

## *Phellodendron amurense* has escaped cultivation in Missouri

ERIN O'CONNELL<sup>1</sup>, ELLIOTT SMITH<sup>2</sup>, GIBSON BLANKENSHIP<sup>3</sup>,  
EVAN PARKER<sup>4</sup>, AND MICHAEL SAXTON<sup>5</sup>

**ABSTRACT.** — Six populations of *Phellodendron amurense*, Amur cork tree, are reported from five sites in the St. Louis metropolitan region. We discuss the spread and establishment of this species in Missouri and evaluate ecological traits enabling its potential invasion of woodlands.

---

### INTRODUCTION

*Phellodendron amurense* Rupr. (Rutaceae), Amur cork tree, is a deciduous tree native to mixed forests in Northeastern China, Japan, Korea, and Far Eastern Russia (**Figure 1**; Ma et al. 2006; Li et al. 2019), where it is valued for its medicinal properties and rot-resistant wood. The native distribution of *P. amurense* is constrained by minimum annual temperatures and summer precipitation (Zhang et al. 2023; Zhu et al. 2018). Amur cork tree commonly occurs in low-altitude habitats with low soil nitrogen and high soil organic matter (Huang et al. 2017). While studies from its native range show a preference for high-light conditions (Zhang et al. 2023; Yoshida & Kamitani 1999), *P. amurense* seedlings in a New York-based study showed tolerance for low-light conditions (Wang et al. 2013). The distribution of *P. amurense* has contracted in China due to over-harvesting for timber and medicinal uses (Zhang et al. 2016).

*Phellodendron amurense* was introduced to North America as a horticultural tree in 1856 (Rehder 1940, Dirr 1998), with early cultivations at the Arnold Arboretum in Boston, Massachusetts. By 1910 it was planted more extensively, including in Maryland and New York (Ma & Brach 2007). Early nursery catalogs and publications (e.g., Elm City Nursery 1905, Missouri Botanical Garden 1921, Rehder 1940) highlight *Phellodendron* for its vibrant fall foliage, conspicuous winter fruit, cold tolerance, and elegantly spreading crown. As late as 1994, the United States Forest Service recommended planting male *P. amurense* in median strips and residential areas, although warning of its inability to thrive in some urban environments (Gilman & Watson 1994). Through the 20th century, cork tree became more common in North American botanical gardens and arboreta and was planted in 20 states by 2007 (Ma & Brach 2007).

---

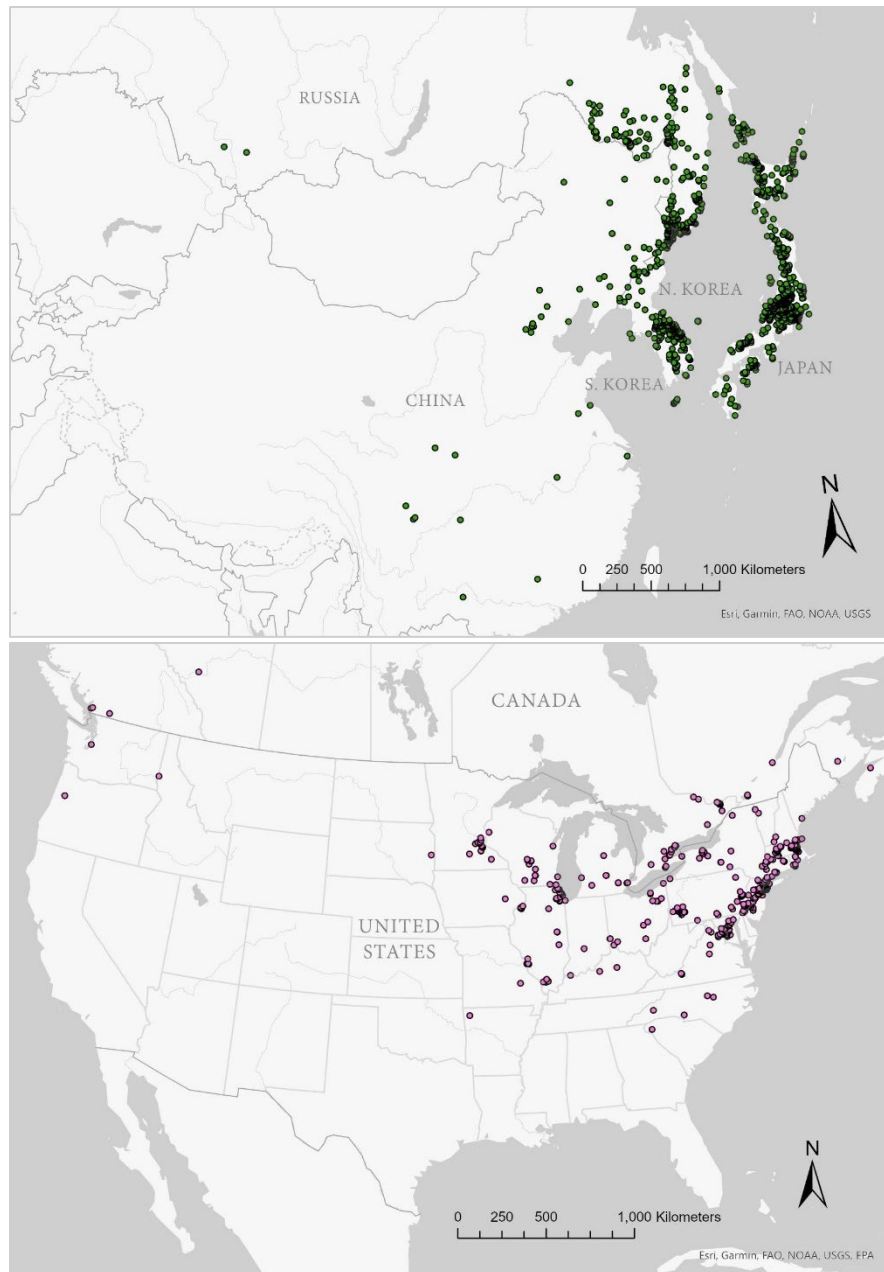
<sup>1</sup> ERIN O'CONNELL — Washington University in St. Louis, Tyson Research Center, 6750 Tyson Valley Rd., Eureka, MO 63025. email: [eoconnell@wustl.edu](mailto:eoconnell@wustl.edu)

<sup>2</sup> ELLIOTT SMITH — Washington University in St. Louis, Tyson Research Center, 6750 Tyson Valley Rd., Eureka, MO 63025. email: [elliosmi@umich.edu](mailto:elliosmi@umich.edu)

<sup>3</sup> GIBSON BLANKENSHIP — Washington University in St. Louis, Tyson Research Center, 6750 Tyson Valley Rd., Eureka, MO 63025. email: [gibsonb2@illinois.edu](mailto:gibsonb2@illinois.edu)

<sup>4</sup> EVAN PARKER — Washington University in St. Louis, Tyson Research Center, 6750 Tyson Valley Rd., Eureka, MO 63025. email: [evan.parker@yale.edu](mailto:evan.parker@yale.edu)

<sup>5</sup> MICHAEL SAXTON — Missouri Botanical Garden, Shaw Nature Reserve, 307 Pinetum Loop Rd., Gray Summit, MO 63039. email: [mike.saxton@mobot.org](mailto:mike.saxton@mobot.org)



**Figure 1.** Native range of *P. amurense* in Asia (top) and introduced range in North America (bottom), based on records from the Global Biodiversity Information Facility (GBIF 2023).

Since its introduction to North America, Amur cork tree has escaped into urban parks, residential areas, and native forests from Nova Scotia to British Columbia, south to South Carolina and Arkansas. There are 983 Global Biodiversity Information Facility (GBIF) records in North America (**Figure 1**), and 1,776 iNaturalist observations in the United States (GBIF 2023; iNaturalist 2023); note that these records likely include horticultural plantings).

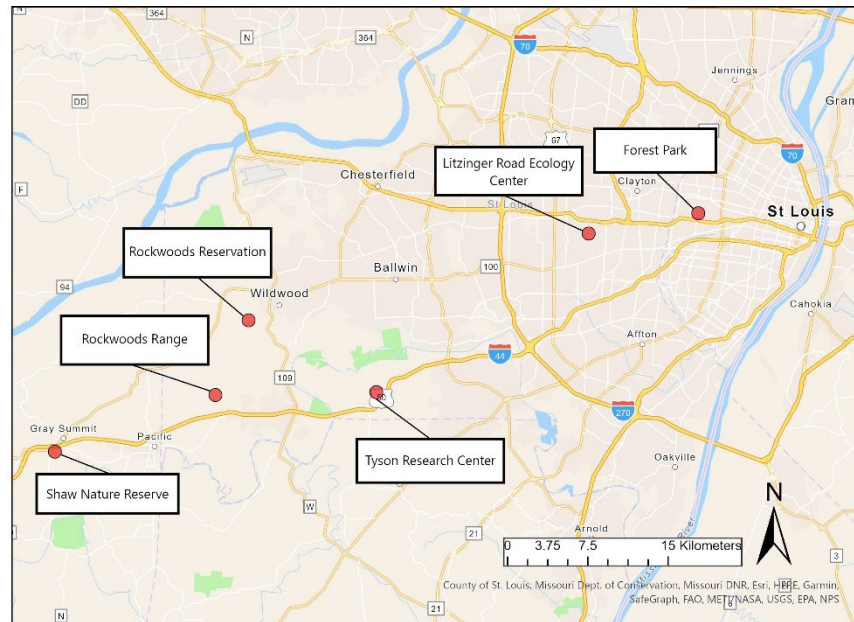
To date, *Phellodendron amurense* has spread primarily in the northeastern United States. Morgan and Borysiewicz (2012) documented the spread of *P. amurense* across New York, Connecticut, New Jersey, and Philadelphia, including at Forest Park in Queens County, New York, where *P. amurense* ranked third of 22 tree species in overall importance value (Gleaser & Kincaid 2005). Similarly, in Bartlett Arboretum Forest, Fairfield County, Connecticut, *P. amurense* ranked highest in relative density and third highest in relative dominance (Morgan 2012). These results indicate the ecological importance and potential impacts of *P. amurense* and highlight the need for broader surveys and documentation.

The history of *Phellodendron* in Missouri begins with cultivated specimens at the Missouri Botanical Garden (MBG), with first mention of *P. amurense* in 1921, where it was recommended for street planting in Missouri, as well as cataloged in a list of trees that suffered frost damage the previous winter (Missouri Botanical Garden 1921). Fruit vouchers of *P. amurense* document its cultivation at the University of Missouri Campus in Columbia, Boone County in 1960 and at the Missouri Botanical Garden in St. Louis City in 1974 and 1989 (Ma & Brach 2007). *P. amurense* has been planted in several additional St. Louis County locations: Forest Park (Amy Witt, personal communication), Tower Grove Park (Joseph Hart, personal communication), and on Washington University's Danforth Campus (trees.wustl.edu; Stan Braude and Cody Azotea, personal communication).

Despite a history of spreading in the northeastern United States, and more than a century after its introduction in Missouri, *Phellodendron amurense* has not been formally documented growing outside cultivation in Missouri. Yatskievych (2013) mentioned two small populations of *P. amurense* growing in the understory at Shaw Nature Reserve in Franklin County and at Forest Park in Saint Louis City, but did not include *P. amurense* as a member of the state's flora. Both populations mentioned were non-reproductive seedlings near adult plantings and under active control. The Early Detection and Distribution Mapping System (eddmmaps.org), which tracks the spread of invasive species, reports *P. amurense* in Missouri based on a cultivated occurrence in Forest Park reported in 2012, likely the one referenced in Yatskievych (2013), as well as two naturalized occurrences in Shaw Nature Reserve reported in 2016. Here, we document Amur cork tree's spread and establishment in Missouri.

### MISSOURI REPORTS

In addition to the three specimens cited below, we have recently documented six naturalized populations of *P. amurense* at five sites in the St. Louis region (**Figure 2**): 1) Forest Park, St. Louis City; 2) Tyson Research Center, St. Louis Co.; 3) Rockwoods Reservation and Range, St. Louis Co.; 4) Litzsinger Road Ecology Center, St. Louis Co.; 5) Shaw Nature Reserve, Franklin Co. Given its prevalence in these areas, *P. amurense* is likely present at more sites throughout the Saint Louis region and eastern Missouri.



**Figure 2.** Distribution of *P. amurensis* in the St. Louis metropolitan area.

**Forest Park:** Forest Park is managed by the St. Louis Department of Parks, Recreation and Forestry, and Forest Park Forever. Since 1998, staff have monitored a self-sustaining population of *P. amurensis* in the Successional Forest, an area of former park turf which has undergone succession for over 30 years. The Forest is bordered by areas of semi-natural and landscaped parkland within an urban environment.

The surrounding parkland contains 17 cultivated *P. amurensis* individuals, ranging from 1.0–19.3 cm DBH. The wild *Phellodendron amurensis* population occurs in a 32,000 m<sup>2</sup> area south of the east-west hiking trail bisecting the Successional Forest (**Figure 3**). In 1998, five cork trees ranging from 5.3 cm to 23.7 cm DBH were documented here (Josh Wibbenmeyer and Amy Witt, personal communication). By 2013, two of the original cork trees remained and three new cork trees were present. All mature trees were eliminated during restoration efforts in 2014-2015, and seedlings have been removed annually since then. In 2023, we counted 222 seedlings (height >20 cm) and 17 saplings (diameter >1 cm DBH), with the largest saplings 3.0 cm DBH. Saplings exclusively occurred in the higher-elevation, eastern side of the site. Seedlings occurred across the site, with the highest abundance near the creek on the site's western edge.

Other tree species occurring in this area were maples (*Acer negundo*, *A. saccharinum*), oaks (*Quercus acutissima*, *Q. alba*, *Q. imbricaria*, *Q. muehlenbergii*, *Q. rubra*), elms (*Ulmus* sp.), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), sycamore (*Platanus occidentalis*), common hackberry (*Celtis occidentalis*), sweetgum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), mulberry (*Morus* sp.), black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), basswood (*Tilia americana*), blackhaw (*Viburnum prunifolium*), Eastern redbud (*Cercis canadensis*), black locust (*Robinia pseudoaccacia*), and *Catalpa* sp.

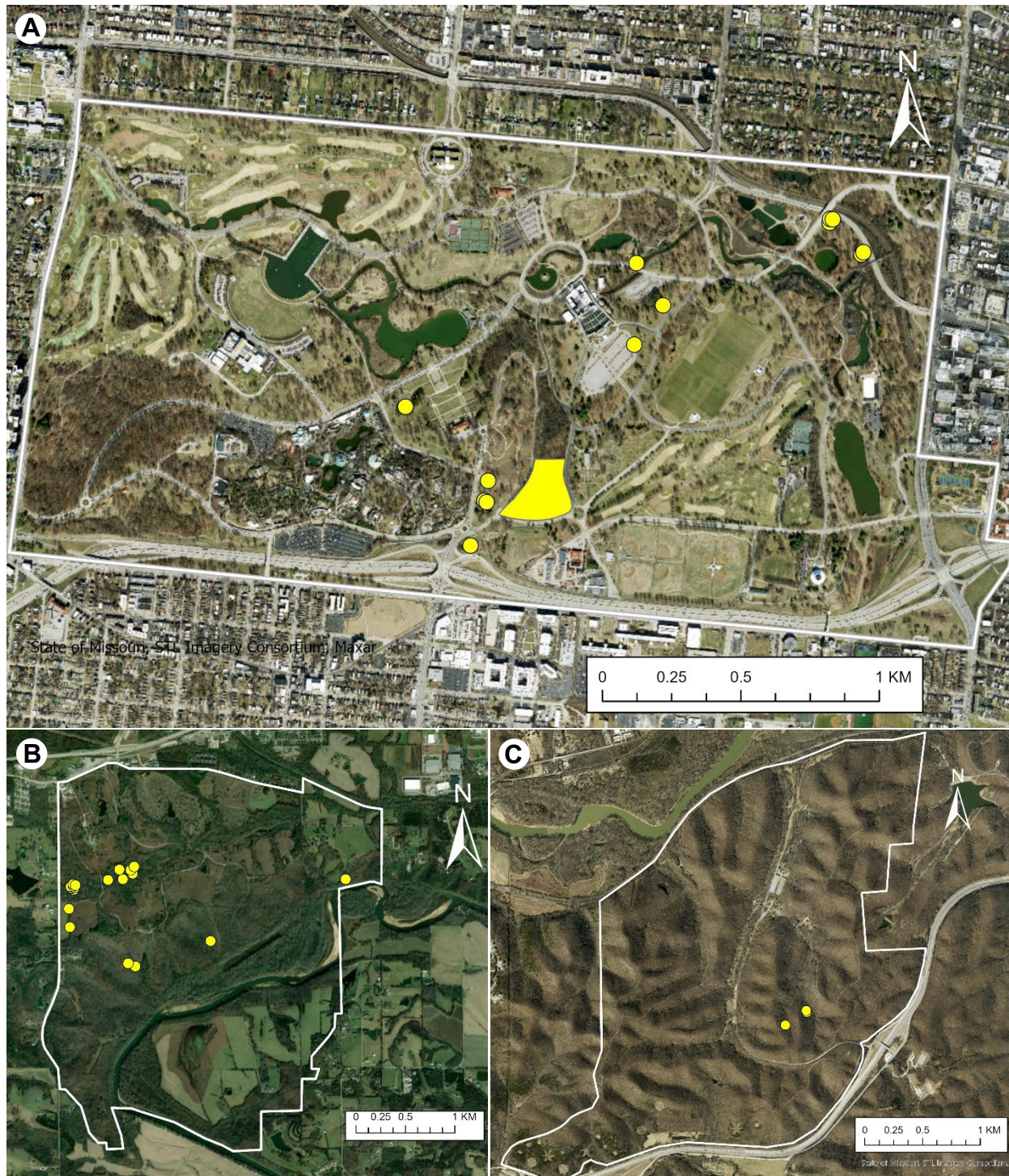
Since 2014, *Phellodendron amurense* saplings have been cut and treated with glyphosate, or treated with a hand swipe basal bark triclopyr application. Staff have also controlled seedlings with prescribed fire in March 2019 and January 2021, with future burns planned. Despite years of removal, we document a population of *P. amurense* which is persisting over time. While there are no fruiting trees in the Successional Forest, bird-mediated dispersal from the mature planted trees in Forest Park could be sustaining this population.

Shaw Nature Reserve: Established in 1925 and subsequently developed as an arboretum, numerous species were planted and propagated at the site through the late 1950s. The site was renamed Shaw Nature Reserve in 2000, with a focus on native species and ecological restoration (Missouri Botanical Garden 2001). In 2008, Nature Reserve staff discovered a grove of *Phellodendron amurense* in a former nursery site (**Figure 3**). The trees were felled and the ~60 cm diameter stumps treated with herbicide (Glenn Beffa, personal communication). In 2016, several dozen saplings were mowed but not treated with herbicide. Currently, the area harbors dozens of ca. 8 cm diameter saplings; a ca. 47-year-old non-fruiting tree (presumably male), and a fruiting ca. 14-year-old tree were both recently felled and stump treated with herbicide. *P. amurense* seedlings have been found at the Nature Reserve up to 1.8 miles (2.9 km) from this population (vouchers cited below; **Figure 4**).

Tyson Research Center: A 2,000-acre environmental field station of Washington University in St. Louis, this site consists primarily of secondary oak-hickory forest on the northern edge of the Ozarks Ecoregion. Within Tyson is a 50-acre long-term research site that is part of the Smithsonian Forest Global Earth Observatory network (ForestGEO; [forestgeo.si.edu](http://forestgeo.si.edu)). Three individuals of *Phellodendron amurense* were observed in the ForestGEO plot in 2023 (**Figure 3**; iNaturalist observation 178696769), occurring on gentle, northeast-facing slopes. The largest individual was 30.1 cm DBH, and coring aged it to about 36 years, indicating a fast average growth rate of 0.8 cm/year. The largest tree is a reproductive female that was observed fruiting in October 2023; no seedlings were found. Although only three individuals were found, it is possible that more were present and previously misidentified.

Here, *Phellodendron* grows under a canopy of red and white oak (*Quercus rubra* and *Q. alba*), shagbark and pignut hickory (*Carya ovata* and *C. glabra*), and white ash (*Fraxinus americana*). Other understory species include flowering dogwood (*Cornus florida*), Carolina buckthorn (*Frangula caroliniana*), pawpaw (*Asimina triloba*), spicebush (*Lindera benzoin*), tree-of-heaven (*Ailanthus altissima*), and bush honeysuckle (*Lonicera maackii*).





**Figure 3.** Maps of populations of *P. amurense*. **A.** Forest Park (including planted specimens). **B.** Shaw Nature Reserve. **C.** Tyson Research Center.



**Rockwoods Reservation and Range:** These areas are multiuse public lands managed by the Missouri Department of Conservation. Land managers have been removing *P. amurense* at Rockwoods Reservation since its discovery there in 2016 (Ben Davis, personal communication). The population is on the west side of the property, near Highway 100, and consists of scattered and sparse individuals that are removed when noted, with around a dozen total individuals removed to date. At Rockwoods Range, *P. amurense* was discovered in 2020, and managers have removed around two dozen individuals there, primarily near Six Flags and in the northwest corner of Rockwoods Range.

**Litzsinger Road Ecology Center:** Part of the Missouri Botanical Garden, Litzsinger Road Ecology Center (LREC) is 39 acres of creek, planted tallgrass prairie, and woodland. A few (<5) ca. 4-5 year old saplings of *P. amurense* were documented at LREC in 2021 and 2022 (James Faupel, personal communication). All plants were cut and herbicided upon discovery. There are no known cultivated or reproductive individuals at the site. Since the occurrences were all in regularly flooded riparian habitats associated with Deer Creek, a tributary of River Des Peres, it is likely that seeds washed in from an upstream source during flooding. Woody associates here include box elder (*Acer negundo*), Ohio buckeye (*Aesculus glabra*), common hackberry (*Celtis occidentalis*), green ash (*Fraxinus pennsylvanica*), and slippery elm (*Ulmus rubra*), under a canopy of American sycamore (*Platanus occidentalis*) and eastern cottonwood (*Populus deltoides*).

**Voucher specimens: U.S.A. MISSOURI:** FRANKLIN CO.: Shaw Nature Reserve, Brush Creek drainage, 8-10 young, single-stemmed individuals to 12 ft tall, scattered on semi-shaded gravel bars of creek, 37.6538800°N, 90.8494400°W, 29 September 2008, *Beffa s.n.* (MO 6087252). Shaw Nature Reserve, West of Wild Flower Trail, semi-shaded gravelly soil in woodland, 21 April 2016; *Megan Engelhardt 183 with James C. Trager* (MO 7023243). SAINT LOUIS CO.: Litzsinger Road Ecology Center, South Woods, along Deer Creek, one individual ca. 6 ft tall, 38.6236111°N, 90.3769444°W, 7 July 2022, *Owen Kathriner 34* (MO).

**Observations: U.S.A. MISSOURI:** ST. LOUIS: Litzsinger Road Ecology Center, 8 October 2021, *Allison Azmy*. iNaturalist observation: [www.inaturalist.org/observations/97557582](https://www.inaturalist.org/observations/97557582). Washington University Tyson Research Center, 16 August 2023, *Zo Benz*. iNaturalist observation: <http://www.inaturalist.org/observations/178696769>.



**Figure 4.** Missouri Botanical Garden herbarium vouchers collected at Shaw Nature Reserve in 2008 by Glenn Beffa (A) and in 2016 by Megan Engelhardt and James Trager (B).



## IDENTIFICATION AND TAXONOMY

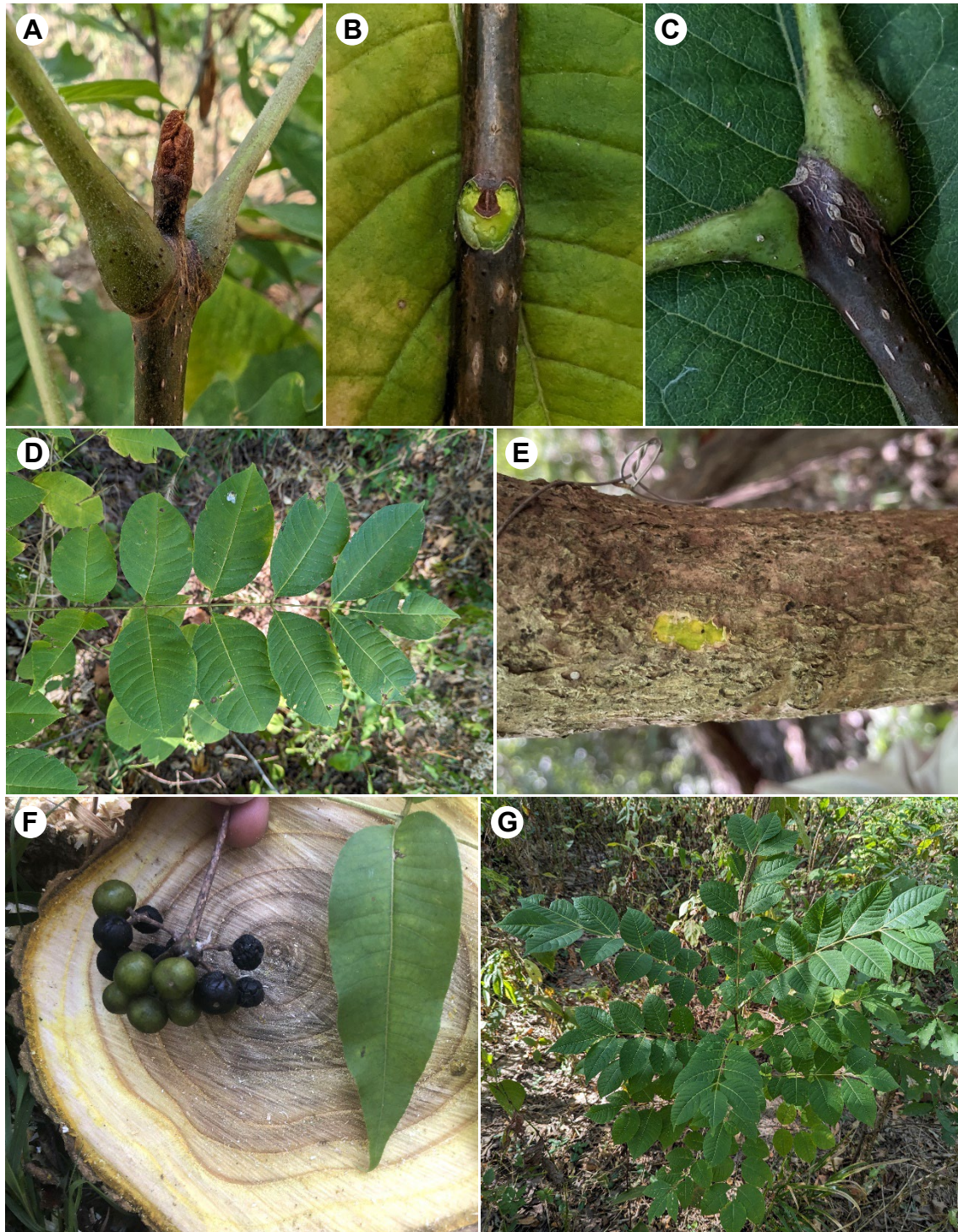
*Phellodendron amurense* is easily recognized by its thick corky bark, bright yellow cambium, and distinctive citrus-skunk odor of the crushed leaves. It has deciduous, opposite, odd-pinnate compound leaves that turn yellow in autumn. Leaflets number 5-13 per leaf and have undulate, entire margins. Amur cork tree is dioecious, with panicles of small yellow-green flowers blooming late May to early June. Fruits are small dark drupes (0.6-1.3 cm) maturing in late October and remaining on the tree into winter. Buds are naked, with the top lateral bud pair offset slightly below the terminal bud. Lateral buds are enclosed by the petiole bases. (**Figure 5**; Rehder 1940; Gilman & Watson 1994; Simons 2006; Ma & Brach 2007).

Locally, several species can resemble *Phellodendron amurense*. In Yatskievych (2013), it would key to *Tetradium daniellii* (Benn.) T.G. Hartley, another Asian tree in the Rutaceae which lacks the corky bark and does not have the axillary buds concealed in the petiole bases. *Phellodendron amurense* can be differentiated from similar compound-leaved plants by its turpentine smell and the bright yellow inner bark. Ashes (*Fraxinus* spp.) have serrate leaflets and exposed axillary buds. Tree-of-heaven (*Ailanthus altissima*) has alternate leaves and leaflets typically with a small basal lobe and a foul, peanut-like odor. Elderberry (*Sambucus* spp.) can be differentiated by its scaled buds and serrate leaflets.

## DISCUSSION

While the *Phellodendron amurense* populations at Forest Park and Shaw Nature Reserve likely originated from cultivated trees onsite, the other populations reported here (Rockwoods Reservation and Range, Tyson Research Center, and Litzsinger Road Ecology Center) have no records of *P. amurense* plantings. Its presence in those locations document dispersal to and naturalization in native ecosystems. All populations documented here are in sites with active management and/or research activities, and we expect that *P. amurense* is also spreading undetected into non-managed areas. The species can thrive in a variety of plant communities as demonstrated by the diverse range of habitats reported here, from floodplain to oak-hickory forest to city park. This contrasts with reports that it requires full sun in its native habitat (Yoshida & Kamitani 1999). However, it is consistent with the site description of the New York City population in a disturbed mesic site with both open sun and dense shade (Gleaser & Kincaid 2005, Morgan 2012).

The success of *Phellodendron amurense* as an invasive species is likely due to life history traits enabling it to spread and establish quickly. Seeds are bird and fluvially dispersed, resulting in a wide dispersal range (Ning & Dafang 1990; James Faupel, personal observation). Amur cork tree is capable of immediate colonization (Morgan & Boryiewicz 2012), and seeds can remain viable for several years (Simmons 2006). Once germinated, *P. amurense* forms dense seedling layers that shade the understory and persist until an opportunistic opening in the canopy enables their release (Morgan 2012). With greater light access, *P. amurense* can grow quickly in its early years, attaining heights of 10-12 feet in 5-8 years (Simons 2006). This is consistent with our



**Figure 5.** *Phellodendron amurense*, Missouri specimens. A. Naked terminal bud and opposite leaf arrangement. B. Lateral bud enclosed by leaf scar. C. Stem lacking terminal bud. D. Compound leaf with 11 leaflets. E. Corky bark with neon yellow underneath. F. Fruits in panicle arrangement, with trunk cross section. G. Seedling. Photos: Erin O'Connell (A-D, G), Zo Benz (E), and Mike Saxton (F).



observations at Tyson Research Center. Furthermore, allelopathy has been documented in *P. amurense*; while this impedes germination and seedling development of *P. amurense* in its native range (Zhang et al. 2011, Wang et al. 2013), it may also provide a competitive advantage in its introduced range. Morgan (2012) reports no signs of deer herbivory on *P. amurense*, suggesting that cork tree may be escaping herbivory pressures experienced by its native counterparts.

Cork tree's adaptation to diverse habitats and suite of invasive-linked life history traits could lead to continued spread in Missouri and elsewhere. Niche modeling predicts that the northern United States, southern Canada, southern Russia, and Kazakhstan provide the most potential area for non-native range expansion of *P. amurense* (Li et al. 2019). However, this suitable range area notably excludes Missouri. This suggests that the wild-growing individuals reported here occur at the southern extreme of their potential North American range or could indicate that *P. amurense* is experiencing competitive release in its non-native range, allowing it to expand beyond its native climatic conditions. Gilman and Watson (1994) suggest that *P. amurense* could survive as far south as USDA Hardiness Zone 8, which includes central Texas and northern Florida.

We warn of *P. amurense*'s ability as a woody invasive plant species to threaten native forest ecosystems. Ma and Brach (2007) argue against classifying *P. amurense* as invasive, since escaped populations have primarily established in urban and residential areas rather than native ecosystems. However, four of our reported populations are in rural natural areas, in direct contrast to Ma and Brach's assertion. Additionally, the population in Forest Park has persisted despite nearly a decade of active restoration and control efforts, and the abundance of seedlings documented there portends a continued invasion threat. Our reports align with several case studies in the northeastern United States categorizing *P. amurense* as an invasive risk. In both New York City and Fairfield County, Connecticut, *P. amurense* ranked among the top three tree species for metrics of ecological dominance (Glaeser & Kincaid 2005, Morgan 2012).

*Phellodendron amurense* currently appears on a number of state invasive species lists. The Midwest Invasive Plants Network ([mipn.org/plantlist](http://mipn.org/plantlist)) reports *P. amurense* as invasive in six states and the Early Detection and Distribution Mapping System ([eddmaps.org](http://eddmaps.org)) reports *P. amurense* from nineteen states; both lists include Missouri (**Table 1**). However, Missouri is excluded from the Center for Invasive Species and Ecosystem Health ([invasives.org](http://invasives.org)) list of 12 states and the Invasive Plant Atlas of the United States ([invasiveplantatlas.org](http://invasiveplantatlas.org)) list of three states. Likewise, the Missouri Invasive Plant Council ([moinvasives.org](http://moinvasives.org)) omits *P. amurense*. Based on the established Missouri populations documented here, we call for inclusion of *P. amurense* in Missouri invasive species lists and for more tracking of *P. amurense*.

Our reports of *P. amurense* populations at five sites in the St. Louis metropolitan region, including three sites with no Amur cork tree plantings, confirm the escape of *P. amurense* from cultivation. Given its history of spread in northeastern United States and life history traits contributing to invasion success, we warn of its potential threat to native Missouri ecosystems.



**Table 1.** States where *P. amurense* is listed as invasive.

State	EDD Maps (no. of reports)	Center for Invasive Species and Ecosystem Health	Midwest Invasive Plant Lists	Invasive Plant Atlas
Colorado	1	-	-	-
Connecticut	10	-	-	-
Delaware	1	-	-	-
Illinois	11	-	-	-
Indiana	19	listed	prohibited and listed	-
Kentucky	1	listed	-	watch list
Maine	-	law	-	-
Maryland	6	listed and law	-	-
Massachusetts	27	law	-	-
Michigan	-	-	listed	-
Minnesota	155	law	listed	-
<b>Missouri</b>	<b>3</b>	<b>-</b>	<b>listed</b>	<b>-</b>
New Hampshire	8	listed	-	-
New Jersey	32	listed	-	-
New York	89	law	-	-
Ohio	11	-	listed	-
Pennsylvania	13	listed	-	-
Rhode Island	3	listed	-	listed
Virginia	3	-	-	listed
West Virginia	1	-	-	-
Wisconsin	24	law	prohibited	-

#### ACKNOWLEDGEMENTS

We thank the following people for sharing their knowledge of *Phellodendron amurense* population history and management in Missouri: Amy Witt and Josh Wibbenmeyer at Forest Park Forever, Ben Davis at Missouri Department of Conservation Rockwoods Range and Reservation, and James Faupel and Caitlyn Sims at Litzsinger Road Ecology Center. Thanks to Stan Braude and Cody Azotea for sharing their records of *P. amurense* planted at Washington University in St. Louis, and to Joseph Hart for confirming the presence of plantings in Tower Grove Park. Additional thanks to Leonel Caceres for assistance with field surveys and to Jonathan Myers for providing historical data at Tyson Research Center. We thank Doug Ladd and two anonymous reviewers for their insightful feedback on this manuscript.

## LITERATURE CITED

- Center for Invasive Species and Ecosystem Health. <https://www.invasive.org/browse/subinfo.cfm?sub=11569>. Accessed 18 October 2023.
- Dirr, M. (1998). Manual of Woody Landscape Plants Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses, 5<sup>th</sup> ed. Stipes Publishing, Champaign, IL.
- EDDMapS. 2023. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. <http://www.eddmaps.org/>. Accessed 27 October 2023.
- Elm City Nursery. 1905. Elm City Nursery Catalogue. New Haven, CT.
- Forest Global Earth Observatory Network. <https://forestgeo.si.edu/sites/north-america/tyson-research-center>. Accessed 14 December 2023.
- GBIF.org. 2023. GBIF Occurrence Download <https://doi.org/10.15468/dl.huc6y2>. Accessed 27 October 2023.
- Gilman, E. F., & Watson, D. G. (1994). *Phellodendron amurense* Amur Corktree. *United States Forest Service, Department of Agriculture*. Fact Sheet ST-437.
- Glaeser, C.W. & D. Kincaid. 2005. The non-native invasive *Phellodendron amurense* Rupr. in a New York city woodland. *Arboricultural Journal*, 28(3): 151–164. <https://doi.org/10.1080/03071375.2005.9747416>.
- Huang Z., X. Zhou, X-R. Zhang, Z. Pu, & S. Xing. 2017. Relationship between the distribution of *Phellodendron amurense* and environmental factors in the Beijing area. *Plant Science Journal*, 35(1): 56-63.
- iNaturalist. <https://www.inaturalist.org>. Accessed October 28, 2023.
- Invasive Plant Atlas of the United States. <https://www.invasiveplantatlas.org/subject.html?sub=11569>. Accessed 28 October 2023.
- Litzsinger Road Ecology Center. <https://litzsinger.org>. Accessed 14 November 2023.
- Li, Y., M. Xiang-xiao, L. Hong-yun, D. Dan-dan, S.M. Chen-zhong, & X. Li. 2019. Globally Ecological Suitability Analysis of *Phellodendron chinense* and *Phellodendron amurense*. *Chinese Journal of Experimental Traditional Medical Formulae* 24: 167-174.
- Ma, J. & A.R. Brach. 2007. The Identity of Cultivated *Phellodendron* (Rutaceae) in North America. *Journal of the Botanical Research Institute of Texas*, 1(1): 357-365.
- Ma, J., W. Cao, Q. Liu, M. Yu, & L. Han. 2006. A revision of *Phellodendron* (Rutaceae). *Edinburgh Journal of Botany*, 63(2–3): 131–151. <https://doi.org/10.1017/S0960428606000515>.
- Missouri Botanical Garden. 1921. Hardy exotic plants suitable for the gardens of Missouri and adjacent states. *Missouri Botanical Garden Bulletin* 9(2): 20-25, (4):48-53, (5): 61-66, (6): 75-77, (7): 90-97, (8): 110-116; (9): 129-135.
- Missouri Botanical Garden. 2001. A new name for the arboretum: Shaw Nature Reserve. *Missouri Botanical Garden Bulletin* 89(1): 5.
- Missouri Department of Conservation. Rockwoods Range. <https://mdc.mo.gov/discover-nature/places/rockwoods-range>. Accessed 14 November 2023.
- Missouri Department of Conservation. Rockwoods Reservation. <https://mdc.mo.gov/discover-nature/places/rockwoods-reservation>. Accessed 14 November 2023.
- Midwest Invasive Plant Network. <https://www.mipn.org/plantlist/>. Accessed 28 October 2023.

- Missouri Invasive Plant Council. <https://moinvasives.org/>. Accessed 28 October 2023.
- Morgan, E.C. 2012. Stand dynamics of a 46-year invasion by *Phellodendron amurense* Rupr. in an eastern North American forest. *Castanea*, 77(1): 21–27. <https://doi.org/10.2179/11-039>.
- Morgan, E.C. & J.A. Borysiewicz. 2012. The Invasion of *Phellodendron amurense* into the urban and suburban woodlands of the New York City Region. *Urban Habitats*. [https://www.urbanhabitats.org/v07n01/phellodendron\\_full.html](https://www.urbanhabitats.org/v07n01/phellodendron_full.html).
- Ning, Z., & D. Dafang. 1990. Seed dispersal, dormancy, seed bank, and regeneration of Amur corktree. *Journal of Northeast Forestry University*, 1(1): 16–22.
- Rehder, A. 1940. *Manual of Cultivated Trees and Shrubs Hardy in North America*, 2<sup>nd</sup> ed. Macmillan Publishing, New York.
- Simons, D. 2006. Fact Sheet: Amur Corktree. <https://www.invasive.org/alien/fact/pdf/pham1.pdf>.
- Tyson Research Center. <https://tyson.wustl.edu/>. Accessed 14 December 2023.
- Wang, H., Z. Zhang, L-C. Dai, J-Y. Si, B. Zhang, Y-F. Li, & Y. Zhang. 2013. Research on allelopathic effects of phellamurine. *China Journal of Chinese Materia Medica*. 38(17): 2768-2772.
- Washington University Arboretum. Amur Cork Tree Arbor Walk #101, Treekeeper #1905. [https://trees.wustl.edu/items/101/?\\_gl=1\\*1xeqvqa\\*\\_ga\\*NTg0Mzg1NTIyLjE2ODgwNTQ5ODc.\\*\\_ga\\_LPTGDJ28VJ\\*MTY5NTIzNTkyNC4yMC4xLjE2OTUyMzU5MzQuMC4wLjA](https://trees.wustl.edu/items/101/?_gl=1*1xeqvqa*_ga*NTg0Mzg1NTIyLjE2ODgwNTQ5ODc.*_ga_LPTGDJ28VJ*MTY5NTIzNTkyNC4yMC4xLjE2OTUyMzU5MzQuMC4wLjA). Accessed 14 November 2023.
- Yatskievych, G. 2013. *Steiermark's Flora of Missouri*, revised edition, volume 3. Missouri Botanical Garden Press, St. Louis.
- Yoshida, T., & T. Kamitani. 1999. Growth of a shade-intolerant tree species, *Phellodendron amurense*, as a component of a mixed-species coppice forest of central Japan. *Forest Ecology and Management*, 113: 57–65.
- Zhang, Z., T. Xia, Y. Tao, L. Dai, Y. Liu, & B. Zhang. 2011. Study on allelopathy effect of pericarp extract of *Phellodendron amurense*. *China Journal of Chinese Materia Medica*. 36(3): 285-288.
- Zhang, Z.-P., Y. Zhang, Z. Zhang, Y.-D. Qi, B.-G. Zhang, F.-M. Suo, & Y. Chen. 2016. Population survival status and chemical characterization of wild *Phellodendron amurense* Rupr. in China. *Plant Science Journal* 34(3): 381–390.
- Zhang, B., H. Zou, B. Chen, X. Zhang, X. Kang, C. Wang, & X. Zhang. 2023. Optimizing the distribution pattern of species under climate change: the protection and management of *Phellodendron amurense* in China. *Frontiers in Ecology and Evolution*, 11: 19 May. <https://doi.org/10.3389/fevo.2023.1186627>.
- Zhu, L., X. Wang, N. Pederson, Z. Chen, D.J. Cooper, Y. Zhang, & Z. Li. 2018. Spatial variability in growth-climate relationships of Amur cork tree (*Phellodendron amurense*) and their connections with PDO in northeast China. *Journal of Geophysical Research: Biogeosciences* 123(5): 162.