Aquarius cordifolius (L.) Christenh. & Byng (Alismataceae), an invasive alien species: its introduction, colonization and plausible threats in India

We hereby report this as an invasive alien species in India, which is now naturalized in marshy ponds and forms a large colony in Howrah. Earlier it was spotted as an ornamental in Dayta Village, near Parwana, along Shimla road, Himachal Pradesh. This species is fast invading the aquatic ecosystems and disturbing native vegetation. Species of Aquarius Christenh. & Byng invade easily because of their high plasticity and adaptability (they can grow partially out of the water and with low levels of light, and can reproduce easily). It can be propagated by means of rhizomes, seeds and young adventitious plantlets from the inflorescence.

Description and photographs are provided here for easy recognition in the field.


Rhizomatous perennial herb, up to 1.2 m high. Leaves emerged, erect, submersed leaves mostly absent; petioles triangular, 17.5–45 cm long, 5 or 6ridged, blades with translucent prominent veins, ovate to elliptic, 6.5–32 × 2.5–19 cm, truncate to cordate at base, entire along margins, obtuse with a short mucronate apex (short acuminate in immature), chartaceous; veins 3–9 from base; secondary veins many, horizontally parallel in-between main veins. Racemes 3–9 in whorls, each 3–15-flowered, decumbent to arching, up to 1.5 m long, often proliferating; peduncles terete, 35–56 cm long; pistils 200–250, apocarpus, spirally arranged on receptacle; style short; stigma lateral, indistinct. Fruit an achene, ovoid, 2–3.5 × 0.9–1.5 mm, shortly beaked at apex, longitudinally three- or four-ribbed, with three or four rounded glands.

Distribution: India (West Bengal, Howrah district; grown as ornamental in Himachal Pradesh); North America (Mexico, USA (Florida, Illinois, Kansas, Texas, Virginia)), Europe (Austria and United Kingdom) and South Africa.

Flowering and fruiting: April–September.

Habitat: Grows in marshes, swamps or muddy ponds/ditches.

Specimen examined: India, West Bengal, Howrah district, in ponds near Padampukur water treatment plant, Danesh Shaikh Lane, 08.04.2019, Anant Kumar 53000 (CAL).

West Bengal is a state of lakes, ponds and rivers, having one of the important

Figure 1. a. Patch of a colony of Aquarius cordifolius (L.) Christenh. & Byng. b. Plants with arching inflorescence. c. Flower. d. Sepals showing papillate veins. e. Fruiting branchlet. f. Fruits. g. Young adventitious plantlet from inflorescence. h. Basal portion of young adventitious plantlet showing new emerging roots.
Ramsar wetland sites, viz. the East Kolkata Wetlands. A common hobby of People of West Bengal is maintenance of ornamental fish aquaria in which they grow *A. cordifolius*. Probably, this species from aquaria might have got introduced into the ponds/lakes. The aquarium plant and fish trade moves thousands of species around the globe, opening the door to unwanted organisms being released into fresh and marine waters, with subsequent adverse ecological and economic impacts. The aquarium plant and fish trade has only recently been recognized as a major pathway for fish and plant introductions. So, the possible pathway of this species is trade in plant seeds, aquaculture and aquarium species. Therefore, the invasion pathways have been mostly attributed to humans.

Invasive alien plant species have gained global interest of ecologists, biological conservationists, forestry planners, natural resource managers and social development planners due to their negative impact on biodiversity and ecosystems. The invasion of alien species is the second major threat for biodiversity loss across the globe, next only to habitat destruction by human beings. The wetland biome has been strongly invaded by invasive aquatic plant species in many parts of the world. This is mainly because many of the invasive aquatic species possess broad environmental tolerance. In the Indian wetlands, the number of alien plants introduced both accidentally and intentionally such as *Pontederia crassipes* Mart., *Pistia stratiotes* L., *Salvinia adnata* Desv. and *Alternanthera philoxeroides* (Mart.) Griseb., have emerged as a major threat to aquatic diversity and pose a serious risk to regional and local economy such as fisheries, agriculture (rice farming) and human health. Excessive increase in population of invasive aquatic plants has often increased habitats conducive to the development of vectors of human diseases. Among wetland and littoral plants, large sums of money are spent annually to control non-indigenous aquatic plant species in the Western countries. In 2001, economists estimated the costs of damages caused by invasive species to agriculture and forestry at about US$ 91 billion a year in India alone.

During field collection, we noticed that rhizomes of the species grow deep in the soil, making eradication by hands ineffective. It is suggested to survey all aquatic habitats in the country and control the further spread of this species from rigorously invading aquatic habitats. For effective management of invasive species, it is necessary to gather and consolidate historical details, including the pathways, morphology, phenology, reproductive biology, ecology and economic impacts of all alien species. This will help us to better scrutinize and control the population of such potential invasive species prior to their introduction.


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