NEW COUNTY RECORDS IN TEXAS (U.S.A.) FOR THE INVASIVE AQUATIC PLANT *HYGROPHILA POLYSPERMA* (ACANTHACEAE)

Casey R. Williams

BIO-WEST, Inc.
1405 United Drive Suite 111
San Marcos, Texas 78666, U.S.A.
cwilliams@bio-west.com

ABSTRACT

This report documents three new county records for the non-native aquatic plant *Hygrophila polysperma* in Texas. A brief background history of the species occurrence in Texas is also provided.

RESUMEN

Se documentan tres nuevos registros de la planta acuática no nativa *Hygrophila polysperma* para condados en Texas. Así mismo, se proporciona un breve antecedente histórico sobre la presencia de esta especie en Texas.

Key Words: *Hygrophila polysperma*, aquatic plants, San Marcos River, Comal River, San Felipe Creek, Cibolo Creek, Lady Bird Lake, San Antonio River

INTRODUCTION

Hygrophila polysperma (Roxb.) T. Anderson Acanthaceae is an old world species historically ranging through India (Rataj & Horeman 1977), Malaysia (Angerstein & Lemke 1994), and Sri Lanka (Senaratna 1945). Originally introduced into Ohio through the aquarium trade around 1942 as a species of *Ludwigia* (Innes 1947), the first naturalized population was observed in 1965 in Florida (Schmitz et al. 1988). However, that population was thought to be a species of *Dyschoriste* until 1977 when it was properly identified by D.C. Wasshausen of the Smithsonian Institute (Les & Wunderlin 1981).

Currently, *H. polysperma* is located in multiple counties within the states of Florida and Texas. Single verified county records also exist for South Carolina (Flora Caroliniana, Francis Marion University Herbarium, Catalog Number: FMUH0006299), Alabama (Alabama Plant Atlas, Accession Number UNA00057159), and Mississippi (Mississippi Museum of Natural Science Herbarium, Catalog Number MMNS032674). One online report from Warren County, Kentucky (EDDS Map Record Number 616231), appears to be *Ludwigia repens* based on photographs provided on the record page. Multiple Virginia locations have been observed but have been reportedly extirpated due to freezes (Sutton 1995). Moro-Olivo et al. (2008) also reported *H. polysperma* in the state of Tamaulipas, Mexico.

The current distribution within the state of Texas is recognized as Hays County, along the San Marcos River; Comal County, along the Comal River; and Val Verde County, along San Felipe Creek (Bowles & Bowles 2001). Unverified accounts are reported from Caddo Lake (Wright & Bister 2013). Currently recognized localities are all major spring systems harboring rare and imperiled aquatic organisms (Bowles & Arsuffi 2006). *H. polysperma* is a dominant aquatic plant species in all three (Bowles & Bowles 2017).

In several accounts, *H. polysperma* has been falsely identified in the San Marcos River as the native species *H. lacustris* (Lemke 1989) or *Ludwigia repens* (Staton 1992). While some authors attribute the presence of the plant there to aquarium releases (Angerstein & Lemke 1994; Bowles & Bowles 2001), historical articles from the *San Marcos Daily Record* newspaper confirm *H. polysperma* was intentionally introduced between 1950 and 1980 by aquatic plant nurseries operating in the San Marcos River for propagation and collection for the aquarium trade (San Marcos Daily Record 1962; Boxall 1976). While *H. polysperma* is not currently on the list of prohibited aquatic species for the State of Texas, it is prohibited or regulated in eight states and listed on the federal noxious weed list (Schmitz et al. 1988; USDA APHIS 2006).

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In Texas, *H. polysperma* has been recognized as a threat to Texas wild-rice (*Zizania texana*), a federally listed rare aquatic plant species found only in the San Marcos River (USFWS 2011; Poole et al. 2007). In the Comal and San Marcos rivers, *H. polysperma* has displaced native aquatic plant species (Angerstein & Lemke 1994; Doyle et al. 2003), contributing to declining suitable habitat for the fountain darter (*Etheostoma fonticola*), a federally listed endangered fish (BIO-WEST 2013). Efforts are currently underway to remove *H. polysperma* in order to improve or reestablish these native habitats (Edwards Aquifer Authority 2017).

While the actual date of introduction is unknown, Angerstein and Lemke (1994) indicate *H. polysperma* was probably present at least 25 years before its identification. Bowles and Bowles (2001) label the introduction around 1940. Articles from the *San Marcos Daily Record* (1962) and Boxall (1976) suggest introduction around 1955.

Hygrophila polysperma is an amphibious aquatic plant exhibiting terrestrial, submerged, and emergent growth depending on site conditions. In the terrestrial form, *H. polysperma* is inconspicuous and spreads prostrate, forming a mat-like growth. When floral parts are absent, it exhibits similar characteristics to several other terrestrial or semi-aquatic plant species including *Calyptocarpus vialis*, *Eclipta* sp., and *Dyschriste* sp. In the submersed form, *H. polysperma* looks similar to *Ludwigia repens* or submersed forms of *Polygonum* sp., further complicating identification in aquatic habitats.

I have observed and collected *H. polysperma* in flower on multiple occasions in the Comal and Hays county locations, showing that identification by floral characteristics is possible. Small and short lived flowers occur occasionally on terrestrial or emergent growth forms in the winter. I have observed seed production as well, but viability is unknown. In current locations, *H. polysperma* is more commonly found as a submersed aquatic macrophyte. Vegetative propagation is most likely the means of colonization for the species, increasing the likelihood of spread via fishing or boating gear.

METHODS

Between 2013 and 2015, I observed *H. polysperma* while botanizing at locations in Bexar, Travis, and Kendall counties (Fig. 1). The first observation in Kendall County indicated to me that *H. polysperma* could be found in other locations outside of its limited known range in Texas. Upon recognizing the species, I collected material for verification and vouchers. Locations were recorded on my smart phone for future reference and pictures were taken of the sites. Specimens were identified based on vegetative characteristics noted by Angerstein and Lemke (1994). Since *H. polysperma* can look very different between growth forms, I used two reliable field characteristics for identification: visual location of a pale band at the node and silver color on the abaxial surface of mature leaves.

RESULTS AND DISCUSSION

The three new locations are quite different compared to those previously known. The Hays, Comal, and Val Verde county locations are all situated along spring-fed streams associated with the Edwards Aquifer where water temperatures are thermally constant (~22°C) and of exceptional quality (Fahlquist & Slattery 1997; Groeger et al. 1997; Slade et al. 1986). The new locations are not associated directly with springs, and water quality is typical to that of surface-fed rivers and streams in Texas. All new locations are situated on a source of continuous flowing water albeit with different hydrological regimes (pers. obs.). *Hygrophila polysperma* is recognized as requiring some degree of flowing water to support biomass expansion (Van Dijk et al. 1986).

In Bexar County, *H. polysperma* was initially observed in 2016, but vouchers were not collected until 2018. *Hygrophila polysperma* was observed at multiple sites along the San Antonio River in Brackenridge Park within the city limits of San Antonio, Texas. Typically, plants were growing in gravel at shallow riffles. Both submersed and emergent growth forms were observed.

In Kendall County, *H. polysperma* was found in multiple sites along Cibolo Creek at the Cibolo Nature Center and Preserve near Boerne, Texas. Plants were growing in gravel along the edges of fast flowing riffles or

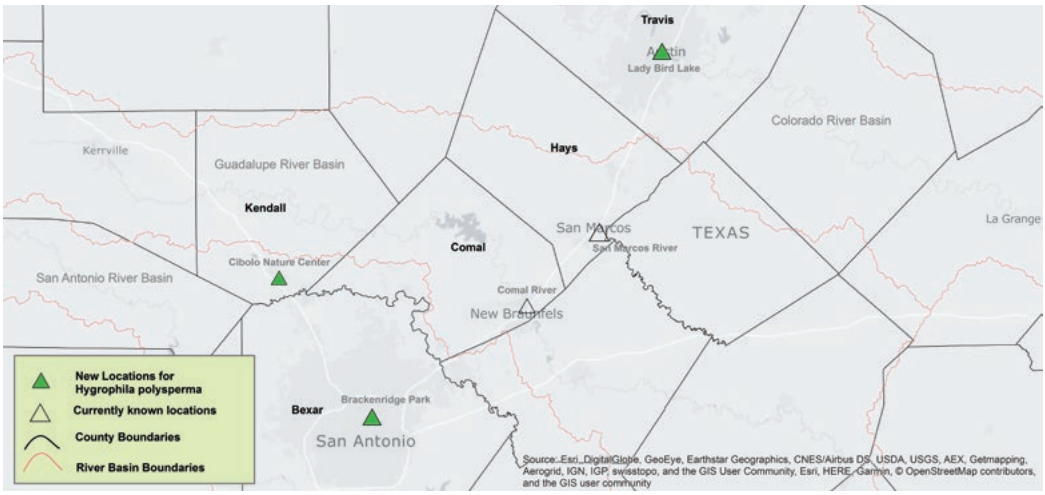

Fig. 1. New locations for *Hygrophila polysperma*.

in slower backwater habitats under shaded riparian cover. Growth was both submersed and emergent. The Bexar and Kendall county locations are the first record of *H. polysperma* in the San Antonio River basin.

In Travis County, *H. polysperma* was observed at four sites within Lady Bird Lake in Austin, Texas. These sites include: (1) the confluence of Waller Creek; (2) the confluence of Barton Creek; (3) the upper areas of Lady Bird Lake upstream of Red Bud Trail Drive; (4) a large gravel island at the confluence of West Bouldin Creek. Vouchers thus far have only been collected at two sites. *Hygrophila polysperma* in each of these locations was observed growing in various forms from fully submersed to terrestrial. The Travis County location is the first record of *H. polysperma* in the Colorado River basin.

Since the first observations, I revisited each of the three locations occasionally to determine if *H. polysperma* was persistent or if each occurrence was a temporary one. As of 2018, *H. polysperma* has been observed at each new county location indicating it is likely an established member of the aquatic habitat. While *H. polysperma* has been noted growing well downstream of thermally stable headwaters at currently recognized locations, I considered it an ephemeral occurrence wholly supported by perennial upstream colonies. The three new locations, as well as habitat descriptions from other U.S. locales, confirm that the species is tolerant of fluctuating water temperatures and can establish in a wide variety of aquatic habitats as alluded to by Bowles and Bowles (2001).

The new occurrences reported here double the county distribution of *H. polysperma* in Texas and extend occurrence into two new river basins (Fig. 2). It is likely that *H. polysperma* exists in other locations within the state of Texas. Small streams, spring runs, sloughs, and irrigation canals all offer seemingly suitable habitat to *H. polysperma*. Indications are that *H. polysperma* should be thought of as yet another naturalized aquatic invader to these waterways of Texas.

Voucher specimens: **TEXAS. Bexar Co.:** San Antonio River at Brackenridge Park at Red Oak Road, growing in gravel along shallow riffles associated with *Justicia americana* and *Nuphar lutea,* rooted in gravel, flowing water (emergent and submersed growth), 29°27'29.72"N, 97°28'27.38"W, 18 Jul 2018, *Williams 272* (BRIT, TEX). **Kendall Co.:** along Cibolo Creek in the Cibolo Nature Preserve, growing emergent and submersed in flowing water, gravel substrate and shade, various locations downstream of the USGS stream gauge, 29°46'53.53"N, 98°42'48.21"W, 3 Nov 2013, *Williams 265* (BRIT, TEX); along Cibolo Creek in the Cibolo Nature Preserve, submersed along waterway edges in gravel substrate, 29°46'53.53"N, 98°42'48.21"W, 18 Nov 2018, *Williams 274* (BRIT, TEX). **Travis Co.:** confluence of Barton Creek and Lady Bird Lake, submersed, 30°16'00.65"N, 97°45'40.17"W, 16 May 2014, *Williams 266* (BRIT-552821, TEX); confluence of Waller Creek and Lady Bird Lake, growing emergent on gravel bar with *Hydrocotyle verticillata.* 30°15'35.80"N, 97°44'27.56"W, 16 May 2014, *Williams 266* (SWT);

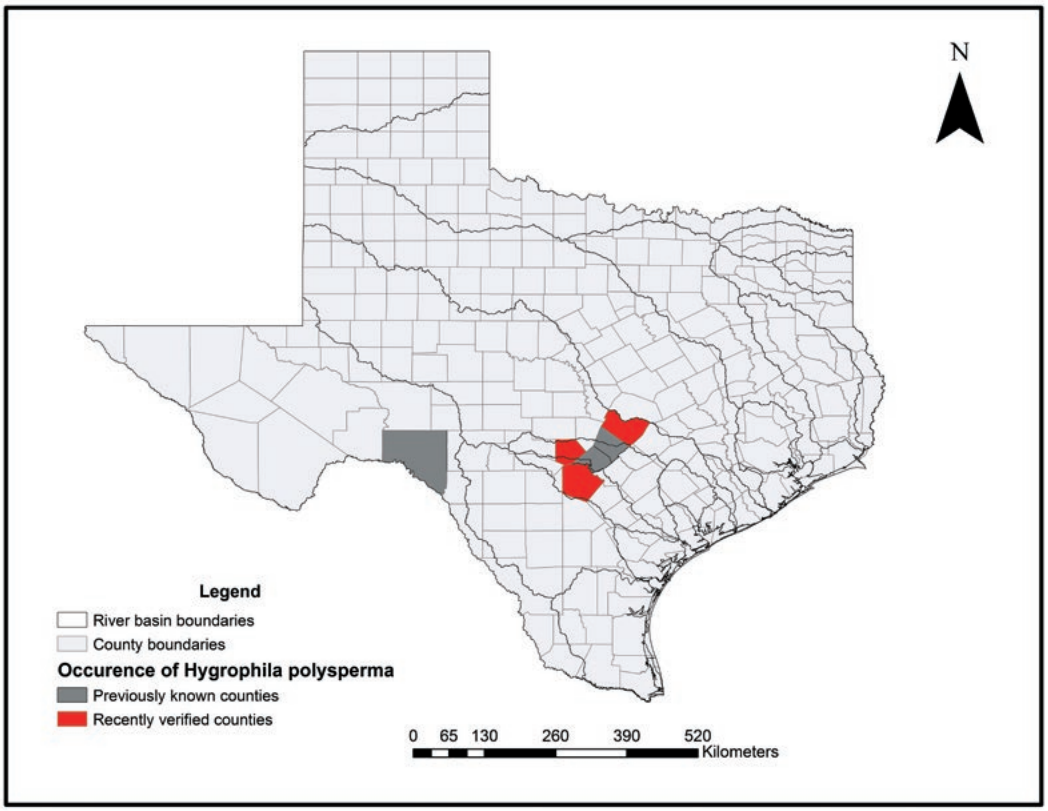

Fig. 2. Previously known county locations (Gray) and new county locations (Red) for *Hygrophila polysperma* in Texas.

29°46'53.53"N, 98°42'48.21"W, 3 Nov 2013, *Williams 265* (BRIT-552827, TEX); along Cibolo Creek in the Cibolo Nature Preserve, 3 Nov 2013, *Williams 265* (BRIT-552822, BRIT-522820).

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