

Incidence of *Phoradendron leucarpum* (Viscaceae) at General Burnside State Park, Pulaski County, Kentucky

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ABSTRACT

A survey of host trees infested with eastern mistletoe (*Phoradendron leucarpum*, Viscaceae) at General Burnside State Park in Pulaski County, Kentucky, was made in late 2008 and early 2009. It is the only island state park in Kentucky, and consists of 174.0 ha in the middle of Lake Cumberland, adjacent to the city of Burnside. A total of 244 mistletoe-infested trees from nine tree species in eight families were found. *Prunus serotina*, *Juglans nigra*, and *Ulmus americana* were the most common host trees. Mistletoe infestation had a greater occurrence in older, full-crowned canopy trees of open, exposed sunny habitats.

KEY WORDS: General Burnside (Island) State Park, eastern mistletoe, host tree specificity, *Phoradendron leucarpum*

INTRODUCTION

General Burnside State Park (GBSP), the only island park in Kentucky, encompasses 174.0 ha in the middle of Lake Cumberland, across from the city of Burnside (Figure 1), and lies 1.8 km south of Somerset off U.S. 27 in Pulaski County (Kentucky State Parks 2009). The island park is located at latitude 36°58'33"N and longitude 84°36'08"W. Elevation ranges from 225 m at the normal pool shoreline at Lake Cumberland to 276 m at the highest point, Bunker Hill (Figure 1). GBSP has been known as Bunker Hill, Chandler Island State Park, and General Burnside Island State Park. A botanical reconnaissance in April 2001 at GBSP revealed a high incidence of eastern mistletoe (*Phoradendron leucarpum* (Raf.) Reveal & M.C. Johnston), an epiphytic hemiparasite in the Viscaceae that infests various deciduous trees. This initial observation inspired the present field survey of eastern mistletoe at GBSP.

HISTORY

The island park is named for Major General Ambrose E. Burnside, the sideburn-whiskered Union general with the Ninth Army

Corps, who established a camp and supply depot at the community of Point Isabel during the Civil War. The purpose was to fortify the site along a major lookout point, Bunker Hill, and control a portion of the Cumberland River from the Confederates. Afterwards, General Burnside accepted the surrender of Confederate forces at Cumberland Gap to secure eastern Kentucky and Tennessee from a strong Confederate presence. His camp at Point Isabel soon became known as Camp Burnside and the community was called Burnside by the end of the Civil War (Kentucky State Parks 2009).

In the 1940s, the Nashville District Corps of Engineers began a project to impound the waters of the Cumberland River by building the colossal Wolf Creek Dam, the 22nd largest dam in the United States. It was completed in 1950 and the Cumberland River was impounded for 163.0 km upstream creating Lake Cumberland with 2008 km of shoreline and a seasonal pool over 25,500 ha.

The rising waters of Lake Cumberland eventually covered the lower portions of Burnside forming a tear-shaped island (Figure 1). The island was suggested as an excellent site for a camping park by the Corp of Engineers, and it subsequently was transferred from the Corps to the Commonwealth

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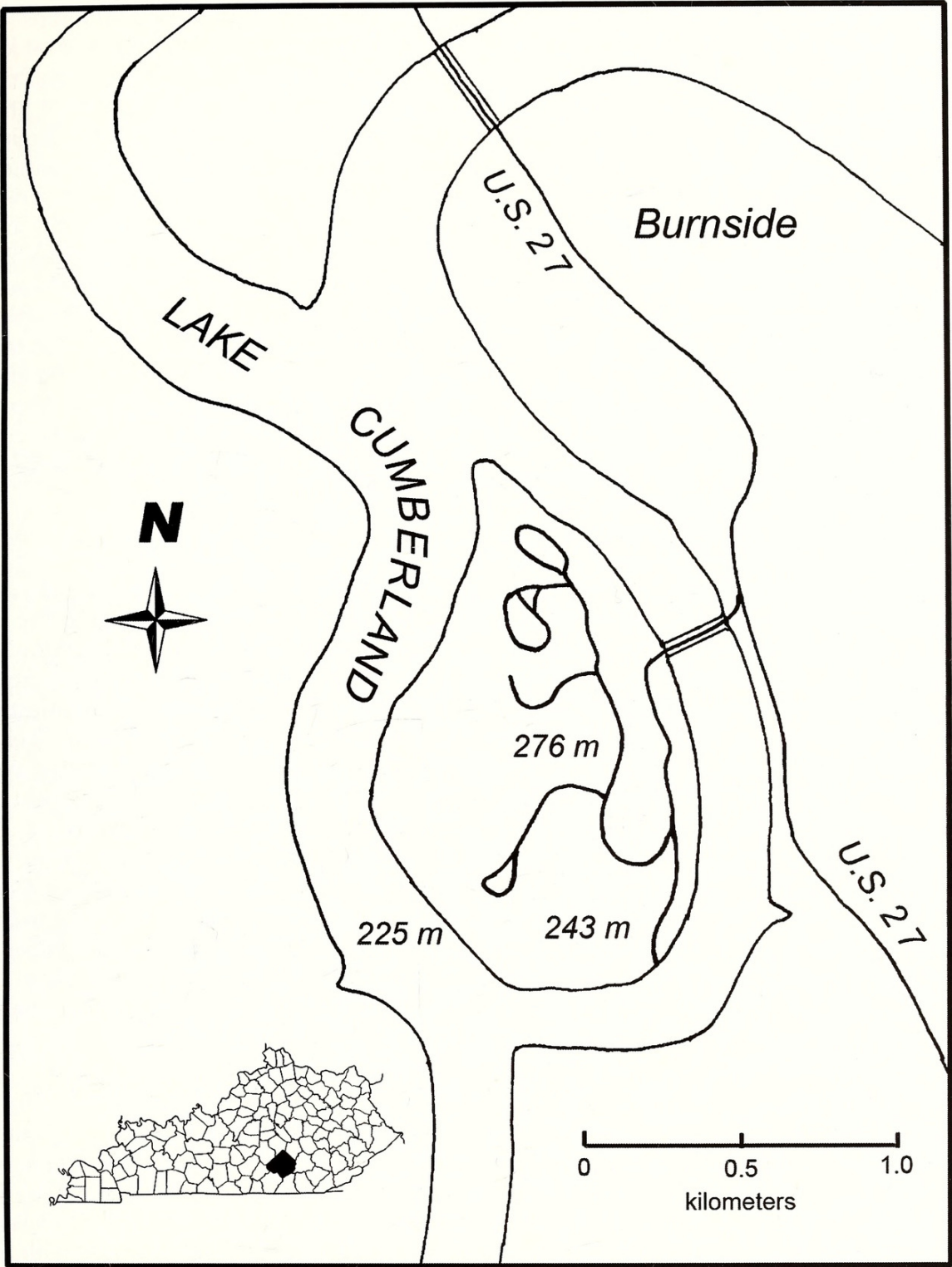


Figure 1. Map of General Burnside State Park, a 174 ha tear-shaped island situated in Lake Cumberland, Pulaski County, Kentucky. The highest elevation is Bunker Hill at 276 m above mean sea level. The park perimeter above cliff line is 243 m above sea level, and the mean lake pool is 225 m above sea level.

of Kentucky for fee simple on 3 February 1958. In 1959, a causeway bridge from U.S. 27 to the island was built by the Kentucky Department of Transportation (Kentucky State Parks 2009). A beach, boat ramp, camping area with 94 utility hookups, and

nine-hole golf course were constructed in late 1959–1960. An 18-hole golf course, built in the mid-1970s, was completely renovated in 2007 to approximately 24.0 ha of green and fairway surface area and 37.0 ha of rough bordering land.

The island park was initially called Chandler Island State Park to honor Governor A. B. "Happy" Chandler after transfer of the land to the Commonwealth of Kentucky. However, the Burnside and Somerset Chambers of Commerce recommended the park be renamed as General Burnside Island State Park, and the Kentucky Parks Board approved the name change on 28 May 1960. The name has changed through the years, and it is now known as General Burnside State Park (Kentucky State Parks 2009).

THE STUDY AREA

GBSP lies entirely within the Eastern Highland Rim of the Interior Plateaus Eco-region (Keys et al. 1995; Woods et al. 2002). Küchler (1964) and Woods et al. (2002) classified the vegetation for this region of Kentucky as Oak-Hickory (*Quercus-Carya*) Forest. The forest stands of GBST include mosaics of Oak-Hickory (*Quercus-Carya*) and Oak-Ash-Elm (*Quercus-Fraxinus-Ulmus*) types on the upper dry sites and an eastern red cedar (*Juniperus virginiana* L.) type on the uppermost drier limestone-exposed sites. These forest types are intermixed with several calcicolous trees including black cherry (*Prunus serotina* Ehrh.), common hackberry (*Celtis occidentalis* L.), honey locust (*Gleditsia triacanthos* L.), and black walnut (*Juglans nigra* L.).

The geology of GBSP consists primarily of Mississippian limestones (Taylor et al. 1975). The Ste. Genevieve limestone member of the Monteagle Limestone are present from 256–276 m elevation and often forms rock outcrops. St. Louis limestone lie from 225–256 m elevation. Concordantly, below 225 m elevation lie the Mississippian limestones of the Salem and Warsaw Formations (Taylor et al. 1975). The underlying and exposed bedrock is comprised mainly of medium to light gray, medium-grained limestone interbedded with some chert, claystone, and siltstone (Taylor et al. 1975).

The soils of GBSP are classified as the Talbott, Waynesboro, and Brookside series (Ross 1974). The Talbott rock silt loams occupy the higher elevations from 260 to 276 m on the north-central part of GBSP. Talbott series are 80.0 cm deep, well-drained, residual limestone soils of gently 6 to 12% side

slopes, ridgetops, and rock outcrops (Ross 1974). Waynesboro loams are found on a large portion of the island including the golf course from 250 to 260 m. These loam soils are 144 to 229 cm deep, well-drained, old alluvium of limestone 6 to 12% side slopes and ridges (Ross 1974). Waynesboro clay loam series are found on severely eroded ridge slopes around the eastern part near boat ramp from 240 to 250 m to the island causeway with 12 to 30% slopes. The Brookside outcrop complex of steep hillsides and rock outcrops on 30 to 75% slopes encloses GBST in a narrow band from 225 to 240 m near the normal pool shoreline of Lake Cumberland. Brookside soils are 74.0 to 99.0 cm deep, well-drained, colluvial limestone soils (Ross 1974).

METHODS

We investigated the occurrence of eastern mistletoe in host trees by walking the complete upper island terrain of GBSP. Nikon Monarch 8 × 42 power binoculars were used to spot visible signs of mistletoe infestation, i.e., broom die-back, limb and trunk swellings, cankers, and clusters. Representative vouchers of mistletoe with accompanying host twigs were collected with the use of a 12 m extendable fiberglass linesman pole, processed, and deposited in the Berea College Herbarium. Seven field trips were made to inventory eastern mistletoe and gather descriptive data from late December 2008 through middle March 2009. Plant nomenclature followed Jones (2005).

RESULTS AND DISCUSSION

General Burnside State Park was a unique and ideal site for a survey of *Phoradendron leucarpum*. As a small island isolated by Lake Cumberland, GBSP has the higher elevations of the contiguous mainland terrain with many anthropogenically-created open habitats and an abundance of deciduous calcicolous trees to serve as hosts for eastern mistletoe.

The GBSP topographic open terrain is a complex consisting of wooded groves and scattered canopy trees among and adjacent to the golf course, forested edges along paved roads, a large camping and maintenance building area, and the forested border of the park contiguous to the steep wooded hillsides

Table 1. Host specificity of *Phoradendron leucarpum* in General Burnside State Park, Kentucky.

Tree species	Total	Percentage
<i>Prunus serotina</i> Ehrh.	88	36.06
<i>Juglans nigra</i> L.	69	28.28
<i>Ulmus americana</i> L.	38	15.57
<i>Fraxinus americana</i> L.	19	7.79
<i>Gleditsia triacanthos</i> L.	14	5.74
<i>Celtis occidentalis</i> L.	7	2.87
<i>Acer saccharinum</i> L.	6	2.46
<i>Diospyros virginiana</i> L.	2	0.82
<i>Carya ovata</i> (Mill.) K. Koch	1	0.41
Total: 9	244	100.00

down to Lake Cumberland. This high degree of variability in open habitat proved most favorable for host tree infestation. In previous eastern mistletoe studies, avian vectors of mistletoe berries have been shown to prefer tall, mature canopy trees in open habitats of higher topographic elevations (Thompson and Noe, Jr. 2003; Thompson and Poindexter 2005; Thompson et al. 2008).

A total of 244 mistletoe-infested trees from nine tree species in eight families were found at General Burnside State Park (Table 1). Occurrence of mistletoe was greater in the older, tall, full-crowned canopy trees of upper elevations in open sunny habitats. Trees with mistletoe often were solitary, scattered, or in small wooded groves. Black cherry, black walnut, and American elm were the most prevalent host trees (Table 1), and they also displayed heavy infestations (31 to 100 clusters). A few black cherry and black walnut trees showed such extensive infestations (100 to 150+ clusters) that mortality of the host trees appeared imminent. Four lesser host trees were white ash, honey locust, common hackberry, and silver maple (*Acer saccharinum* L.). These host trees tended to have light (1 to 10 clusters) to moderate (11 to 30 clusters) infestations. Two persimmon trees (*Diospyros virginiana* L.) and one shagbark hickory (*Carya ovata* (Mill.) K. Koch) exhibited one to four mistletoe clumps each.

The host tree species observed in this research were consistent with studies in nearby counties. The five main hosts at the Lexington-Blue Grass Army Depot in Madison County were black cherry, black walnut, American elm, white ash, and honey locust

(Thompson 1992). This same host incidence was found at GBSP. Black cherry, black walnut, silver maple, and American elm were the four dominant host taxa in a survey of Berea, Kentucky, in Madison County (Thompson et al. 2008). In neighboring Garrard County, the primary host trees were black walnut, black cherry, American elm, black locust (*Robinia pseudoacacia* L.), and white ash (Thompson and Poindexter 2005). A mistletoe survey of Rockcastle County, contiguous to Pulaski County, revealed an occurrence of 12 host tree species with the most widespread hosts being black walnut and black cherry (Thompson and Noe, Jr. 2003). General Burnside State Park displays a nearly identical pattern of hemiparasite to preferred host infestation as these three south-central counties. Such affinities between these studies may be attributed to similarities in primary substrates and soils (limestone-based), as well as uniformity in available open habitats, topography, and host availability.

CONCLUSION

The forest vegetation of GBSP is a complex function of the limestone geology, substrate-derived soils, climate, topography, existing vegetation, and anthropogenic disturbance. The host trees for mistletoe-infestation at this island site favored calicoles. Host trees typically occurred in wooded groves, scattered bunches, or solitary trees in open habitats. These trees frequently were taller, older, full-crowned canopy trees in open sunlight. The total of 244 trees infested with eastern mistletoe on this 174 ha island exemplify the availability of host trees, physical site conditions, and bird vectors for its dispersal, establishment, and spread.

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