California Pest Rating Proposal for

***Hygrophila polysperma* (Roxb.) T. Anderson: Indian swampweed**

Lamiales- Acanthaceae

Current Pest Rating: A | Current Seed Rating: R

Proposed Pest Rating: A | Proposed Seed Rating: P

Comment Period: 4/10/2019 through 5/25/2019

Initiating Event:

Hygrophila polysperma is listed as a noxious weed in the United States (7CFR 360, 7CFR 361 (USDA NRCS 2019). *Hygrophila polysperma* (Roxb.) T. Anderson is currently listed as an A-rated Noxious Weed (3CCR Section 3855) and Restricted Noxious Weed Seed (3CCR Section 3855) in California. It is an invasive aquatic plant that grows under both submersed and emergent conditions. A pest rating proposal is needed to reevaluate the rating, especially as the pink-leaved cultivar "Rosanervig" is still widely sold in the aquarium trade.

Common Names:

Miramar weed, East Indian swampweed, hygrophila.

Commercial Trade Names and Descriptors (list not definitive): hygro, dwarf hygro, green hygro, sunset hygro, tropic sunset, tropic sun, siamensis, Ceylon, temple plant, rosanervig, oriental ludwigia.

History & Status:

Background:

Hygrophila polysperma was first introduced to the United States as an aquarium plant in 1945. It was first collected in the wild 1965 in the U.S. near Tampa, Florida, but was misidentified until 1977. It was recognized as weed in Florida by 1980 and spread to 18 public bodies of water by 1994 (Gettys and Enloe, 2018).

Hygrophila polysperma is a submerged plant that can grow and form dense stands and floating mats. Its stems are four angled, 4-8 inches tall and are prostrate when emersed. The petiolate leaves are opposite, ovate to lanceolate, with entire margins. Flowers appear on emerged branches; they are white or bluish and bloom from September to November. Fruits are oblong capsules, with each capsule producing 20-30 seeds.

Hygrophila polysperma prefers flowing waters, but it can also be found in slow moving lakes, marshes, canals, rivers, swamps, wetlands, and irrigation ditches (FNW Disseminules, 2007). It is difficult to control because it forms new plants easily from fragments, thereby spreading to new locations.

Worldwide Distribution:

Hygrophila polysperma is native to India, Bangladesh, Bhutan, Nepal, Pakistan, Myanmar, Vietnam and China. It is naturalized in Australia, Hungary (Saba 1968; Lukacs et al. 20416), Mexico (Mora-Olivo et. al 2008), Germany (NGRP, 2014) and Poland (Gabka and Owsianny 2009).

In the Unites States, *Hygrophila polysperma* has been reported as naturalized in Alabama, Florida (Les and Wunderlin 1981), Kentucky, Mississippi South Carolina (Hook and Nelson 2011), Texas (Angerstein and Lemke 1994) and Virginia (Swearingen and Bargeron, 2016).

Official Control:

Hygrophila polysperma has been reported as a harmful organism in Chile (USDA- APHIS- PCIT) and is an aquatic weed and Plant not to be sold in all or parts of NSW (New South Wales and Special Investigation List (Queensland), Australia.

In the United States, *Hygrophila polysperma* is a listed as federal noxious weed.

Hygrophila polysperma is a state listed noxious weed in Alabama, California, North Carolina, Vermont, Oregon, Florida, Massachusetts, and South Carolina (USDA NRCS, 2019).

California Distribution:

Hygrophila polysperma has not been observed occurring naturally in California. (Consortium of CA Herbaria, 2019). However, it is sometimes sold in aquarium stores despite its listing as a noxious weed.

California Interceptions:

Hygrophila polysperma has been intercepted once by CDFA through the nursery trade (Sacramento County, April 2005) and through interstate shipments (San Mateo County: June 1999; Alameda County: July 1999; Eldorado County: December 2009) (Pest and Damage Report Database, 2018). However, visits to aquarium stores show that it is imported especially the cultivar "Rosanervig" (D.G. Kelch, Personal Communication)

The risk *Hygrophila polysperma* (Indian swampweed) would pose to California is evaluated below.

Consequences of Introduction:

Climate/Host Interaction:

Hygrophila polysperma occurs in areas corresponding to USDA plant hardiness zones of 7-13 and with annual precipitation of 0-100+ inches of rain fall. Optimum temperature for its growth is 71-82°F. It favors warmer waters of 18-30°C; however, it can tolerate water as cold as 4°C for short periods (Ramey, 2001). It can tolerate colder water temperatures and may adapt and persist in cold winter areas. It is widely distributed outside of its habitat. Most of California's waterways, wetlands, irrigation systems, and inland water bodies are potentially suitable for its establishment. It receives a **High (3)** in this category

Evaluate if the pest would have suitable hosts and climate to establish in California. Score:

- Low (1) Not likely to establish in California; or likely to establish in very limited areas.
- Medium (2) may be able to establish in a larger but limited part of California.
- **High (3) likely to establish a widespread distribution in California.**

2) Known Pest Host Range:

Hygrophila polysperma does not require one host but can occur wherever environmental conditions are favorable for its growth and establishment. It is an aquatic plant and grows as emerged or fully submerged in water. It occurs in lakes, ponds and in riparian habitats (Weber, 2003). It is likely to establish in these areas of California. It receives a **High (3)** in this category.

Evaluate the host range of the pest.

- Low (1) has a very limited host range.
- Medium (2) has a moderate host range.
- **High (3) has a wide host range.**

3) Pest Dispersal Potential:

Hygrophila polysperma has been made popular through the aquarium and nursery trade, and is available worldwide through online sales despite prohibitory federal and state regulations.(Ramey, 2001; Kay and Hoyle 2001). Flowering plants can produce large amounts of tiny seeds. However, the importance of seed production for its spread and establishment is unknown (Sutton 1995). Its stems are brittle, easily fragment, and develop new stands from rooted nodes. This species tends to grow vigorously in flowing waters. Its spread and colonization to new areas occur mostly through vegetative means (Gettys and Enloe, 2016). It has been intentionally and accidentally introduced outside of its native range. *Hygrophila polysperma* can be transported with wildlife and carried to new locations. It can spread accidentally to new locations by the movement of boats, trailers, nets, sea planes, and other recreational equipment between water bodies (DCR, 2003). It can be a 'hitchhiker' plant with other species ordered through water garden catalogues. It could easily spread from discarded aquarium contents. It receives **High (3)** in this category.

Evaluate the natural and artificial dispersal potential of the pest.

- Low (1) does not have high reproductive or dispersal potential.
- Medium (2) has either high reproductive or dispersal potential.
- **High (3) has both high reproduction and dispersal potential.**

4) Economic Impact:

Hygrophila polysperma can clog irrigation and flood control canals. Its mats of fragments are collected at culverts and interfere with water control pumping stations. This species can limit the recreational use of infested waters by clogging boat motors with weeds and can also snag fishing lines (Ramey 2001). It is considered a potential weed threat to rice fields (Spencer and Bowes 1985), a major agricultural commodity in California. Infestation by *H. polysperma* could increases production costs due to increased cost of herbicides, equipment and labor (Cuda and Sutton, 2000). *Hygrophila polysperma* is an alternate host for phytoparasitic nematode genera in both its native and introduced ranges, especially for rice (Mukherjee et al. 2012) It receives a **High (3)** in this category.

Evaluate the economic impact of the pest to California using the criteria below.

a. **The pest could lower crop yield.**
b. **The pest could lower crop value (includes increasing crop production costs).**
c. The pest could trigger the loss of markets (includes quarantines).
d. The pest could negatively change normal cultural practices.
e. The pest can vector, or is vectored, by another pestiferous organism.
f. The organism is injurious or poisonous to agriculturally important animals.
g. **The organism can interfere with the delivery or supply of water for agricultural uses**.

- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- High (3) causes 3 or more of these impacts.

5) Environmental Impact:

Hygrophila polysperma reduces biodiversity by out-competing and displacing organisms within an ecosystem and landscape (Doyle et. al 2003). It does not provide habitat, cover, forage or food for wildlife. *Hygrophila polysperma* forms dense stands and mats, which can decrease oxygen levels by limiting water flow and by decomposition of plants. These affects can contribute to toxic cyanobacteria blooms and fish die offs. Increased sediment levels are

observed with increasing *H. polysperma* abundance (DCR, 2003). Dense mats can also change water hydrology and quality and negatively affect ecosystem and waterways. All options for management efforts have negative impacts on species and ecosystems. It receives a **High (3)** in this category.

a. **The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes**.
b. **The pest could directly affect threatened or endangered species.**
c. **The pest could impact threatened or endangered species by disrupting critical habitats.**
d. **The pest could trigger additional official or private treatment programs.**
e. **The pest significantly impacts cultural practices, home/urban gardening or ornamental plantings.**

Score the pest for Environmental Impact. Score:

- Low (1) causes none of the above to occur.
- Medium (2) causes one of the above to occur.
- High (3) causes two or more of the above to occur.

Consequences of Introduction to California for *Hygrophila polysperma*

(Indian swampweed*)* High (15)

Add up the total score and include it here.

-Low = 5-8 points

-**Medium** = 9-12 points

-High = 13-15 points

Post Entry Distribution and Survey Information: *Hygrophila polysperma*

has been grown as an aquarium plant throughout California but has not established in the state and receives a **Not Established (0)** in this category.

Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication, or have been delimited with no further detections should not be included.

-Not established (0) Pest never detected in California, or known only from incursions.

-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).

-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.

-**High (-3)** Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

The final score is the consequences of introduction score minus the post entry distribution and survey information score: **High (15)**

Uncertainty:

Hygrophila polysperma is not currently known to occur in California. Possession, sale, and distribution of this taxon is prohibited by state and federal regulations. If plants suspected to be *Hygrophila polysperma* are observed or found, please bring samples immediately to your nearest Agricultural Commissioner office [https://www.cdfa.ca.gov/exec/county/countymap/] to be submitted to the CDFA Botany Lab. For determination and voucher. There is concern that *Hygrophila polysperma* may be present in parts of the state and may not have been documented. For example, in Texas, *Hygrophila polysperma* was misidentified as *Ludwigia repens* and *Hygrophila lacustris* (Lemke 1989; Angerstein and Lemke 1994; Poole and Bowles 1999; Doyle et al. 2003). It is very similar to *Alternanthera philoxeroides, Limnophila,* and other aquatic weeds.

Conclusion and Rating Justification:

Hygrophila polysperma is not currently known to occur in California. It is a Federal and State listed Noxious Weed. If this species were to occur and become established in California, it will have

significant economic and environmental impacts. An “A” Noxious Weed rating and "Prohibited" Noxious Seed rating is justified.

References:

Angerstein, M. B., and D. E. Lemke. 1994. First records of the aquatic weed *Hygrophila polysperma* (Acanthaceae) from Texas. SIDA, Contributions to Botany 16(2):365–371.

Consortium of CA Herbaria (CCH). 2018. Data provided by the participants of the CCH. Regents of the University of California, 2018. Accessed 01/24/2019 http://ucjeps.berkeley.edu/consortium/

Cuda, J.P., Sutton, D.L., 2000. Is the aquatic weed hygrophila, *Hygrophila polysperma* (Polemoniales: Acanthaceae), a suitable target for classical biological control? Proceedings of the X International Symposium on Biological Control of Weeds, Bozeman, Montana, USA, July 4-14, 1999. Bozeman, USA: Montana State University, 337-348. Accessed 12/13/2018.

Department of Conservation and Recreation (DCR). 2003. Eastern Indian *Hygrophila*: an exotic aquatic plant. DCR, Massachusetts. Accessed 12/14/2018.

Doyle, R. D., M. D. Francis, and R. M. Smart. 2003. Interference competition between *Ludwigia repens* and *Hygrophila polysperma*: two morphologically similar aquatic plant species. Aquatic Botany 77(3):223-234.

FNW Disseminules, 2007. Federal Noxious Weed Disseminules of the U. S. Accessed 12/11/2018.http://www.lucidcentral.org/keys/FNW/FNW%20Disseminules%20Key/html/index.htm

Gąbka, M., and P. M. Owsianny. 2009. First records of the *Hygrophila polysperma* (Roxb.) T. Anderson (Acanthaceae) in Poland. Roczniki Akademii Rolniczej w Poznaniu 388. Botanika-Steciana 13:9–14.

Gettys, L. A., and Enloe, S.F. 2018. East Indian Hygrophilla: *Hygrophila polysperma* (Roxb.) T. Anderson. Publication# SS-AGR-411. Center for Aquatic and Invasive Plants. University of Florida/ IFAS Extension, Gainesville, Florida, Accessed 1/24/2019
https://apirs.plants.ifas.ufl.edu/entries/374009/

Hook, M. W., and J. B. Nelson. 2011. Noteworthy Collections: South Carolina. Castanea 76(2):195-196.

Kay, S. H., and S. T. Hoyle. 2001. Mail order, the internet, and invasive aquatic weeds. Journal of Aquatic Plant Management 39(1):88-91.

Lemke, D. E. 1989. Aquatic macrophytes of the upper San Marcos River, Hays Co., Texas. The Southwestern Naturalist 34(2):289-291.

Les, D. H., and R. P. Wunderlin. 1981. *Hygrophila polysperma* (Acanthaceae) in Florida. Florida Scientist 44(3):189–192.
https://www.biodiversitylibrary.org/item/129854#page/203/mode/1up

Lukács, B. A., A. Mesterházy, R. Vidéki, and G. Király. 2016. Alien aquatic vascular plants in Hungary (Pannonian ecoregion): Historical aspects, data set and trends. Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology 150(3):388-395.

Mora-Olivo, A., T. F. Daniel, and M. Martínez. 2008. *Hygrophila polysperma* (Acanthaceae), una maleza acuática registrada por primera vez para la flora mexicana. Revista mexicana de biodiversidad 79(1):265–269.

Mukherjee, A., M. R. Khan, W. T. Crow, and J. P. Cuda. 2012. Phytoparasitic nematodes associated with the rhizosphere of the aquatic weed *Hygrophila polysperma*. Journal of Aquatic Plant Management 50:84-91.

NGRP. 2014. Germplasm Resources Information Network (GRIN). United States Department of Agriculture, Agricultural Research Service. National Genetic Resources Program (NGRP). Accessed 12/14/2018. http://www.arsgrin.gov/cgi-bin/npgs/html/index.pl?language=en

Pest and Damage Report Database. 2018. *Hygrophila polysperma*. Plant Health and Pest Prevention Services. CA Department of Food and Agriculture. Accessed 12/10/2018. http://phpps.cdfa.ca.gov/user/frmLogon2.asp

Poole, J., and D. E. Bowles. 1999. Habitat characterization of Texas wild rice (*Zizania texana* Hitchcock), an endangered aquatic macrophyte from the San Marcos River, TX, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 9(3):291-302.

Ramey, V. 2001. *Hygrophila polysperma*. University of Florida, Center for Aquatic and Invasive Plants. Accessed 12/18/2018. http://plants.ifas.ufl.edu/seagrant/hygpol2.html.

Reams, W. 1953. The occurrence and ontogeny of hydathodes in *Hygrophila polysperma* T. Anderson. New Phytologist 52(1):8-13.

Spencer, W., and G. Bowes. 1985. *Limnophila* and *Hygrophila*: a review and physiological assessment of their weed potential in Florida. Journal of Aquatic Plant Management 23:7-16.

Suba, J. 1968. Az egri melegvizek növényei. Acta Academiae Paedagogicae Agriensis Nova series, Tom. 6. 6:395-415.

Swearingen, J., and Bargeron, C. 2016 Invasive Plant Atlas of the United States. University of Georgia Center for Invasive Species and Ecosystem Health. Accessed 12/18/2018.http://www.invasiveplantatlas.org/

USDA, NRCS. 2019. *Hygrophila polysperma*. The PLANTS database. National Plant Data Team, Greensboro, North Carolina. Available: Accessed 1/24/2019.https://plants.usda.gov/java/citePlants

USDA Phytosanitary Certificate Issuance & Tracking System (PCIT), Phytosanitary Export Database (PExD). Harmful organism report: *Hygrophila polysperma*. Accessed 12/10/2018. https://pcit.aphis.usda.gov/PExD/faces/ViewPExD.jsp

Weber, E. 2003. Invasive Plant Species of the World: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK. 548 pp.

How to report a plant pest

Any suspected plant pest should be reported immediately to the relevant county/state agriculture agency through the Report a Pest Hotline (1-800-491-1899) and to your nearest Agricultural Commissioner office https://www.cdfa.ca.gov/exec/county/countymap/

Author:

Raj Randhawa, 1220 'N' Street, Room 221, Sacramento CA 95814, (916) 654-0317, plant.health@cdfa.ca.gov.

Responsible Party:

Dean G. Kelch, Primary Botanist; California Department of Food and Agriculture; 1220 N Street, Sacramento, CA 95814; Tel. (916) 403-6650; plant.health@cdfa.ca.gov.

***Comment Period: 4/10/19 through 5/25/2019**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at plant.health[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

  Example Comment:
  Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.

- Comments may not be posted if they:

  Contain inappropriate language which is not germane to the pest rating proposal;

  Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

  Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

  Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.

- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Proposed Pest Rating: A | Proposed Seed Rating: P