

University of Connecticut Department of Plant Science and Landscape and Architecture

UConn scientist develops sterile variety of invasive plant

“Scientific breakthrough could help restore the popular ornamental shrub *Euonymus alatus*, otherwise known as burning bush, to prominence in commercial marketplace.”

Abundantly planted, this shrub native to China, Japan, and Korea is increasingly escaping from cultivation into urban/suburban woodlands in North Carolina. It is a problem invasive exotic in the northeastern US and may become a problem here, too. The photo at left was taken in Price Park in Greensboro, NC, where it is a common escape. Photo: Duke



Professor Yi Li's Laboratory in the University of Connecticut's College of Agriculture and Natural Resources has developed a seedless variety of the popular ornamental shrub *Euonymus alatus*, also called 'burning bush,' that retains the plant's brilliant foliage yet eliminates its ability to spread and invade natural habitats.

"The availability of a triploid seedless, non-invasive variety of burning bush creates a win-win situation for both consumers and commercial nurseries," says Li, head of UConn's Transgenic Plant Facility and director of the New England Invasive Plant Center on the UConn campus in Storrs, CT. "The bush is an extremely popular ornamental plant for landscapers and gardeners because of its intense red autumn foliage and robust ability to grow in a wide range of soils and environmental conditions. In addition, the plant has very few pest or disease problems."

Also known as 'winged euonymus' because of its distinctive winged branches, burning bush is a top cash crop for the \$16 billion ornamental plant industry. It is especially popular in New England and along the eastern seaboard where the shrub is used as foundation plantings, hedges and along highways and commercial strips.

National sales of burning bush top tens of millions of dollars each year. The plant, however, spreads aggressively and has been listed as an invasive species in 21 states. It has already been banned in Massachusetts and New Hampshire and is on an invasive plant 'watch list' in many other states, including

Connecticut. The economic cost of invasive plants is estimated at more than \$40 billion per year in the US.

The creation of a non-invasive variety of burning bush should help restore the shrub's prominence in the commercial marketplace.

Professor Max Cheng, a horticultural plant biotechnologist at the University of Tennessee-Knoxville, says Li's success in regenerating a triploid non-invasive burning bush "has great economic and environmental significance."

"Several universities and laboratories in the U.S. have been working on developing triploid or sterile burning bush for years," says Cheng. "Endosperm cells of angiosperms are naturally triploid but regeneration from endosperm cells, particularly from endosperms of woody species, is often very difficult. Dr. Li's success represents a major breakthrough in developing sterile non-invasive *Euonymus alatus*, which is of great importance to the American ornamental horticulture industry and gardeners."

Burning bush's invasive characteristics stem from its prodigious seed production. The plant produces tens of thousands of seeds that are transported by rainwater and birds where they take hold in open woodlands creating dense thickets that displace native vegetation. The plant's root system forms a tight mat below the soil surface and its broad profile (it averages 6 to 9 feet in height and is capable of reaching 15 feet) creates heavy shade that threatens the survival of plants living beneath it.

Native to eastern Asia, the deciduous *Euonymus alatus* was introduced in the United States around 1860. The shrub's natural ornamental features have been genetically improved over time giving rise to its widespread popularity. It can be found in the eastern United States from New England to Florida and as far west as Illinois.

The new lines of sterile non-invasive burning bush plant – which were derived from a popular dwarf variety known as (*E. alatus*) 'Compactus' – took years to develop. Members of Li's research team, Chandra Thammina, Mingyang He, Litang Lu, and others, painstakingly removed thousands of immature and mature endosperm from deep inside the plant's seeds under sterile conditions and then treated them with special plant growth regulators. The team carefully maintained endosperm tissue explants in Petri dishes so that a callus, bud, seedling and ultimately a new triploid seedless variety were grown.

"Finding the right combination of plant growth regulators, appropriate amounts for the treatment and repeatedly testing and re-testing the process to validate success was a lengthy, yet ultimately rewarding, process," Li says.

The process to produce triploid plants from endosperm tissues is so difficult that since endosperm regeneration of plants was first reported in the early 1950's, it has been successful in only 32 plant species. Li praised his research team's persistence, dedication and passion, which he said carried his staff through the long hours necessary for separating thousands of mature and immature endosperms once the plants went to seed in the fall.

The research report appears in the August 2011 issue of *HortScience*, an international journal serving horticulture scientists and the horticulture industry.

The research team reports that it successfully produced twelve independently regenerated triploid plants of burning bush. Triploid plants are sterile due to uneven chromosome division as cells multiply. Li is working with UConn's Office of Technology Commercialization to patent the process used to regenerate the burning bush triploid and ultimately bring the new plant variety to the commercial horticulture industry.