FIRST RECORDS OF THE AQUATIC WEED *HYGROPHILA POLYSPERMA* (ACANTHACEAE) FROM TEXAS

MICHELLE B. ANGERSTEIN

Bee County College
3800 Charco Road
Beeville, TX 78102, U.S.A.

DAVID E. LEMKE

Department of Biology
Southwest Texas State University
San Marcos, TX 78666, U.S.A.

ABSTRACT

The first collections of *Hygrophila polysperma*, a species with the potential to become a noxious aquatic weed, are reported from the Comal and San Marcos rivers of central Texas, and a description and illustrations of the species are provided.

RESUMEN

Se citan las primeras recolecciones de *Hygrophila polysperma*, una especie que tiene el potencial de convertirse en una mala hierba acuática, de los ríos Comal y San Marcos de Tejas central, y se ofrecen una descripción e ilustraciones de la especie.

Key words: *Hygrophila*, Acanthaceae, aquatic weeds, Texas.

In the spring of 1994 we began to question the identification of several aquatic macrophyte collections from the upper San Marcos River in Hays County, Texas, on deposit at SWT. The specimens in question had been variously identified as either *Hygrophila lacustris* (Schlecht. & Cham.) Nees (Acanthaceae) or *Ludwigia repens* Forst. (Onagraceae) and represented vouchers from two separate studies of the river's macrophyte flora (Lemke 1989, Staton 1992). Contributing to the difficulty of making an accurate determination was the fact that most of the specimens comprised only sterile material, a common deficiency of aquatic plant collections. Ultimately, however, we were able to secure both flowering and fruiting material of these plants and to identify them as *Hygrophila polysperma* (Roxb.) T. Anderson, a previously unreported vascular hydrophyte from Texas that has the potential to become a troublesome aquatic weed.

Hygrophila R. Br. comprises approximately 80 species distributed primarily in the Old World tropics, particularly Indochina and Malaysia, with only a few African and American species (Long 1970). The only representative of the genus native to the U.S. is *H. lacustris*, which is distributed from Florida to eastern

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Texas (Correll & Correll 1975, Godfrey & Wooten 1981). *Hygrophila polysperma* is a native of India and Malaysia that was introduced into the United States in the 1940s and quickly became a popular aquarium plant (Innes 1947). In the U.S., the species has been reported as naturalized in lakes and drainage canals in south Florida (Les & Wunderlin 1981). Our recent field observations and collections indicate that the species is also naturalized in and along the San Marcos and Comal rivers in, respectively, Hays and Comal counties, Texas. Furthermore, herbarium records indicate that *H. polysperma* has been well-established in the San Marcos River for at least 25 years (see specimen citations below).

We surmise that *H. polysperma* was introduced into Texas river systems either directly through cultivation by local aquatic plant nurseries, as documented by Hannan (1969) for the hydrophytic pteridophyte *Ceratopteris thalictroides* (L.) Brongn., or indirectly through careless dumping by aquarists. Profuse vegetative reproduction is well developed in *H. polysperma* (Spencer & Bowes 1985, Van Dijk et al. 1986) and even small fragments will produce roots and grow into new individuals. We therefore feel it is likely that isolated introductions of plants cultivated for sale may have resulted in the establishment of the species in both the Comal and San Marcos river systems.

The high growth potential of *H. polysperma* may pose a serious threat to the native flora and biotic integrity of the Comal and San Marcos river ecosystems. Several studies (Lemke 1989, Staton 1992, U.S. Fish and Wildlife Service 1994) have suggested that elements of the native biota of these two river systems are being displaced or otherwise adversely affected by exotic plant species. High growth potential, profuse vegetative reproduction, lack of seasonal variation in biomass, low light compensation and saturation points, a low CO_2 compensation point, and the capacity to rapidly change resource acquisition ability in response to environmental change are characteristics that make *H. polysperma* a competitive plant and potentially serious weed (Spencer & Bowes 1985, Botts et al. 1990, Kovach et al. 1992). The species is included on the federal list of noxious aquatic weeds (U.S. Department of Agriculture 1983) and is listed as a category II species by the Exotic Pest Plant Council of the State of Florida, indicating that its population is rapidly expanding and has the potential to invade and disrupt native vegetation in that state (Lantz 1993); however, the species is not currently recognized as a potentially harmful aquatic weed in Texas.

To facilitate the identification of future collections of this species, we provide the following key, description and illustration (Fig. 1):

KEY TO TEXAS SPECIES OF *HYGROPHILA*

Plants terrestrial or emergent; aerial leaves 5–12 cm long; flowers in axillary clusters along length of stem; capsule 8–12 mm long, glabrous ..... *H. lacustris*

Plants submersed, emergent, or only rarely terrestrial; aerial leaves 0.7–2.5 cm long; flowers solitary in the axils of distal leaves; capsule 6–7 mm long, distally pilose ..... *H. polysperma*

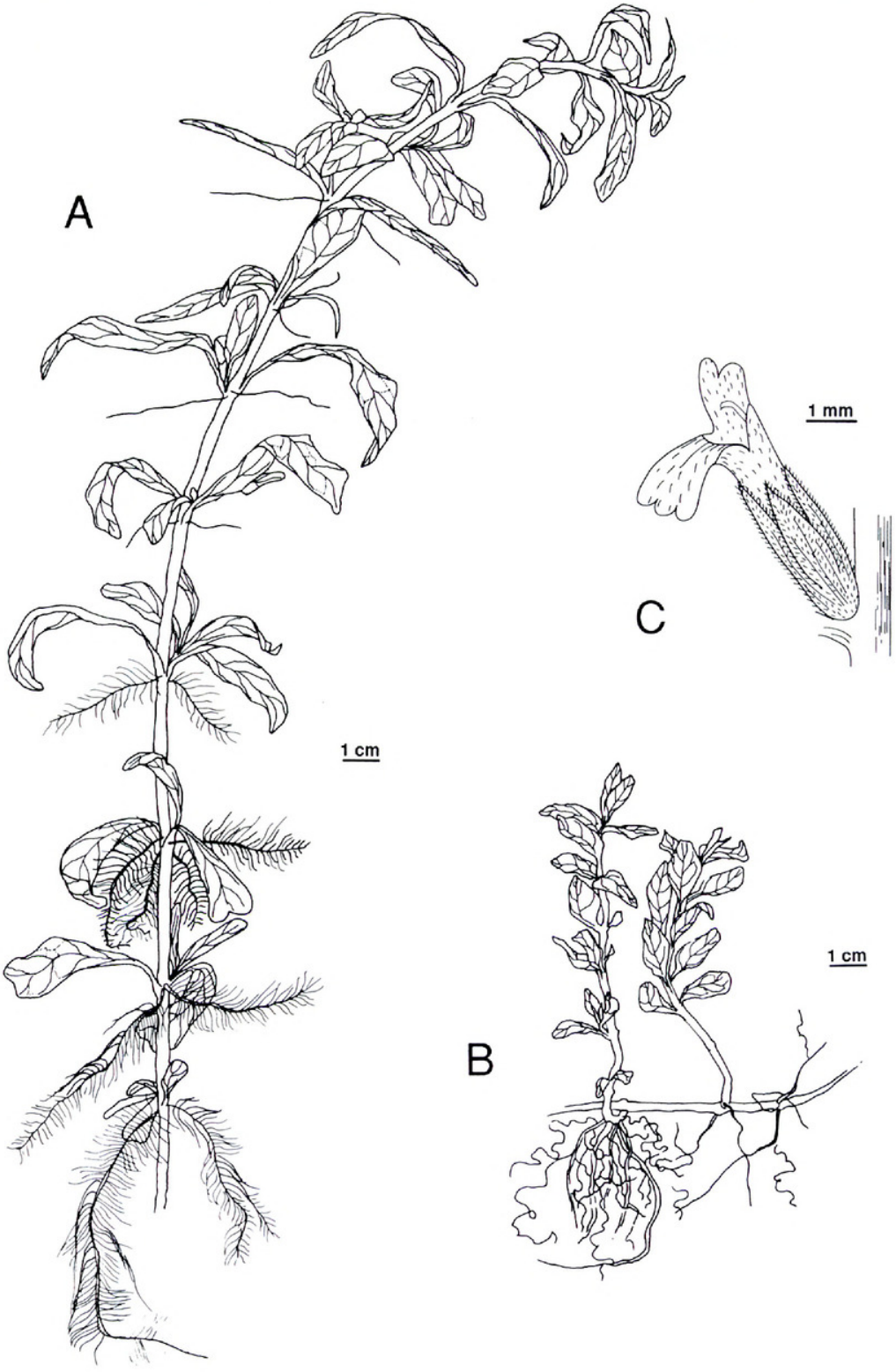

FIG. 1. *Hygrophila polysperma*, A. Distal portion of submersed shoot with abundant adventitious roots. B. Terrestrial form, drawn to same scale. C. Flower. A and B drawn by Amy L. Mahloch from live material; C redrawn after an illustration provided by the Center for Aquatic Plants, University of Florida, Gainesville.

Hygrophila polysperma (Roxb.) T. Anderson, J. Linn. Soc., Bot. 9:426. 1876.

Justicia polysperma Roxb., Fl. Ind. 1:120. 1820.
Hemidelphis polysperma (Roxb.) Nees in Wall., Pl. Asiat. Rar. 3:30. 1832.

Perennial rhizomatous terrestrial or aquatic herbs to 1.5 m tall. Stems ascendant or rarely erect, more or less 4-angled, puberulent to glabrate, with abundant elongate or rarely rounded cystoliths in the epidermis. Leaves opposite, broadly elliptic to oblanceolate, acute at apex, attenuate to a subpetiolar base, minutely denticulate to entire, 7–65 mm long, 2–10 mm wide, mostly glabrous but those subtending the flowers hispid, especially on the margins, the abaxial and adaxial surfaces with abundant elongate cystoliths. Flowers solitary in the axils of uppermost leaves, sessile. Bracts narrowly lanceolate, 4–5 mm long, herbaceous. Calyx equally 5-lobed, the lobes scarious-margined, 4–5 mm long, united basally, hispid. Corolla bluish-white (yellowish in dried specimens), 5–6 mm long, the upper lip 2-lobed, the lower lip 3-lobed, puberulent. Fertile stamens 2, included, filaments glabrous, anthers 2-celled, ca. 1 mm long. Ovary hispid distally, the style ca. 3 mm long, sparingly hispid, the stigma flattened, ca. 0.3 mm long. Capsule 6–7 mm long, mostly glabrous but with a few distal hairs. Seeds flattened, round, ca. 0.8 mm diameter. Blooming mostly Sep–Oct.

In the San Marcos and Comal rivers, *H. polysperma* is most often found growing completely submersed, although we have frequently encountered both emergent and terrestrial individuals along the upper San Marcos River. Submersed individuals have longer stems (0.3–1.5 m tall) with elongate internodes (20–54 mm long), relatively large oblanceolate leaf blades (17–65 mm long), and produce abundant adventitious roots at the upper nodes. Terrestrial individuals are of shorter stature (10–20 cm tall) with shorter internodes (2–16 mm long), smaller elliptic leaves (7–25 mm long), and bear roots almost exclusively on the rhizome. We have observed flowers and fruits primarily on terrestrial individuals and, occasionally, on emergent shoots of partially submersed plants; in both cases the distal leaves subtending the flowers are marginally hispid. These observations accord well with those of Sculthorpe (1967) who cited numerous examples of normally terrestrial plants (e.g., species of *Alisma* L., *Bacopa* Aublet, *Campanula* L., *Gratiola* L., *Nomaphila* Bl., *Ranunculus* L., and *Rotala* L.) that can grow entirely submerged even in deep water, leading to their common use as ornamental plants in aquaria; submersed individuals of such species were usually found to be characterized by elongation of the leaf blade, loss of pubescence, and sterility.

Two previous studies of the aquatic macrophytes of the San Marcos River failed to document the occurrence there of *H. polysperma*. Lemke (1989) incorrectly identified collections of this species as *H. lacustris*, while Staton (1992) misidentified her collections as *Ludwigia repens*. *Hygrophila lacustris*, a native of the southeastern U.S., occurs in only a few counties in southeast Texas (Brazoria,

Chambers, Fort Bend, Hardin, Harris, Jackson, Montgomery, Orange, and Walker counties), where it grows as a terrestrial or emergent plant along muddy stream and pond margins (Wasshausen 1966, Correll & Correll 1975). The plants are typically erect herbs to 80 cm tall with leaves mostly 5–12 cm long and flowers borne in distinct axillary clusters along the length of the stem. *Hygrophila polysperma,* in contrast, is usually found submersed, the leaves of the aerial shoots are typically 7–25 mm long, and the flowers are solitary in the axils of the uppermost leaves.

When first introduced to the aquarium plant market, *H. polysperma* was though to be a species of *Ludwigia* L. and was given the common name "oriental ludwigia" (Innes 1947). Vegetatively, the terrestrial shoots of *H. polysperma* are very similar to those of *L. repens*, a native species also known from the San Marcos and Comal rivers; both species have small, opposite, elliptic leaves and short internodes. Even in the absence of reproductive structures, however, the two species are readily separable by nodal morphology. The petioles of *L. repens* are subtended by a pair of minute, glandular stipules less than 1 mm long, while the connate leaf bases of *H. polysperma* are exstipulate but bear a number of setiform hairs to 1.5 mm long (Fig. 2).

Hygrophila polysperma is the second adventive aquatic member of the Acanthaceae to be reported from Texas in recent years. Ramamoorthy and Turner (1992) documented the occurrence of *Nomaphila stricta* (Vahl) Nees, another Malaysian species, from San Felipe Springs in Val Verde County and surmised that this species was also introduced by aquarists.

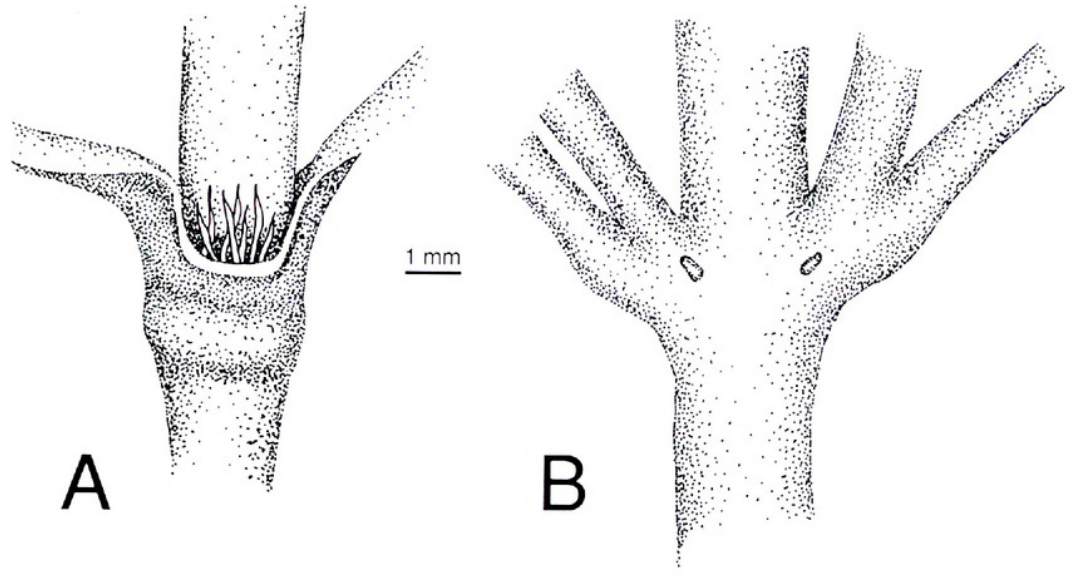

FIG. 2. Comparison of nodal morphology in *Hygrophila* and *Ludwigia*. A. *Hygrophila polysperma*. B. *Ludwigia repens*. Drawn by Amy L. Mahloch from live material.

Specimens examined. TEXAS. **Comal Co.**: Comal River, Landa Park, City of New Braunfels, ca. 100 m upstream of Pecan Island, mid-channel, in 1–2 ft of water, 21 Feb 1994, *Angerstein 94-1* (BRIT, SWT, TEX); Comal River, Landa Park, City of New Braunfels, in spring run underneath Landa Dr., 23 Feb 1994, *Angerstein 94-2* (SWT). **Hays Co.**: San Marcos River below Southwest Texas State University campus, 30 Nov 1969, *Tabler s.n.* (SWT); shoreline sandbar formed at mouth of Sessoms Creek, 22 Nov 1975, *Litchfield s.n.* (SWT); San Marcos River downstream from Clear Springs Apts. spillway, 5 Jul 1976, *Litchfield s.n.* (SWT); Southwest Texas State University raceway in gravel substrate, 28 Aug 1976, *Litchfield s.n.* (SWT); San Marcos River at Thompson's Island below county road bridge, 6 Mar 1991, *Staton s.n.* (SWT); San Marcos River upstream from Purgatory Island, 26 Apr 1991, *Staton s.n.* (SWT); San Marcos River at University Blvd., 26 Jun 1991, *Bierner 91-71* (TEX); Rio Vista Park, Purgatory Island, City of San Marcos, 30 Mar 1994, *Angerstein 94-5* (SWT, TAES); San Marcos River, Lions' Park area, San Marcos, 30 Mar 1994, *Angerstein 94-6* (SWT); San Marcos River, Sewall Park, San Marcos, along edge of concrete channel, 30 Mar 1994, *Angerstein 94-7* (SWT, TEX); Southwest Texas State University campus pond beside Freeman Bldg., 30 Mar 1994, *Angerstein 94-8* (SWT, TAES); Southwest Texas State University campus pond directly in front of J.C. Kellam Bldg., 30 Mar 1994, *Angerstein 94-9* (BRIT, SWT).

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