Vernicia fordii ‘Anna Bella’, a New Ornamental Tung Tree

Timothy A. Rinehart¹, Ned C. Edwards, and James M. Spiers

USDA-ARS, Thad Cochran Southern Horticultural Laboratory, 810 Highway 26 West, Poplarville, MS 39470

Additional index words. *Vernicia fordii*, *Aleurites fordii*, tung oil tree, tung nut

Despite their floral display and tropical foliage, ornamental use for tung trees has been limited by the production of tung nuts, which are large, heavy, and toxic. ‘Anna Bella’ is a semisterile, or nutless, tung tree selection that significantly reduces homeowner concerns about mowing and toxicity to pets and children. Sterility also reduces the possibility of invasiveness. ‘Anna Bella’ is the first and only ornamental tung tree selection available to landscape professionals and homeowners and is recommended for USDA cold hardiness zones 8 to 10.

The Thad Cochran Southern Horticultural Laboratory (TCSHL) was formerly the USDA Tung Oil Research Station in the 1940s, 1950s, and 1960s and maintains the most extensive *Vernicia fordii* (Hemsl.) Airey Shaw (syn. *Aleurites fordii* Hemsl.) germplasm collection in the United States that includes historic breeding lines and cultivars used in commercial tung oil production. This collection includes trees that are late-flowering and were used as parents in a USDA-ARS tung tree breeding program to delay flowering and prevent freeze damage to commercial tung oil orchards. Tung germplasm has been conserved by the USDA Agricultural Research Service in Poplarville, MS, for the last 50 years although the mission of the research station transitioned to small fruits in 1971. The germplasm collection was screened for ornamental use and ‘Anna Bella’ was selected for evaluation.

Although they have not been shown to displace native flora, tung trees persist in fence rows and along roadsides and are classified as mildly invasive in parts of Florida (Langeland and Craddock Burks, 2008). Some specimens have been retained or planted in landscapes as ornamental trees because they flower profusely in early spring. Tung nuts are large, 8.0 cm in diameter, heavy, and toxic making them a nuisance for homeowners. ‘Anna Bella’ is a semisterile, or nutless, tung tree selection that significantly reduces concerns about mowing and yard maintenance, toxicity to pets and

children, and the possibility of invasiveness. In four years of observations, peak flowering for ‘Anna Bella’ occurs 4 weeks later when compared with popular tung tree cultivars for tung oil production such as ‘Folsom’ and ‘Isabel’. ‘Anna Bella’ is the first ornamental tung tree selection released by the USDA-ARS Southern Horticultural Research Unit.

Origin and Description

‘Anna Bella’ was collected in the 1950s from unknown sources because of its late flowering. In this respect, it was an ideal candidate to be used in the tung breeding program for delayed flowering. It has a typical growth habit, flower numbers, and environmental tolerances. Unfortunately, it was not used in the tung improvement breeding program because it lacked fertility and did not appear to produce seed. Many years later, germplasm from the tung collection was screened for ornamental use and ‘Anna Bella’ was selected for evaluation because

Fig. 1. Mature trees can reach heights of 12 m with an umbrella-shaped canopy. Trees may be damaged from high winds because they are softwood. However, trees grow rapidly and recover quickly from pruning or limb removal. The ‘Anna Bella’ specimen pictured is more than 30 years old and withstood wind gusts in excess of 130 miles an hour during Hurricane Katrina in Aug. 2005.

it does not produce tung nuts. It was propagated by bud grafting in 2005 for evaluation by university and nursery cooperators in Georgia, Texas, Washington, DC, Tennessee, South Carolina, Florida, and Mississippi. ‘Anna Bella’ was released in 2012 by T. Rinehart after evaluation for ornamental qualities and sterility.

Vernicia fordii ‘Anna Bella’ is a deciduous, multistemmed, upright tung tree with an umbrella canopy. Trees are oval and symmetrical. Mature trees can reach 12.0 m tall and 10.0 m wide after 30 years of growth (Fig. 1). Bark is smooth and grayish reddish brown [Royal Horticultural Society (RHS) N200B; Royal Horticultural Society, 1986]. New stem growth is rapid and strong yellowish green in color (RHS 144A). Trees are softwood and may shatter in high winds.

Leaves are alternate, simple, and moderate olive green (RHS 146A) on an adaxial leaf surface and moderate yellowish green on an abaxial leaf surface (RHS 147B). Leaves are pointed, ovate-cordate, on long stalks with red glands at the top of each petiole.

Fig. 2. Floral displays consist of 50 to 80 flowers in terminal clusters on branches. Buds are set in late summer. Leaves emerge slightly before blooms. Staminate flowers typically emerge first over 1 to 2 weeks and drop off the tree as pollen dries, making a carpet of blooms on the ground around the tree. One to five pistillate flowers are generally located in the center of the cluster, which is usually 25 to 30 cm in diameter. Depending on the wind and humidity, trees bloom for 30 to 40 d with peak bloom display lasting 2 weeks.

Fig. 3. Individual flowers are either staminate (A) or pistillate (B). Blooms average 4.0 cm in diameter with five white petals. Stamens are typically pink or orange color with yellow pollen visible. Styles on pistillate flowers may be light green. Flowers have light pink or orange striping in the throat.

Received for publication 11 Sept. 2012. Accepted for publication 1 Nov. 2012.

Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

¹To whom requests should be addressed; e-mail Tim.Rinehart@ars.usda.gov.

Most leaves are unlobed and heart-shaped but sometimes with lobes on one or both sides. Leaves emerge just before flowering on 'Anna Bella' and are strong yellowish green at the time of flowering (RHS 144A) on the adaxial leaf surface and moderate yellowish green on the abaxial leaf surface (RHS 146C).

Inflorescences are terminal, solitary, and consist of multibranched corymbiform thyrsoid panicles (Fig. 2). These panicked cymes

Fig. 4. Unopened pistillate flowers were bagged on 'Anna Bella' to prevent insect pollination and then hand-pollinated with fresh pollen from 'Isabel' and 'Folsom'. In rare cases, fruits began to develop, swelling to 2.5 cm in diameter. These fruits aborted development, turned yellow, and eventually dried as hollow shells that fell off the tree.

or clusters consist of 50 to 80 flowers that make an impressive floral display similar to catalpa or dogwood. Tung trees are monoecious and inflorescences usually contain both staminate and pistillate flowers, often with only one or few pistillate flowers surrounded by

Fig. 6. Growth habit is upright and symmetrical. Buds grafted onto wild rootstock take one year to produce and are expected to grow more than 3.0 m tall after four years. Full flowering on all terminal branches is expected on four-year-old trees with increasing density as trees mature.

many staminate flowers. Observations of bloom type on mature 'Anna Bella' trees in 2009 indicate that 8.2% of the flowers are pistillate (214 of 2608), which is comparable to 'Isabel', a tung cultivar grown for tung oil production that displayed 8.4% pistillate flowers (145 of 1730 flowers). Flower buds are set during the previous season and may be affected by vigor and/or freeze damage during winter.

Flowers may be slightly zygomorphic but typically have five petals in a radial arrangement (Fig. 3). Petals are free, obovate, and yellowish white (RHS N155B) with strong yellowish pink striping in the throats (RHS 43D) that may darken in color with age. Flowers are pedicellate with pistillate forms often the last to open. Staminate flowers have petals that are basally adnate to outermost stamens, which are arranged in two whorls consisting of eight to 12 stamens. The outer stamens are free except for the base and the inner stamens, which may be united into a column. Pollen is bright yellow and sticky but filaments are typically the same color as striping on the petals but slightly darker (RHS 43C). Staminate flowers fall from the tree intact as they age and pollen dehiscence, leaving a carpet of blooms beneath the tree. Pistillate flowers have three to five ovaries with one ovule per ovary. Ovary and style are strong yellowish green color (RHS 144A). Once pollinated, pistillate flowers drop their petals. On a normal tung tree such as 'Isabel', ovaries swell and fruits develop into large (8.0 cm diameter) tung nuts that ripen and drop to the ground in late September.

Fig. 5. Pollen grain size distributions between 'Isabel' and 'Anna Bella' measured in micrometers.

'Anna Bella' is not considered fertile. It has not produced viable seed even when planted in close proximity to other tung trees for efficient pollination. Fruits produced by 'Anna Bella' are aberrant if they form at all and consist of small (2.5 cm diameter), ovoid shells that lack seed (Fig. 4). Eight years of observation of the sterile nature of 'Anna Bella' were confirmed by controlled pollination. Pollen is abundant but shows a 75% reduction in staining using aceto-carmin when compared with 'Isabel' and 'Folsom', which are tung cultivars grown for tung oil production. Ninety-four percent of the pollen grains from 'Isabel' and 'Folsom' stained as potentially viable (2802 of 2982 total). Only 23.4% of the pollen grains from 'Anna Bella' stained as potentially viable (672 of 2872). Pollen grain size measurements differed between 'Isabel' and 'Anna Bella' (Fig. 5). Of 74 controlled crosses made using 'Anna Bella' pollen, 43 started to swell into fruits when crossed with 'Isabel' but no seed from the aborted nuts germinated. Self-pollination of 'Anna Bella' produced similar results. More importantly, 147 controlled pollinations using 'Anna Bella' as the female parent failed to produce fruits when using pollen from 'Isabel' and 'Folsom'. The same pollen was used to fertilize more than a dozen pistillate flowers on 'Isabel' and 'Folsom' with 100% success.

Culture

'Anna Bella' is easily propagated by bud grafting using methods developed for tung orchards. Rootstocks can be grown from wild-collected seed or one-year-old seedlings collected from roadsides and pastures. Plants are propagated by bud grafting in late August to September onto wild root stock in pots or field plantings (Potter, 1957). Leaders are cut back

in late spring and bare root or potted whips are sellable in the late fall, winter, or early spring of the next year. Softwood and stem cutting propagation for clonal propagation has not been researched.

Plants grown in containers develop rapidly to larger sizes over the first two years. Over a four-year study, in-ground plantings show superior growth and maturation to flowering when compared with containers, although this may depend heavily on pot size, environment, and cultural conditions. Three plants observed for five years in Poplarville, MS, under landscape conditions without soil amendment or fertilizer grew to more than 3.0 m high and 1.5 m wide with full flowering by four years (Fig. 6). Tung trees typically grow to 12.0 m tall with an umbrella canopy providing dense shade (Potter, 1957). The original 'Anna Bella' specimen growing in Poplarville, MS, is more than 30 years old and 10.7 m tall (Fig. 1).

One-year-old trees grown in pots and in the ground at USDA cold hardiness zone 7 sites experienced stem and trunk dieback over three winters. Plants are root-hardy at these temperatures with new-season growth of up to 1 m. 'Anna Bella' can be grown in USDA cold hardiness zone 7 if young trees are protected.

Outstanding Characteristics and Uses

'Anna Bella' is adapted to conditions in the South and recommended as a flowering landscape tree in USDA cold hardiness zones 8 through 10. It has outstanding vigor, soil adaptability, and environmental tolerance to heat, sun, and drought. Like most tung trees, it is tolerant of common insects and diseases and has no significant pathogens or pests. 'Anna Bella' has superior green foliage and prolific long-lasting white flowers in the

spring making it an ideal plant for low-maintenance plantings.

The growth habit and scale of 'Anna Bella' are ideally proportioned for home landscaping and urban use as single specimens or rows of trees next to driveways, roads, and landscape features. Trees are fast-growing, upright, and symmetrical with umbrella canopies that increase in flower and leaf density with age. Leaves are heart-shaped with tropical appeal and rapidly expand to full size making it an excellent shade tree. Tung nuts produced by 'Anna Bella', if any are produced at all, are small and do not contain viable seed, making this clone suitable for use in environments where tung trees can naturalize, including Florida and parts of the Gulf Coast region.

Availability

'Anna Bella' was released by the USDA Agricultural Research Service and is not patented. It may be propagated and sold freely. Stock increase by specialty nurseries was initiated in 2009 and propagated plants are available from a limited number of retail sources. TCSHL does not have stock of 'Anna Bella' available for general distribution but can supply budwood or mother plants to nurseries wishing to propagate.

Literature Cited

- Langeland, K.A. and K. Craddock Burks (eds.). 2008. Identification and biology of non-native plants in Florida's natural areas. 2nd Ed. University of Florida Press, Gainesville, FL.
- Potter, G.F. 1957. Tung production. Washington, DC, UNT Digital Library. 16 May 2012. <<http://digital.library.unt.edu/ark:/67531/metadc3381/>>.
- Royal Horticultural Society. 1986. RHS colour chart. Royal Hort. Soc., London, UK.