Japanese Climbing Fern: The Insidious "Other" Lygodium

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"The first time I saw a climbing fern I was shocked, as if I'd opened a window and a trout had flown in."

These words from Hipps (1989) may describe the reactions of many when first observing either of the invasive climbing ferns found in the southeastern United States. This has been particularly true for Old World climbing fern (*Lygodium microphyllum*), for which initial shock has turned to horror as the species has spread rapidly and dramatically across southern and now central Florida. Japanese climbing fern (*Lygodium japonicum*), however, has spread with perhaps equal rapidity but less drama, creeping insidiously through the understory of mesic sites in northern, central, and now southern Florida, and gaining much of its early recognition from its close relationship to Old World climbing fern. This close relationship has almost certainly enhanced awareness of Japanese climbing fern, but has potentially served to diminish perceptions of its invasiveness and impact as well. While not typically found forming the dense, canopy-covering infestations seen with Old World climbing fern, and limited annually by freezing temperatures throughout much of its range, many aspects of the life history of Japanese climbing fern indicate the potential for this species to be both equally tenacious and more broadly pervasive regionally, though perhaps slightly less damaging on individual sites.

DESCRIPTION

Japanese climbing fern (*Lygodium japonicum* (Thunb.) Sw.) (Lygodiaceae), is a perennial, creeping or twining vine with a wiry, stem-like, brown rachis capable of indeterminate growth to 30 m (90 ft.), and slender, dark brown rhizomes. Leaves (pinnae) may be fertile or sterile, stalked, twice-compound, roughly triangular in outline, and 10-20 cm (4-8 in) long and wide, and a moderate to "yellowy" green color, turning rusty-brown after frost damage, but evergreen in South Florida (Figure 1). Leaflets (pinnules) are deeply lobed, dissected, with fertile leaflets bearing two rows of sporangia on an enrolled leaflet margin (Langeland and Burks 1998). Throughout much of its range, initial leaflet formation is sterile, with increasing formation of fertile leaflets as the growing season progresses. Spores are trilete, rusty-brown in color and mature from July through January in much of its range, and year-round in South Florida (Lott 2003). During peak spore-release in the fall and early winter, a rust-colored haze can be seen in heavily infested stands.

TED BODNER, COURTESY OF WWW.INVASIVE.ORG

Figure 1: Typical leaflets of Japanese climbing fern (Lygodium japonicum).

DISTRIBUTION AND HABITAT

In its native range of temperate and tropical eastern Asia, Australia, and the East Indies, Japanese climbing fern occurs in forest edges, open forests, and secondary forests at both lower and higher elevations (Ferriter 2001). Introduced to the United States as an ornamental plant around 1900, naturalized populations of Japanese climbing fern are now established in nine southeastern states, extending westward from Florida to eastern Texas and northward to North Carolina. The fern is also documented in Hawaii and Puerto Rico. In this range, Japanese climbing fern occurs primarily in mesic and temporally hydric areas, including floodplain forests, bottomland hardwood forests, marshes, wetlands, secondary woods, moist pinelands (especially flatwoods), limestone outcroppings, and disturbed areas such as road shoulders and rights-of-way (Clewell 1982, Nauman 1993, Langeland and Burks 1998), and may occur on more hydric and xeric sites to a limited extent. Established populations range from scattered, creeping stems to dense, tangled mats of up to 100% cover over many acres. Dense patches effectively eliminate native groundcover and understory vegetation and smother seedlings of overstory tree species (Figure 3). While the ecological requirements of Japanese climbing fern are poorly defined, its broad distribution indicates a tolerance for a range of environmental conditions, across sites with a mesic moisture regime (Langeland and Burks 1998, Ferriter 2001).

One factor which has likely prevented formation of the "dense arboreal blankets" in tree canopies as seen with Old World climbing fern is frost/freeze damage in sub-temperate and temperate climates (Zeller and Leslie 2004). Winter dieback of Japanese climbing fern fronds occurs to varying extents through the majority of its range in Florida, but from 5-30% of the foliage has survived in some northern Florida populations over each of the past three winters. Like Old World climbing fern, the plants remain evergreen below the frost line in Florida (Ferriter 2001,

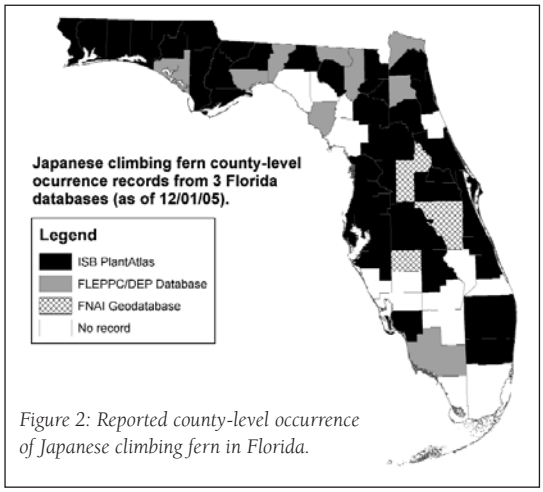

Figure 2: Reported county-level occurrence of Japanese climbing fern in Florida.

Valenta et al. 2001). In the spring, the fern will re-sprout from cold-tolerant subterranean rhizomes and often utilize freeze-damaged stems as ladders to grow back into the canopy. Plants are considered hardy in USDA plant hardiness Zones 7, 8, 9, and 10, and semi-hardy in Zone 6.

Japanese climbing fern has now been reported in 53 of Florida's 67 counties (Figure 2), with the heaviest infestations in northern and western Florida. This number reflects the herbarium-vouchered records from the ISB Atlas of Florida Vascular Plants (Wunderlin and Hansen 2003), as well as records in the FNAI Invasive Plant Geodatabase (FNAI 2005), and the FLEPPC/DEP land manager database (FLEPPC 2005). It is likely that infestations also exist in Taylor, Lafayette, Gilchrist, Levy and Flagler counties but have not yet been reported to any of these databases. Recognition of this plant has increased annually among public land managers since the mid 1990s, aiding in reporting, detection, and management, and the plant is now recognized as a threat to public conservation lands. Unfortunately, as is often true with invasive plants, private land owners and managers have been largely unaware of the plant's presence or that it's continued spread is of concern.

PRIVATE LANDS

A strategy that crosses property boundaries is required for successful management of most invasive species. In particular, the reproductive strategy (i.e. spore-dispersal, self-fertilization) of both the invasive climbing ferns facilitates rapid spread and establishment in remote areas (Lott 2003), and continual re-invasion if all populations in an area are not addressed jointly. The significance of private lands in management of Japanese climbing fern can be partially illustrated from a forestry perspective. According to Brown (1995), Florida has an estimated 14.7 million acres of timberland. 82% (12 million acres) is in the northern half of the State—the area most heavily impacted by Japanese climbing fern invasion, and 49% (7.2 million acres) is owned by private, non-industrial forest landowners.

Figure 3: Heavily infested pine plantation in Northwest Florida.

A very gross indication of Japanese climbing fern invasion on these lands might be derived from a 2002 survey conducted across 280 pine plantations in northern and western Florida in which seven non-native invasive plant species were recorded. Japanese climbing fern was recorded in 22% of slash pine plantations (flatwoods sites), and 3.8% of longleaf pine plantations (sandhill sites). If we only look at slash pine plantations (5.1 million acres in North Florida), and use the 22% occurrence figure for Japanese climbing fern in slash pine plantations, a value of 1.1 million acres of slash pine plantation with Japanese climbing fern occurrence *could* be calculated. However, occurrence in a plantation does not equate to occurrence over an acre, and this value serves only as a coarse indicator of what is a very large private land and plantation forest problem.

CURRENT CONTROL TECHNOLOGY

Figure 4: Typical Puccinia lygodii *damage on climbing fern foliage in Northwest Florida, 11/2004.*

Current control technologies recommend either glyphosate (e.g. Roundup or other) or metsulfuron methyl (e.g. Escort) applied foliarly (Valenta et al. 2001, Zeller and Leslie 2004) during the growing season, preferably prior to the maturation and release of the greatest spore load in the fall and early winter. These recommendations are further supported by preliminary results from herbicide trials evaluating 15 common forestry and vegetation management herbicides conducted on Japanese climbing fern in a heavily infested pine plantation in Northwest Florida. In general, glyphosate treatments have yielded both better long-term control (70-80% reduction in fern cover at one year after treatment), and slightly greater non-target damage than was seen with metsulfuron methyl. When finalized, results from the most recent evaluation may serve to expand and clarify the efficacy of several commonly used herbicides.

A species of foliar rust fungus (*Puccinia lygodii* (Har.) Arth. (Uredinales)) has been isolated from Japanese climbing fern in Louisiana, and several locations in North and Central Florida. The fungus, native to South America, causes severe damage to the leaflets, including necrosis, browning, and drying (Rayachhetry et al. 2001), and has been observed to be increasing in distribution and impact in North Florida climbing fern populations (Figure 4). The impact of this fungus on climbing fern in North Florida has been most noticeable in early winter (i.e., November and December), when varying levels of damage have been observable on approximately 95% of foliage in some forest stands in Calhoun County.

REGULATORY ISSUES

In 1999, Japanese climbing fern was designated as a noxious weed (Rule 5B-57.007, FAC) by the Florida Department of Agriculture and Consumer Services (FDACS), making it unlawful to introduce, cultivate, transport, or release any living stage of the fern without a permit. This designation has been an important part in the process of raising awareness among private forestland managers and members of the forest products industry in Florida. In particular, some members of the pinestraw industry have received scrutiny for sale of pinestraw bales intended for mulch that contained pieces of climbing fern frond. As a result, Rule 5B-57 has been utilized in multiple cases since 2001 where Japanese climbing fern was a contaminant in pinestraw. Notable cases include the rejection of contaminated pinestraw sold to Eglin Air Force base in 2001 and 2004, the prevention of the sale in Florida of multiple tractor-trailer loads of contaminated pine straw in 2004, and the removal of contaminated pine straw product found at a home-improvement store in 2004 (Clark, personal communication). However, the regulatory agency charged with implementing this Rule, the FDACS-Division of Plant Industry, does not have adequate resources to incorporate surveys of pine plantations into field inspectors' schedules, particularly in areas of the state where the pinestraw industry is most prominent. Therefore, enforcement of the Rule occurs primarily in response to violations reported by individuals outside the agency. FDACS and the University of Florida Institute of Food and Agricultural Sciences have provided focused training to members of the pinestraw industry to aid in compliance with the Rule. As with all such issues, some members of the industry have worked voluntarily to comply since 2001, while others continue to harvest pinestraw from infested stands. Japanese climbing fern has recently been recognized as "spreading at an alarming rate" in Georgia (Evans and Moorhead 2005), but it is not yet designated as a noxious weed by the Department of Agriculture in that state. Currently, Alabama is the only other state that designates Japanese climbing fern as a noxious weed.

CONCLUSION

"Although I'm sure the same thing was once said of kudzu and Japanese honeysuckle, I simply can't believe that this lovely vine will ever pose a threat to the world as we know it." (Hipps 1989)

These words from a horticulturist in north Alabama may have an unfortunately prophetic significance as Japanese climbing fern continues to spread with time. As with so many invasive plants, kudzu and Japanese honeysuckle have gone from being widely promoted and intentionally spread by humans to being recognized as problematic invasive plants. As the inadvertent spread of Japanese climbing fern through human activity continues, concurrent with natural spore dispersal, a similar widespread effect may result. Even if climate, biology, education, and management combine to restrict the range of Japanese climbing fern, experiences in Florida indicate that this plant is likely to continue to spread in the southeastern United States, impacting understory plant communities and their associated inhabitants.

References available from the author at vanloaa@doacs.state.fl.us