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'Patriot' Elm¹

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Elms have potential for greater landscape use because of their ability to adapt to a wide variety of stressful environments (7). Their use currently is hindered by the occurrence of Dutch elm disease, caused by the fungus *Ophiostoma ulmi* (Buism.) C. Nannf., as well as by the injury caused by the elm leaf beetle [*Xanthogaleruca luteola* (Muller)]. The 'Patriot' elm is a new disease-resistant and insect-tolerant cultivar released by the U.S. Department of Agriculture.

Origin

'Patriot' elm (NA 60071, PI 566597) resulted from a controlled pollination made in 1980 between 'Urban' elm (4) (used as a female) and a selection of *Ulmus wilsoniana* Schneid. (used as a male). The male selection itself was later released as 'Prospector' elm (6). Seedlings from this cross and other crosses were outplanted in a replicated field trial near Delaware, OH, in 1981. Inoculations with a mixture of three aggressive and one nonaggressive (7) isolates of *Ophiostoma ulmi* were made into all seedlings in May, 1984, using an aqueous suspension of 1.4×10^6 spores/ml inoculated into a 1.6 mm hole in two branches at the bottom of the top one-third of the crown. The 'Patriot' clone expressed no foliar symptoms in the summer following inoculation, and no dieback the next year.

For further testing of disease-resistance, 'Patriot' was propagated by rooted cuttings and, along with ramets from several other clones (Table 1), was established in 1989 in a randomized block design with four trees/block/clone in 7 blocks. A total of 28 trees represented each clone in the planting. Within each block, each clone was planted as a four-tree plot, which was further subdivided into two subplots of two trees each representing two inoculation times of May 18, 1992, and May 27, 1992. Two inoculation dates were used in order to decrease the probability that perhaps because of unique phenology, a given clone during inoculation might escape its period of disease susceptibility. Twenty eight American elm (*Ulmus americana* L.) seedlings grown from a Delaware, OH, native seed source, also were included in the experiment as a standard disease-susceptible biotype. These American elm seedlings were randomly distributed across blocks in a way identical to that used for the clonal material. Inoculations on each date were made into a 2.4 mm (0.1 in) hole in the bottom one-third of the main trunk (6) with an aqueous spore suspension containing 2×10^6

spores/ml of *O. ulmi*. Included in this suspension were two aggressive and two nonaggressive isolates of the fungus (these isolates were different from the ones used in 1981 in the seedling test). This inoculation was artificially severe and was designed to detect high levels of resistance. The percentage of the crown showing wilting or death of the foliage, and the percentage of the crown's branches showing a lack of foliage (dieback), were visually estimated four weeks and one year, respectively, after inoculation. Four weeks after both inoculation dates, 'Patriot' showed fewer symptoms than its male parent, 'Prospector,' (Table 1), which has proved in a previous study to be resistant to both aggressive and nonaggressive strains of the fungus (6). It also showed after four weeks a resistance level equal to 'Homestead' elm (5), a highly resistant elm released by the USDA program (Table 1). Dieback of the crown of 'Patriot' one year after each inoculation date was only 1%, again expressing evidence of high resistance, especially when compared to the American elm seedlings, which showed average dieback of 88% or 89% (Table 1).

When grown for 11 years among hundreds of infected American elms at Delaware, OH, 'Patriot' showed no signs of susceptibility to elm yellows, an often lethal disease found naturally on North American elm species. Based on its exotic parentage and on its apparent field resistance, 'Patriot' is likely to be highly tolerant of natural infections of elm yellows.

Along with other clones, it was chosen in 1985 for more intensive evaluation of its elm leaf beetle resistance. Of all of the 689 elm hybrids created in 1980, it has proven in several studies to have the highest beetle resistance (1, 2, 7).

Table 1. Relative susceptibility of several elm clones to *Ophiostoma ulmi*.

Clone/seedlings	Avg. percent of crown affected by symptoms 4 weeks after inoculation ^a		Avg. percent dieback one year after inoculation, in 1993	
	Inoculation dates			
	1992		1992	
	May 18	May 27	May 18	May 27
American Elm seedlings	87a ^y	82a	88a	89a
‘Prospector’	47b	16b	9b	5b
‘Homestead’	19c	4c	2b	1b
‘Patriot’	11c	6c	1b	1b

^aMixed spore suspensions of two aggressive and two nonaggressive strains of the fungus were used in trunk inoculations of 3-year-old ramets on each date.

^bMeans within columns followed by the same letter are not significantly different from each other at the 5% level, by Duncan's New Multiple Range Test.

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Table 2. Oviposition and feeding by elm leaf beetle adults on different elm clones.

Clone	n	Eggs/ female*	Leaf disk area consumed (mm ²) ^y	
			Choice test	No-choice test
'Homestead'	10	222a	71a	45a
'American Liberty'	10	153b	—	—
1-85	30	145b	—	39a
'Patriot'	30	53c	2b	7b

*10 or 30 beetles were fed on excised leaves of an elm clone for 14 days. Data were subjected to a one-way ANOVA (0.05 level). Means in columns followed by the same letter are not significantly different at the 5% level using Duncan's New Multiple Range Test.

^yAssays were carried out on each clone by placing one adult beetle in each of 10 plastic petri dishes each containing four (choice tests) or two (no-choice tests) 11 mm diameter elm leaf disks.

It appears to have significantly more beetle resistance than 'Urban' elm but less resistance than *Ulmus wilsoniana* selections such as its male parent, 'Prospector' (1, 6). Ramets growing for one to three years in such diverse locations as Iowa, Minnesota, Tennessee, Texas, Oregon, New Jersey, and Ohio have shown little or no damage. Ramets of 'Patriot' growing near Glenn Dale, MD, have shown some damage, but only when planted in the midst of hundreds of other elms, all subject to a very high population pressure of the beetles. Data on fecundity and feeding have shown it to be much less susceptible than 'Homestead' elm (5) (Table 2).

Description

'Patriot' elm has a moderately vase-shaped crown, similar to a more upright American elm (Fig. 1). At 13 years from seed, the parent tree in Ohio was 13.1 m (43 ft) tall, and showed a crown spread of 7.6 m (25 ft). Leaves are oblong-obovate and doubly serrate with acuminate apices and rounded and uneven bases, and are smooth and glabrous above and pubescent below. Leaves average 103 mm (4 in) long and 74 mm (2.9 in) wide; leaf length varies from 78 to 130 mm (3.1 to 5.1 in), and leaf width ranges from 60 to 90 mm (2.5 to 3.5 in). New leaves are yellow-green (RHS 144A) (3), then gradually change to green (RHS 137A) as they mature. Autumn color is yellow (RHS 13A). Leaf veins are parallel and straight, running directly out to the teeth from the midrib. The grey (RHS 201B) branchlets are numerous, slender and slightly pubescent, with elongated, somewhat appressed, pointed, and pubescent vegetative buds that show imbricate bud scales colored greyed-orange (RHS 177A), and are 4 to 5 mm (.15 to .20 in) long. The bark is colored grey (RHS 201B) and is smooth to lightly roughened in texture.

Adaptability

In cooperative trials across the United States, this clone has performed well in Maine, New Jersey, Maryland, Ohio, Oregon, Minnesota, Iowa, Texas, Kansas, and Tennessee. It has shown no cold damage in such harsh locations as Minnesota and Iowa, and can be considered cold hardy through USDA hardiness Zone 4 (8). As emphasized earlier, 'Patriot' has a high level of resistance to Dutch elm disease and reduced susceptibility to the elm leaf beetle.

Cultural Conditions

'Patriot' does best when grown in well-drained, moist soils with slight acidity. However, it appears to adapt well to a wide variety of edaphic conditions, including either low or high pH or wet or dry soils. It transplants readily and will perform well under shade or sun, with more rapid growth occurring under sunny conditions.

Performance

Growth rate, vigor, and symmetry of crown form of 'Patriot' has been good when it has been grown at various locations throughout the U.S. One-year-old rooted cuttings (average 0.5 m (1.6 ft) tall) planted at Glenn Dale, MD, in March, 1989, showed an average height and crown spread of 6.2 m (20.3 ft) and 2.9 m (9.5 ft), respectively, in the autumn of 1994.

Propagation

'Patriot' is easily propagated from softwood cuttings taken in the spring or early summer, dipped in 0.8% IBA (Hormo-Root 'C'), and placed under intermittent mist in a mixture of peat:perlite (1:1 by vol) or other similar medium. Rooting usually is complete in 5 weeks. For good survival after rooting, ramets can be transplanted to 3.8 liter (1 gal) containers in a peat:perlite:soil (2:2:1 by vol) media, fertilized



Fig. 1. 'Patriot' elm.

bimonthly with a 20N-10.2P-16.6K (20-20-20) liquid fertilizer, and watered frequently. In USDA Zone 7, they can be successfully overwintered in an unheated, single-layered plastic house.

Landscape Uses

Because of its unique combination of adaptability, disease- and insect-tolerance, and desirable crown form, 'Patriot' should make an excellent landscape, street, highway, or park tree. Its moderately vase-shaped habit will prove useful where a substitute for American elm is desired.

Availability

The U.S. Department of Agriculture released 'Patriot' in 1993. A few wholesale nurserymen are propagating and growing liners of this new cultivar for future sale. The U.S. National Arboretum can supply a limited number of bud sticks or rooted cuttings to nurseries, experiment stations, arboreta, or other interested parties. Written request should be made to A. M. Townsend, U.S. National Arboretum, USDA-ARS, 3501 New York Avenue, N.E., Washington, DC 20002.

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