complex underground networks, and they use different burrows for summer and winter. These burrows serve as shelter and escape cover for not only woodchucks but several other wildlife species, including rabbits, skunks, raccoons, foxes, snakes, weasels and chipmunks.

Woodchucks hibernate during the winter months and spend their summers feeding to build up fat for winter hibernation, when they lose about 50% of their body weight. Hibernation lasts between three to six months depending on winter conditions. Woodchucks breed in early spring, soon after they emerge from hibernation. They have one litter per year with three to five pups per litter.

Damage

Many landowners experience damage when woodchucks feed on planted gardens, crops and landscaping. Woodchuck burrows also can pose a threat to landowners and farm animals if they injure a leg by stepping in the open holes. In addition, these large rodents often dig their burrows under foundations and homes or farm structures, which can compromise the integrity of the structure.

Management

Electric fencing can be used to keep woodchucks out of select areas. Construct an electrified wire 4 inches off the ground with a second wire about 8 inches off the



Figure 6. Woodchucks, brownish in color, are a rodent and the largest representative of the ground squirrels.

ground. There are plug-in or battery-powered fence chargers available at most home and garden stores. Remember to keep the fence clear of any debris or vegetation that might short out the charge.

Non-electric fencing also may be used. Choose a fence with a mesh size smaller than 2-by-2 inches. Remember that woodchucks can climb over and dig under a fence, so make the fence at least 3 feet high and bend the top 12 inches outward at a 45-degree angle to deter them from climbing over. To keep woodchucks from digging under a fence, you will need to bury a portion of the fence to a depth of about 10 inches or bend the lower portion of the fence out creating a wider barrier for woodchucks to burrow under. You also can lay a 15- to 18-inch wide strip of fencing on the ground keeping the vertical fence flush with the ground portion.

Remember, it is illegal to relocate wildlife, so landowners should not capture a woodchuck or any wildlife and release them elsewhere. If you trap a woodchuck, you can release it on your own property (the same on which it was trapped) or euthanize it. If you want to trap a nuisance woodchuck, we recommend using cage traps. Place the cage trap at the most commonly used burrow entrance blocking off any way around the trap. This way, the woodchuck has no option of exiting their burrow other than going into the trap. You also can bait the trap with cantaloupe, apple slices, or fresh carrots or lettuce. Change the bait daily to keep it fresh. Landowners may shoot woodchucks year-round without a permit when it is safe to do so.

Powdery mildew of cucurbits

Powdery mildew of cucurbits is caused by two fungal pathogens: *Podosphaera xanthii* and *Erysiphe cichoracearum*. *P. xanthii* is more common and prefers warmer climates, while *E. cichoracearum* is less common and prefers cooler climates.

Morphologically, the two organisms possess nearly identical conidia with similar growth habits and can only be differentiated by fibrosin bodies that are present in the conidia of *P. xanthii*.

While powdery mildew affects all cucurbits, the disease is most common on cantaloupe, squash and pumpkins usually late in the season. As affected leaves are covered with a white powdery mass of fungal conidia and tissues get killed over time, plants are compromised with diminished carbohydrate production.

Under hot and humid weather conditions, the severity of the disease can increase dramatically causing premature death of leaves – thereby reducing yield and fruit quality.

Symptoms

Powdery mildew is manifested primarily on both sides of plant leaves as a white powdery fungal growth on the surface.

Symptoms may first appear as pale spots on leaves that quickly turn powdery white as the fungal body (hyphae) produces abundant conidia and spreads to the petioles and stems. Lower leaves on the vine near the crown of the plant, mainly on the shaded underside of the leaf become infected first.

Leaves that are severely infected turn brown, brittle and die. Younger, affected plants may be stunted, turn yellow and wither prematurely. Exposed fruit may suffer from sunscald, as well as malformation, reduced size, shriveled peduncles and speckled rind.

Life cycle

In eastern North America, powdery mildew can survive the winter by forming minute sexual fruiting bodies called cleistothecia that contain sexual spores called ascospores. These spores can initiate the disease at the start of the growing season. However, most of the initial infections occur by airborne conidia from warm, southern areas that are transported northward via wind currents early in the season. Secondary spreads normally occur through conidia produced at primary infection sites or by insects and farm equipment.

Conidia germination occurs in high humidity, but unlike other fungi, it is repressed by free standing water. Conidia remain active for seven to eight days; depending on weather conditions, symptoms usually appear three to seven days after infection.

A dense plant canopy and poor air circulation coupled with low sunlight intensity provide favorable conditions for the fungus. Although powdery mildew infection on cucurbits can occur at 50 to 90 F, the mean temperature of 68 to 80 F is favorable for rapid disease progression.

Integrated pest management strategies

There are cucurbit varieties that are resistant or tolerant to powdery mildew. Organic growers should plant those varieties and apply sulfur or stylet oil at the early stage of the disease. Increasing air circulation by ensuring proper spacing can help reduce disease severity.

If disease occurs late in the season, application of fungicides is not necessary. However, if disease is confirmed early in the season, fungicides (such as Vivando, Torino, Quintec, Pristine or Rally) should be applied on a weekly basis.

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