IS THE BLOOMING ORNAMENTAL AQUATIC PLANT INDUSTRY A THREAT TO THE AQUATIC ECOSYSTEMS OF SRI LANKA?

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Summary

Sri Lanka is blessed with a large number of native aquatics. However, the high demand for certain exotic plants in the export market has resulted in the importation of the exotics. Subsequently, this has lead to the release of exotic aquatics with invasive potential to the natural environment and there is a possibility for some of these plants to become invasive in future.

Under this context the unavailability of a comprehensive list of ornamental aquatics that are currently being traded stands as a barrier in monitoring exotic plants and conservation of natural ecosystems from alien invaders. Hence, the present study was undertaken to gather information on the ornamental aquatics that are being traded and to compile an inventory.

Information gathered from state institutes/authorities and private sector growers revealed that 389 species are currently on trade. Of which, exotics represents 62%, while natives and endemics represents 9% and 4 % respectively. Further, 3% were cultivated species while the remaining 22% included hybrids/cultivars, plants referred only by its genus or illegitimate names. The list contained plants identified as IAS and potential invasives in the country. Further, 124 were listed in the Global Compendium of Weeds.

In the light of hitherto generated information, a long needed information gap has been fulfilled and this could be used to uplift the aquatic plant trade as a lucrative industry and by the authorities responsible for the industry. As the industry is growing with a potential to establish as a stable foreign exchange generating venture in Sri Lanka the tension between the industry and the regulations implemented has to be taken into account when developing strategies in overcoming the negative impacts on the aquatic plant biodiversity.

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INTRODUCTION

Aquatic plants have been widely used in traditional landscape practices in Sri Lanka. The aesthetics of aquatic plants were appreciated in ancient literature which has continued for decades and a similar trend can be recognized even today where the incorporation of aquatic plants is considered as a scenic superlative to a man made aquatic landscape. In addition to outdoor planting, incorporation of aquatic plants in aquariums together with ornamental fish is also popular. This global trend has made aquatic plants an important element of high demand. As a result many aquatic plants have been traded through various routes during the past few decades.

Sri Lanka has been a supplier for native and endemic aquatic plants to global demands for decades. *Cryptocoryne* and *Lagenandra* are two endemic genera that are on sale as popular aquarium plants and still being illegally collected from the wild for international trade. According to Slocum *et al.*, (1996) and Slocum, (2005), tubers of *Nymphaea nouchali* have been exported in thousands annually from Sri Lanka to the aquarium trade in America and Europe. Subsequently, with the advancement of propagation techniques for most of these tropical plants, Europe grabbed the strongest market for aquatic plants for many years. However, once again Sri Lanka at present is gradually establishing its position as a supplier of freshwater aquatic plants in the form of cuttings, modified stems, or whole plants. Even though Sri Lanka harbours a larger number of naturally occurring aquatics, there is a high demand for certain exotic plants in the export market which has resulted in the importation of alien plants into the country for propagation and re-exportation. Subsequently, the ornamental aquatic plant industry has grown substantially in Sri Lanka and with a potential to become a major foreign exchange generating venture in future.

Once escaped from their controlled environments, some of these exotic aquatic species, commonly referred as alien plants, have the potential to invade extensively into the natural environment posing a detrimental threat to the local biodiversity, agriculture and recreation. Many such events have been encountered in Sri Lanka in the past.

Eichhornia crassipes (Water Hyacinth) and *Salvinia molesta* are two classic examples for alien aquatics introduced to Sri Lanka because of their ornamental value but subsequently became a menace to its biodiversity, and irrigation systems, adversely affecting agriculture and natural wetlands (Figure 1). Due to its rapid spread, two years after the introduction of *E. crassipes* to the island, the Water Hyacinth Ordinance was enacted in 1909 to bring the enormous amount of biomass that was rapidly covering water bodies and canals under control. In 1980's biological control methods were adopted by introducing Water Hyacinth weevils, *Neochetina eichhorniae* and

N. bruchi (Marambe, 2001). However, after more than a century Sri Lanka has still not been able to keep it under control, and it continues to causes problems in conservation of wetland biodiversity, choking water bodies and irrigation schemes.

The spread of *S. molesta* was also rapid as it occupied 22,000 acres by 1950 after it was first introduced to the country in 1939 (Senaratne, 1943). The rapid spread could also be attributed to its occupation of large water-bodies in the dry-zone which was promoted during the Second World War to mimic bare land for landing of enemy aircrafts (pers. comm. DMS Dissanayake, Araula, Dambulla). The plant was declared a weed under Plant Protection Act in 1956 and subsequently an island wide eradication campaign was initiated in 1957 (Williams, 1956). The combating activities were also attempted via biological control using 'Salvinia beetle', *Cyrtobagous salvineae*, which was fairly effective (Amarasinghe and Eknaligoda, 1997).

Several other plants that are traded as aquarium or pond plants are also considered as naturalized in local water bodies. Bambaradeniya (2001 and 2008) identified *Egeria densa*, *Hydrilla verticillata*, and *Pistia stratiotes* as alien invasive species naturalized in water bodies of the Western Province. There have been few other species added to this list in recent past that warrant attention. Yakandawala and Yakandawala (2007) reported three other additions *Ludwigia sedioides*, *Mayaca fluviatilis* and *Echinodorus* spp., as potential invasives to the list that were found in local water bodies in the Western Province of Sri Lanka and are popular aquatics in aquariums and in aquatic landscaping (Figures 2 – 5).

Myriophyllum aquaticum has also been recorded in large scale in the Gregory's Lake in Nuwara-Eliya, possibly another escape from a controlled environment (pers. com. Sujith Ratnayake, Ministry of Environment and Renewable Energy, Sri Lanka).

The most recent addition into the list is a violet flowered water-lily which is of great interest as it opened up a new chapter in invasive alien plant research in Sri Lanka while reiterating the importance of proper identification of organisms. The flawed identification of a violet flowered water-lily as *N. nouchali* and subsequent recognition as the national flower of Sri Lanka ('Nil manel'), overlooked its threat to the local biota and invasiveness.

This exotic violet flowered water lily has been invading the local water bodies silently and continued to be unnoticed due to its erroneous identification (Yakandawala and Yakandawala, 2011). There are no records of its arrival in the country but the landscape industry was believed to have played a role.

Figure 1: Natural wetlands threatened by ornamental aquatics – A: Invasions by *Eichhornia crassipes* and B: *Salvinia molesta*, natives competing for the habitat with invasives

Figure 2: Escapes from aquatic plants nurseries – *Ludwigia sedioides* growing in dense mats in the forefront and *Echinodorus* spp., in the backdrop on wet soils A: during the dry season in year 2006 and B: during the wet season in 2007.

Figure 3: After six years in 2013 at the same vicinity *Echinodorus* sp. has spread around while *Ludwigia sedioides* is confined to the center where water collects.

Figure 4: Escapes from aquatic plants nurseries – *Ludwigia sedioides* and *Mayaca fluviatilis*. Note, A: the dense growth of *Mayaca fluviatilis* growing below the surface of the water during wet season and B: their survival on wet soil during dry season.

According to present observations, the plant occurs in all three major climatic zones of the country and has invaded local water bodies. This flower is offered in shrines and also popular in floral decorations. Unless immediate steps are taken to reinstate the scientifically correct *N. nouchali* as the national flower of Sri Lanka and come up with awareness programs for controlling the spread of this alien plant, it will continue to invade silently (Figure 6).

Invasion of alien plants through the aquatic ornamental plant industry is a problem worldwide. Over 85% of declared and naturalised aquatic weeds in Australia (Petroeschevsky and Champion, 2008) and 75% of the declared aquatic weeds in New Zealand are aquarium or pond plants (Champion and Clayton, 2000). In Japan over 40 such plants have been recorded (Kadono, 2004) while 76% of all aquatic plants introduced into southern New England have escaped from cultivation (Les and Mehrhoff, 1999). As a result, the industry is considered as an 'unregulated industry' by many scientists as most of the noxious invasives have spread directly via the trade as either intentional introductions for ornamental use or subsequent use as ornamentals after the initial introduction. The problem is even becoming severe as most of these plants are now on sale via the mail order/internet (Kay and Hoyle, 2001; Padilla and Williams, 2004; Petroeschevsky and Champion, 2008). According to Kay and Hoyle (2001), there are more than 11 million hobbyists in the US alone supporting a $25 billion/year worldwide industry in aquarium and aquatic ornamental species, most of which are obtainable through mail order and via the Internet. International organizations/governments are now giving a priority in analysing the risk and compiling data for prevention of further introductions. The National Aquatic Weeds Management Group in Australia in a team work identified 25 high-risk aquatic plant species and recommended them to be banned nationally (Petroeschevsky and Champion, 2008). Pathway analyses are regarded as a very efficient method/tool to address the risks posed by invasive alien species. In 2009, Brunel conducted a pathway analysis on aquatic plants imported in EPPO region (European and Mediterranean Plant Protection Organization) to identify invasive or potentially invasive alien plants that could be introduced into the region. The study resulted in identifying plants with risks at different levels, and plant species for further monitoring/investigation.

The present study makes a case for the need of increased attention to the threat posed by alien aquatic plants that are being introduced via ornamental aquatic plant industry in Sri Lanka. At present, the unavailability of a comprehensive list of ornamental aquatic plants that are currently being imported and/or propagated for the export market stands as a barrier in monitoring alien plants and the conservation of natural ecosystems from alien invaders. Therefore, the main objective of the present study was to gather information on the ornamental aquatic plants that are being traded in the country and compile a list of ornamental aquatic plants. These statistics would provide base line information for further

Figure 5: Established populations along watercourses – A: *Mayaca fluviatilis* and B: *Ludwigia sedioides* along waterways in the Western Province. Growing on flowing water increases the possibility of downstream contamination. Note that both plants are capable of establishing through stem fragments/parts.

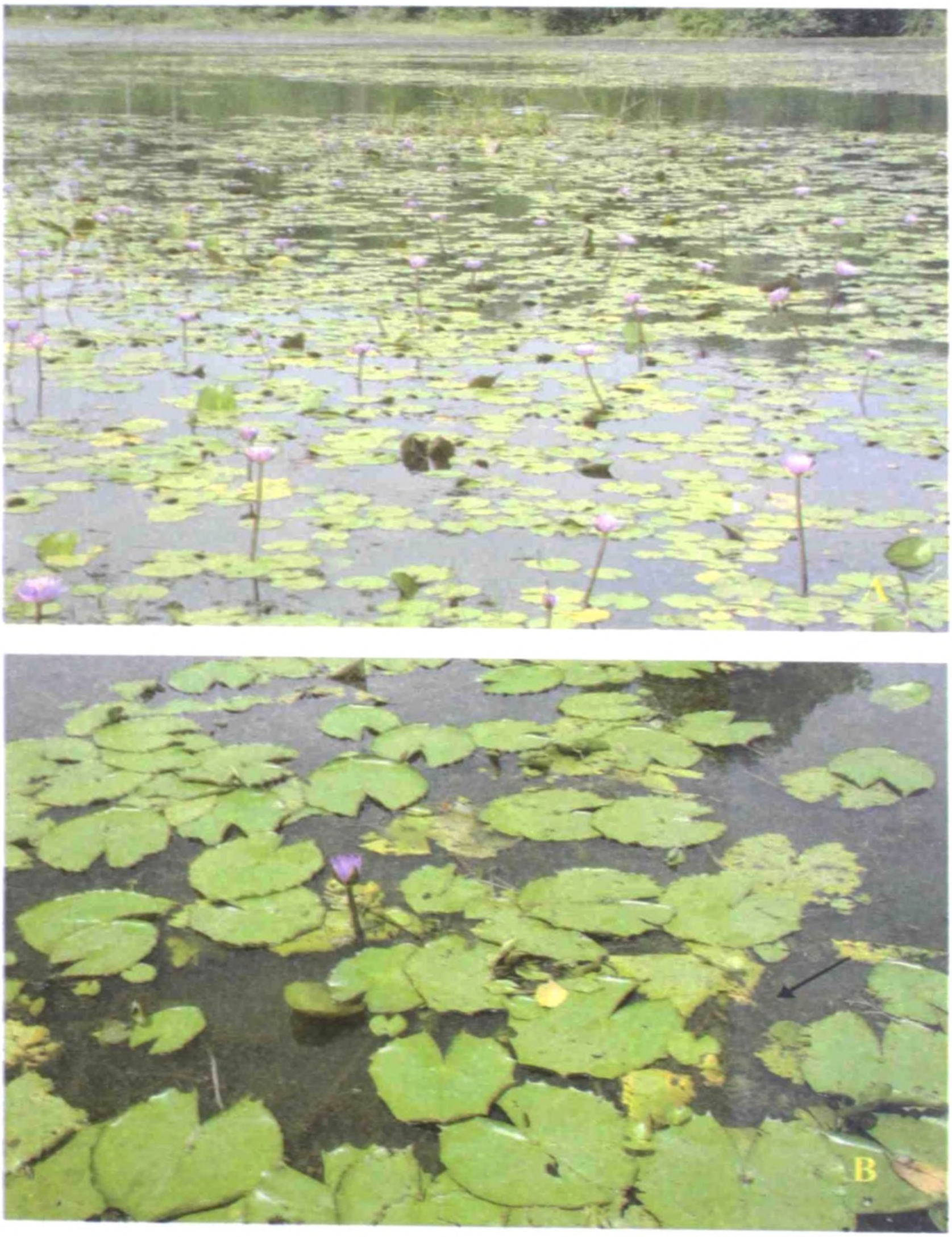

Figure 6: Exotic *Nymphaea* species invading the natural water bodies as a silent invader. Note the large number of epiphyllous plantlets that has developed from the mother plant.

research in identifying their potential threats and conservation of aquatic ecosystems in Sri Lanka.

Further, in this paper we would also highlight the tension between the ornamental aquatic plant industry and the attempts to support the conservation of wetland biodiversity, and the negative impacts from ornamental aquatic invasives. In addition, we suggest relatively simple measures that the state authorities and policy makers can adopt in management plans for sustainable development of the aquatic plant industry as well as to conserve biodiversity and prevent wetland degradation.

MATERIALS AND METHODS

Identification of species in the trade

A list for different ornamental aquatic plants of Sri Lanka that are currently imported/ exported/ and on sale was complied by obtaining data from the Forest Department, Sri Lanka Customs Air Cargo terminal at the Bandaranayake International Airport, The National Aquaculture Development Authority of Sri Lanka (NAQDA), The National Aquatic Resources Research and Development Agency (NARA), and private growers either by visits, personal communication, or through their 'sale lists' provided on the internet. During compilation, it was necessary to work on authentication of the taxonomy of the traded species as mistakes in the plant names that were used in the trade were evident.

Compiling the legitimate species list of ornamental aquatic plants

Corrections for illegitimate species, species combination and synonyms was carried out based on The International Plant Names Index (IPNI, 2004), The Plant List (The Plant List, 2010), Tropicos (hosted by the Missouri Botanical Garden) and The Germplasm Resources Information Network (GRIN, 2009). A list of globally traded plants was collated from extensive databases of aquarium species (Booth, 2002; Ruzek, 1996-2007) and other literature (Slocum and Robinson, 1996; Slocum *et al.*, 1996) for checking the names of the ornamental aquatics. The complied list was analysed using descriptive statistics to estimate the endemics, natives and exotics. Based on the compiled list, potential weeds or plants currently on the world invasive plant list were identified (Randall, 2012; Lowe *et al.*, 2000). The endangered species were identified using National Red Data Book (Ministry of Environment, Sri Lanka, 2012).

RESULTS

The taxonomic investigation revealed that many nomenclatural errors are inherited in the current list of ornamental aquatic plants of Sri Lanka, especially in the lists provided by the growers and traders. Consequently, the lists compiled by the government authorities also carried the same errors into their lists. The errors were broadly grouped into two generalized categories as (i) nomenclatural errors and (ii) mis-matches and erroneous identifications.

1. Nomenclatural errors

i. Use of synonyms

Instead of using the legitimate name, a number of species were referred by their synonyms. As examples, *Nymphaea nouchali* Burm.f. by its synonym *Nymphaea stellata* Willd.; *Sagittaria subulata* (L.) Buchenau by its synonym *Sagittaria pusilla* Nutt. and *Azolla filiculoides* Lam. by its synonym *Azolla caroliniana* Willd. (The plant list, 2010).

ii. Unrecognised names

In instances where a plant was listed by a common name or a illegitimate name it could not be identified. Such names were retained in the list. *Hydrilla verticillata* (L.f.) Royle is the only accepted species name for the genus *Hydrilla*, with 17 synonyms. However, the present compiled list had other species names (*viz.* 'Hydrilla najans', and 'Hydrilla natans') that could not be placed under any category. In some instances *Hydrilla* was mixed up with *Elodea* ('Hydrilla (Elodea) Crispa') and *Egeria* ('Hydrilla (Egeria) Najas'). It is possible that the former is *Hydrilla verticillata* var. *crispa* Casp. while the later being *Egeria najas* Planch. Plants by these names are available and are exported, and in addition are sold on the web as aquarium plants globally.

iii. Spelling mistakes

Several mistakes occurred during spelling of the Latin names. As example in many instances, the generic name of *Alternanthera* was spelt as 'Althenethhra' or as 'Althenethra'. Specific epithet of the genus *Cryptocoryne* was misspelt in many instances; *Cryptocoryne beckettii* Thuill. ex Trim. was spelt as 'C. becketi' and *C, wendtii* de Wit as 'C. wenditi' or 'C. wendit'.

Further, both 'Chlorophyllum bicheii' and 'Chlorophytum buchetii' are not scientific names. These could be a spelling mistake of *Chlorophytum bichetii* Backer which is a synonym of *Chlorophytum laxum* R.Br., and is an aquarium plant. 'Crinum aquatica' is another plant name that does not exist and this could be either *Crinum aquaticum* Herb. or *Crinum aquaticum* Burch. ex Spreng, both been synonyms of *Crinum campanulatum* Herb. 'Echinodorus vivipara' could also be a spelling mistake as there is no such plant in flora or on sales lists on the web. This could most probably be *Eleocharis vivipara*, which is an aquarium plant.

iv. Plant names with ambiguities

Several plants were listed by a specific feature of ornamental interest, which could be an improved variety/cultivar/hybrid. Certain instances this particular name was used to refer to more than one species. As an example *Alternanthera* 'Green' was used as a common name to refer to both

Alternanthera bettzickiana var. 'Green' and *Alternanthera ficoidea* var. 'Green' while *Alternanthera* 'Red' is common to both *Alternanthera bettzickiana* var. 'Red' and *Alternanthera reineckii* var.'Red'. In instances when a plant is referred only by the generic name (*viz.*, *Acorus* sp., *Alternanthera* sp. and *Bacopa* sp.), it was difficult to decide on a species name and therefore this may cause over scoring of the species number.

2. Mis-matches and erroneous identifications

Wherever possible, the plant images on sale lists were checked. In some instances it was revealed that the plant that is referred by the name is not the plant that is on sale. Especially, the plants referred to as *Nuphar* sp. 'Blue flower', *Nuphar* sp. 'White flower', and *Nuphar* sp. 'Pink flower' were not *Nuphar* species, where *Nuphar* sp. 'Blue flower' and *Nuphar* sp. 'White flower', were *Nymphaea* species, while *Nuphar* sp. 'Pink flower' was a *Nelumbium* species. Further *Nymphaea stellata* (synonym of *N. nouchali*) 'White', 'Pink' and 'Red' carried images of horticultural cultivars/ hybrids of *Nymphaea*.

Composition of the ornamental aquatic plants

Different lists provided by four State institutes/authorities and 15 private sector growers, when compiled, added up to 443 ornamental aquatic plant species as being traded as ornamental aquatic plants in Sri Lanka. Once the spelling mistakes and synonyms were corrected the number of ornamental aquatic plant names was reduced to 389. This included 29 plants that are referred only by the generic names which might be a repetition (eg., *Vallisneria* sp., *Nuphar* sp. and *Alternanthera* sp.). Considering taxonomic circumscriptions, 193 plants were recognised under species level, 74 included below species level taxa while 60 names that were not scientific names and 12 were common names. The list also included 20 synonyms.

Among the illegitimate names, names of few plants such as 'Hygrophila ammaniya', 'Ludwigia perruviansis', and 'Echinodorus barthigensergis', are names that have not been recognised in any of the aquatic plant lists or on the internet for sale. The list of ornamental aquatic plants generated from the study is given in the annexe 1.

All the plants in the list are exported and some are available in the local market. The list of plants belongs to 43 plant families that included 36 angiosperm plant families with 67 genera, 6 fern/ fern allies with 6 genera and 1 liverwort. Of the recorded ornamental aquatic plants, exotics represents 62%, while natives and endemics represents 9% and 4% respectively. Further, 3% were cultivated species. The remaining 22% included hybrids/cultivars of either natives or endemics, plants referred only by its generic name and plants with illegitimate names. The highest plant number for a genus was 36, recorded by an

exotic plant genus, *Echinodorus* (Alismataceae), which included 11 species, 7 varieties/cultivars/ hybrids, and 17 plants with illegitimate names (figures 7-10) while the genus *Hygrophila* (Acanthaceae) recorded 22 plants of which only one species being native. *Cryptocoryne* (Araceae) recorded 21 species as ornamental aquatics in the traded list. This included 14 species of which 7 were endemic and 7 were exotic, and 7 varieties/ cultivars/hybrids of endemic members.

The list included 4 plants that are currently identified as Invasive Alien Species in Sri Lanka of which *E. crassipes* is in addition recognized under the 100 most invasive plants of the world (Bambaradeniya, 2008; Lowe *et al.*, 2000). Further, the list contained plants that are identified as potential invasive plant in the country, which included *Mayaca fluviatilis*, *Ludwigia sedioides* and *Echinodorus* species. Checking each species against the Global Compendium of Weeds (Randall, 2012) which indicate their invasive behaviour elsewhere in the world identified 124 plant species (this included 27 natives, 4 cultivated and 2 endemics) as in the present list.

Apart from invasive members, 12 endemic species are in the sale list of which eight belong to the genus *Cryptocoryne*, and the others being *Aponogeton rigidifolius* H.Bruggen, *Impatiens repens* Moon ex Wight, *Lagenandra lancifolia* (Schott) Thwaites, and *L. thwaitesii* Engl. Further, six below-species level taxa (cultivar/hybrids) of the endemics *Crptocoryne* are listed for sale with seven other exotic *Cryptocoryne* species. All these endemic members are listed in the National Red-list as threatened plant species (Ministry of Environment, Sri Lanka, 2012), *C. undulata* Wendt, *C. walkeri* Schott, *C.* × *willisii* Reitz and *Impatiens repens* Moon ex Wight under *CR* category; *C. nevillii* Trimen, *C. parva de* Wit, *C. thwaitesii* Schott, *Lagenandra thwaitesii, L. lancifolia* (Schott) Thwaites, and *Aponogeton rigidifolius* H. Bruggen under EN category; and *C. beckettii* and *C. wendtii* under VU category. Seven members in the list are included under the FFPO (Fauna and Flora Protection Ordinance, 2009) *viz. A. rigidifolius* H. Bruggen, *C. walkeri* Schott, *C. thwaitesii* Schott, *Impatiens repens* Moon ex Wight, *L. lancifolia* (Schott) Thwaites, *L. thwaitesii* Engl., and *Lemna gibba* L. Some of the ornamental aquatic plant species available at plant sale outlets and nurseries are given in Figures 7-27.

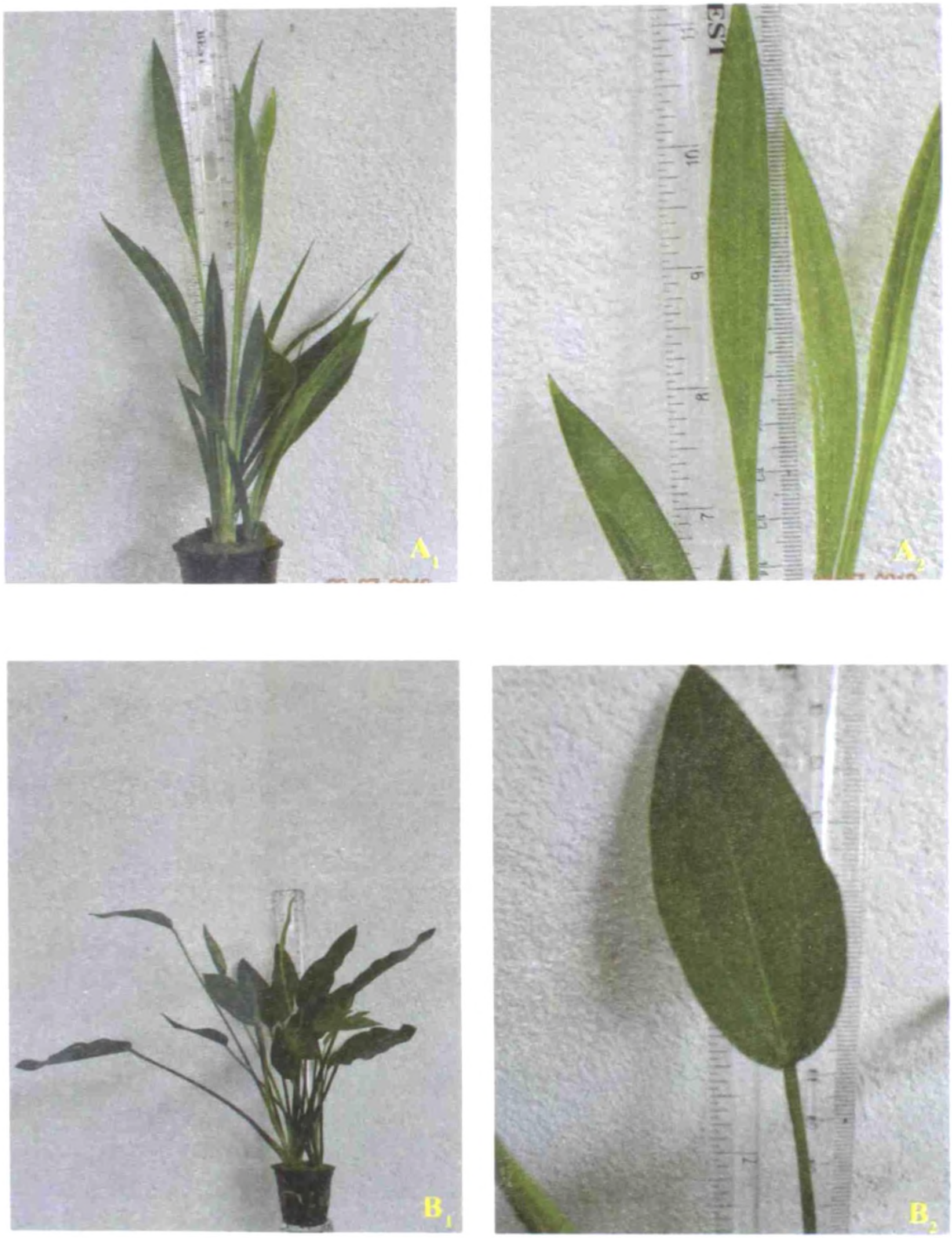

Figure 7 : *Echinodorus decumbense* plant (A_1) and leaves (A_2) and *Echinodorus argentinensis* plant (B_1) and leaf (B_2)

Figure 8 : *Echinodorus schluteri* 'Léopard' plant (C_1) and leaf (C_2)
***Echinodorus* 'Rose' plant (D_1) and leaf (D_2)**

Figure 9 : *Echinodorus uruguayensis* plant (E_1) and leaves (E_2)
***Echinodorus* 'Ozelot' plant (F_1)and leaf (F_2)**

Figure 10 : *Echinodorus bleheri* (a non-scientific name) plant (G_1) and leaf (G_2) *Echinodorus amazonicus* plant (H_1) and leaves (H_2) (*Echinodorus grisebachii* is the accepted name)

Figure 11 : *Echinodorus tenellus* plant (I_1) and leaves (I_2) (*Helanthium tenellum* is the accepted name) and *Echinodorus parviflorus* 'Tropica' plant (J_1) and leaf (J_2)

Figure 12 : *Echinodorus cordifolius* 'Marble Queen', in plant sale outlets at flower market , Battaramulla.

Figure 13: Exotic ornamental *Nymphaea* species on sale in plant sale-outlets at Flower Market Battaramulla. All these are day bloomers and are capable of hybridizing with each other.

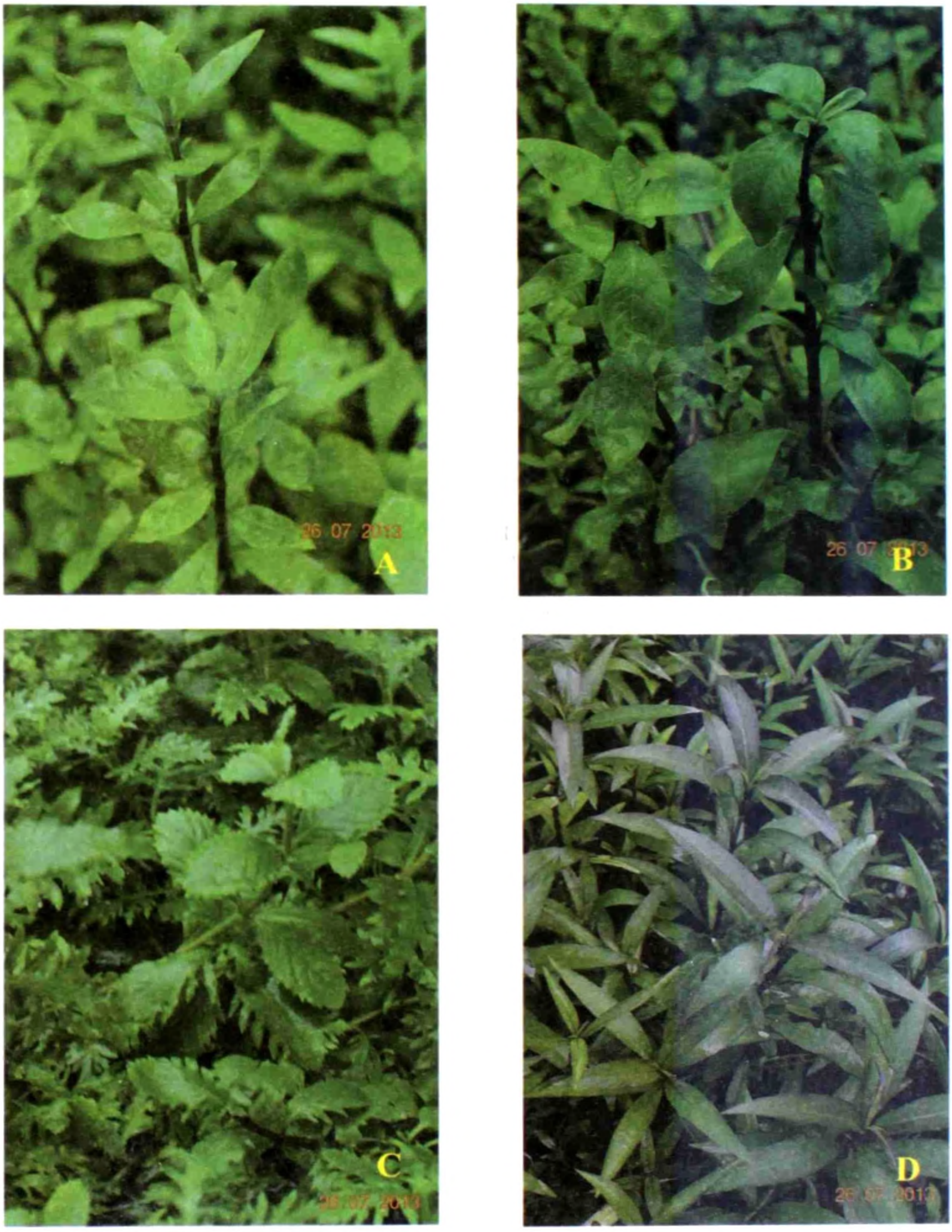

Figure 14: A - *Hygrophila polysperma*, B - *Hygrophila polysperma* 'Broad leaf', C - *Hygrophila difformis and* D - *Hygrophila corymbosa* 'Siamensis'

Figure 15 : E - *Hygrophila polysperma* 'Rosanervis' and F -*Hygrophila guianensis*

Figure 16 : A - *Hygrophila ammaniya* (Not a scientific name), B - *Eriocaulon* sp., C - *Colocasia esculenta* 'Black Magic', and D - *Limnophila aromatica*

Figure 17: E - *Limnophila aquatica* 'Variegates' and F - *Limnophila heterophylla*

Figure 18: A - *Anubias congensis*, B - *Anubias hastifolia*', C - *Anubias* 'Bon-sai', and D - *Anubias barteri* 'Broad leaf'

Figure 19: A - *Anubias barteri* and B - *Anubias barteri*

Figure 20: A - *Microsorum pteropus*, B - *Microsorum pteropus* 'Windelov' and C - *Hydrocotyle* sp.

Figure 21: A - *Hymenocallis caribaea* 'Variegata' and B - *Hydrocleys nymphoides*

Figure 22: A - *Bacopa amplexicaulis*', B - *Bacopa* 'Variegatus' and C - *Sagittaria subulata*

Figure 23: A - *Bacopa caroliniana* and B - *Sagittaria latifolia* 'Flore Pleno'

Figure 24: A - *Rotala rotundifolia,* B - *Rotala macrandra* and C - Alternanthera liliensis (Not a scientific name)

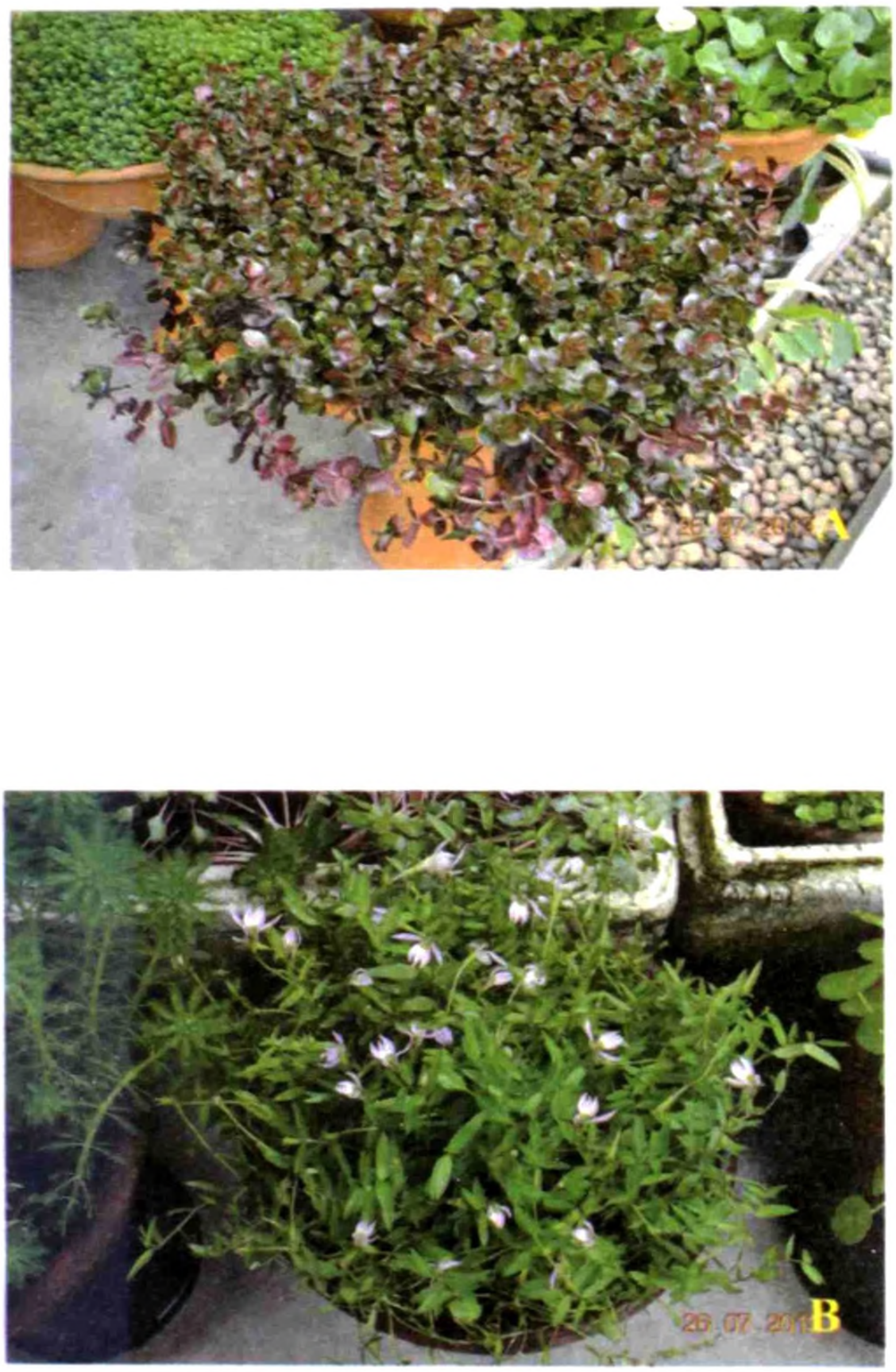

Figure 25 : A - *Rotala rotundifolia* 'Red' and B - *Lobelia* sp.

Figure 26: A - *Cyprus* sp., B - *Ludwigia* sp. and C - *Ludwigia repens* 'Rubin'

Figure 27: A - *Ludwigia* sp., B - *Ludwigia sedioides* and C - *Myriophyllum aquaticum*

DISCUSSION

Ornamental aquatic plant industry as a source of IAS

The compiled list during the present study identified a major percentage (62%) of the ornamental aquatics that are on sale as exotics. Even though most of these exotics are not invasive/s, these plants are capable of naturalizing locally very successively. This poses a competition for the natives, where in most cases the natives being the losers. A small fraction of these aliens becomes invasive but, these few can cause enormous damage. In many instances there is a lag time before adverse effects are observed in the environment. One third of the aquatic species on the IUCN Invasive Species Specialist Group list of 100 worst invasive species (Lowe *et al.*, 2000) are from aquarium or ornamental releases (Padilla and Williams, 2004). At present, over 150 species of vertebrates, invertebrates, plants, and microbes (including pathogens) that have invaded natural ecosystems have been documented as a result of aquariums and aquatic ornamental culture (Padilla and Williams, 2004).

Biological invasions are considered a serious threat to the biodiversity and presently ranked second only to habitat loss (Gurevitch and Padilla, 2004; Didham *et al.*, 2005; Tiebre *et al.*, 2007). However, according to Chapin *et al.* (2000), biological invaders may soon surpass habitat loss as the main cause of environmental degradation globally. This ranking has attracted greater attention towards Invasive Alien Species (IAS) in the last decade (Gurevitch and Padilla, 2004; Didham *et al.*, 2005; Tiebre *et al.*, 2007). Invasive Alien Species have the ability to compete with and replace native biota in natural habitats, thereby causing an immense threat to the native biological diversity. According to Elton (1958) and Donlan *et al.* (2003), islands have long been considered to be under intense ecological threat from the spread of IAS. Sufficient evidence has emerged that IAS may now be the most significant drivers of population declines and species extinctions in island ecosystems globally (Veitch and Clout, 2002; Donlan *et al.*, 2003).

Invasive Alien Species and potential invasives already introduced to Sri Lanka via the industry

Eichhornia crassipes

Eichhornia crassipes (Water hyacinth) is a native plant to Amazon basin that has established as an invasive plant and is also recognized under the 100 worst invasive species of the world; nevertheless, this plant is listed as an ornamental aquatic for sale in the present list complied. This is not only common to the local aquatic plant industry but also globally as the plant is marketed over the internet orders and is a concern raised by many researchers (Key and Hoyle, 2001; Padilla and Williams, 2004). Apart from this, another *Eichhornia* species, *E. azurea*, also an invasive species, is listed for sale in the present complied list.

Salvinia molesta

Even though, *S. molesta* (accepted name *S. adnata* Desv.), the well known invasive species is not in the current list for sale, it is interesting to note that four other *Salvinia* species are listed and sold as ornamental aquarium plants locally, *viz.*, *S. auriculata* Aubl., *S. cucullata* Roxb., *S. natans* All. and *S. oblongifolia* Martius. All these four species are listed under various categories for their invasive behaviour elsewhere in the world (Randall, 2012). Moreover, some lists provided by the growers do not identify the plant to the species level. The risk associated with this is the difficulty to the general public in identifying these species and any infestation due to the release of propagules of these new *Salvinia* spp. will go un-noticed in the aquatic ecosystems.

Echinodorus species

Of the 11 *Echinodorus* species recorded, 9 species (except those identified below species level taxa and the plants recognised by illegitimate names on the lists) are recorded as invasive weeds elsewhere (Randall, 2012). Species of *Echinodorus* have already been recorded for their potential invasiveness in the western province in the country (Yakandawala and Yakandawala, 2007). *Echinodorus* is a genus of aquatic plants that are popular as specimen plants in aquariums and ponds. The plant produces a long inflorescence with 1-18 whorls of florets which are eye catching. Each floret is capable of developing into a plantlet while still attached to the mother plant facilitating the spread successfully. Since the inflorescence reaches beyond the mother plant, these plantlets get established quite easily.

Egeria densa

Egeria densa (synonym - *Elodea densa*) is a fully submerged aquatic plant. *Hydrilla, Elodea* and *Egeria* are three genera belonging to the family Hydrocharitaceae and morphologically closely resemble each other. In many instances when 'labelling' *Hydrilla* for sale, either *Elodea* or *Egeria* is given in brackets indicating that both species are the same which is incorrect. The plants of all three genera are submerged perennial species that are usually rooted in mud. All three species possess long slender stems with leaves occurring in whorls at the nodes. Even though they look very similar in vegetative morphology, their flowers are quite different. *Hydrilla, Elodea* and *Egeria* have not being recorded as weeds in their country of origin, however these have been recorded as weeds elsewhere (Bowmer *et al.*, 1995). *Elodea* is distinguished from *Hydrilla* by the number of leaves in the whorls (usually three in *Elodea*, and four to six in *Hydrilla*) and by the lack of marked leaf serrations and scratchy nature of the latter. *Egeria* is distinguished by its larger leaves which are usually in whorls of four or five, sometimes three to eight. It differs from both *Elodea* and *Hydrilla* in its larger, at-

tractive white flowers with three petals (9-12 mm long) and the presence of 'double nodes' (Bowmer *et al.*, 1995).

Mayaca fluviatilis

Mayaca fluviatilis or the Bog moss, naturally occurs in the southeast USA, central and tropical South America and in tropical Southwest Africa. Yakandawala and Yakandawala (2007) reported it as a potential invasive plant in Sri Lanka. The plant with a moss like appearance has spirally-arranged linear leaves. It is capable of growing fully submerged and utilised in aquaria as a submerged plant. The plant, when grows fully submerged in natural ditches and pools, could be mis-identified as *Hydrilla*. Even though the leaves of *Hydrilla* are arranged in whorls and spirally in *Mayaca*, while submerged in water, the latter could be very well overlooked as *Hydrilla* (field observations). During dry conditions the plant is capable of growing as a dense mat on the surface of wet soils.The mechanical control of *Mayaca* has been dismissed due to the reason that fragmented vegetative parts of even 2 cm in length are capable of developing into a new plant and, potentially leading to further spread downstream (Yakandawala and Dissanayake, 2010).

In addition to *M. fluviatilis,* the present list identified another species of *Mayaca*, *viz.*, *M. madida* (synonym *M. sellowiana* Kunth), as traded.

Ludwigia sedioides

Ludwigia sedioides is identified as another potential invasive in Sri Lanka (Yakandawala and Yakandawala, 2007). It is commonly known as Mosaic flower or False loosestrife and is a herbaceous perennial and is native to South America. This is also used as a floating aquatic plant especially in outdoor landscaping in ponds. The red and green diamond-shaped leaves occur in a rosette giving an attractive appearance to the plant. The habitual propagation is via snipping off a rosette, with a section of stem attached. But studies conducted by Debarawatte and Yakandawala (2009) reveal that propagation is possible even through other stem sections. According to our observations made in the Western Province wet habitats, the plant forms dense mats during the dry season and is capable of surviving on completely dry soil. In 2006, *L. sedioides* was observed only in two water bodies however in 2009 it has spread up to 10 neighboring water bodies (Yakandawala, 2009). Therefore, research directed towards its modes of propagation, in order to recommend controlling methods, should be encouraged.

Role of growers and hobbyists

The introduction of a species repetitively and on a large scale into a new environment is identified as one of the key factors that lead to invasiveness (Randall and Marinelli, 1996). In the context of aquatics, Ruiz *et al.*, (1997) has

identified aquarium release as one of the five top avenues for introduction of non-native invasive species, with many other studies endorsing (Padilla and Williams, 2004 and reference there in). This situation is fulfilled by the release of propagules from nurseries during the waste disposal and thereby these plants becoming established in local wetlands.

The escape of *M. fluviatilis*, *L. sedioides* and *Echinodorus* spp. and their subsequent spread in local water bodies of Western Province are such local examples (Yakandawala and Yakandawala, 2007). Such plants inherit rapid propagation methods, especially by vegetative means. Since these are aquatics, their propagules are carried to other destinations easily with the water current enabling them to establish.

It is not only that the aquatic plant growers are responsible for their spread, but hobbyists also often contribute by discarding plant material into the environment rather than destroying them leading to serious weed infestations provided that the growing conditions of the surrounding environment is suitable for them. Consequently the hobbyists are playing an important role as a vector in the distribution and spread of these noxious aquatic weeds (Kay and Hoyle, 2001).

Contaminations

Maki and Galatowitsch (2004) who conducted a study on 'ordered plants' around the USA found that 93% of the 40 orders contained contaminant plants, animals, fungi or algae. According to Les (1996) *Hydrilla* infestation in Connecticuit (USA) is one such example, where it entered as a contaminant from ornamental water lilies. According to personal observations, there are possibilities of spreading of water plants, as contaminants, through legally imported vegetable seeds. The importation of dried plant materials in bulk for decorative purposes too provides another route of new arrivals and spreading of the same. Therefore, the monitoring of bulk imports should be considered as a routine and encouraged.

Other associated threats

Over-exploitation

Another threat that is associated from the ornamental aquatic plant trade is the over collection of ornamental aquatics from the wild. Many endemic and native ornamental aquatics on the list are collected from wild for the trade. This has led to the rapid decline in wild populations. In spite of the existing rules and regulations, many exporters maintain their own undisclosed suppliers and areas of collection which include Kelani Velley basin, and in small streams in areas such as Mawanella, Awissawella, Bulathkohupitiya, Ruwanwella, and Yatiyanthota in the lowland and central wetzone of Sri Lanka (Seneviratne, 2002) and dry zone rivers including Kalaoya, Malwathu-

oya and Kuda-oya. Ornamental plant hunters as a habit, smuggle aquatic plants, especially members of the genus *Cryptocoryne*, where they are grown, improved and supplied to the market. Many unidentified and un-recorded species and varieties of *Cryptocoryne* are available for sale on the internet with Sri Lanka as the original source, where the most recent species named as *C. waseri* Kettner (Bastmeijer, 2012).

Exotics with native relatives and possible hybridization

Ellstrand and Schierenbeck (2006), analysing the concept of hybridization to build up a possible model for the evolution of invasiveness *viz.*, hybridization can, through one or more mechanisms catalyze the evolution of invasiveness, highlights some interesting trends. Abbott (1992) observed that inter-specific hybridization involving non-native plant species has often served as a stimulus for the evolution of entirely new, and sometimes invasive, species. Specifically, Abbott (1992) noted that hybridization involving a non-native species and another, either native or non-native, has led to a numeral new sexually reproducing plant species, which are either stabilized introgressants or allopolyploids. Some of these species have remained localized, but most have spread successfully far beyond their sites of origin. Such hybridization between natives and an alien invasives has been recorded in Sri Lanka (Yakandawala and Yakandawala, 2011). This phenomena could well be repeated with the new arrivals through the ornamental aquatic plant industry and their related natives. Even though *E. crassipes* is an alien, it has now become naturalized in all parts of the country. The list identifies another species *E. azurea*, which being propagated/sold in the country. Further, several *Salvinia* spp., *Alternanthera* spp., *Aponogeton* spp., *Blyxa* spp., *Cabomba* spp., *Cryptocoryne* spp., and many other non-native exotics with native relatives are listed as traded in Sri Lanka.

Other impacts of invasives

Apart from the well-established detrimental effects of IAS, several other negative impacts on the biodiversity have been highlighted. Studies have implied that *E. crassipes* is also responsible for drastic changes in the plant and animal communities of freshwater environments and acts as an agent for the spread of serious diseases in tropical countries (Téllez *et al.*, 2008). The impact of *E. crassipes* on the physico-chemical characteristics of the water in general are declines in temperature, pH, biological oxygen demand (organic load), and nutrient levels (Rai and Datta Mushi, 1978). In some cases there was a complete decline of dissolved oxygen noted that lead to the death of a great number of fish (Téllez *et al.*, 2008). The exceptional rate of evapotranspiration in water hyacinth "draws down" scarce water reserves and it is recorded that before control was implemented in the Nile region in Africa, one tenth of the average available water (7 billion m^3 of water per year) was lost from the river (de

Groot 1993), which is also evident in the dry-zone of Sri Lanka, where tanks covered with *E. crassipes* dry off quickly compared to open tanks.

What should be done?

Early intervention and prevention

It is widely accepted that prevention is the most effective means of reducing the future costs of invasive species (Padilla and Williams, 2004) and early detection and treatment of new infestations of invasive non-native plants are considered as an effective and ecologically sound management approach (Marambe, 2000; Harris *et al.*, 2007). However, this exclusively depends on the correct identification or reference of the scientific name and the information on the potential invasive species. Therefore, the present compiled list will aid identification of the potential invaders from the aquatic plant industry. As suggested by Triet *et al.*, (2001) awareness and early intervention are especially important for developing countries where there is a lack of funding for the management of alien invasive species.

The most effective criterion to predict the potential invasiveness of a plant species is to consider its behavior in other areas of the world, especially those with the same climatic conditions (Reichard, 2001). According to the Global Compendium of Weeds (Randall, 2012) 35% of the plant species in the present complied list of Sri Lankan ornamental aquatic plants are recognised for their invasive behaviour elsewhere in the world. Apart from *E. crassipes* and *S. molesta*, that are already on record, other notable exotic species with invasive records elsewhere in the world are several species of the genus *Echinodorus*, *Eichhornia azurea*, *Egeria densa*, *Hydrocotyle verticillata*, *Hygrophila costata*, *Ludwigia palustris*, *Mayaca fluviatilis*, *Ophiopogon japonicus*, *Ophiopogon jaburan*, *Salvinia* spp., and *Trapa* spp. (Table 01).

The present study revealed that the number of ornamental aquatic plants estimated and listed by the state institutes was less than half of the plants recorded during the present study. Since the lists of these institutes are compiled based on the information provided by the growers, it is evident that most of the plant names have not been correctly declared or probably mis-identified. As an example *Limnobium laevigatum* (Hydrocharitaceae) the first author encountered in a water body close to Kandy is not recorded under the present list (Figure 28). *Nelumbo* has been a popular plant in the past, but however, there are no export records in the recent years. Several plants are been sold under names that have not been recognized. It is therefore necessary to carry out an extensive survey on the ornamental aquatic plants that are currently propagated and exported or sold at local aquaria.

Awareness programs

Species that have similar appearance are often misidentified or misrepresented. Developing

methodologies for taxonomic identification of IAS has been identified as a priority by Marambe (2008), emphasizing the scarcity of taxonomists in Sri Lanka. During the compilation of the present list it was noted that similar problems existed in our trade where the species that look morphologically similar are being mislabeled. *Hydrilla, Elodea* and *Egeria* have been one such group of plants. *Nymphaea stellata* (*N. nouchali*) with white flower, Pink flower, and Red flower are also mislabelled in many instances. All the plants sold as *Nuphar* spp. with blue, white or pink flower in a local plant-list were *Nymphaea* spp. but not *Nuphar*. Further, the contradicting statistics in the lists provided by the growers and the state institutes could also be due to the mis-identification of certain species. Therefore, steps need to be initiated in educating the growers and other stakeholders of the industry via pictorial guides for identifying the plants that they deal with.

A very effective means of addressing the problem, particularly in Sri Lankan context, would be via educational and outreach programmes/ workshops. Further it is important to educate the officials in the regulatory bodies regarding these plants in order for them to notice any mis-identification where these potential invasives could go unnoticed. Educating the plant growers/dealers on the IAS and the associated risks would also contribute in minimizing the risk. Displaying posters complied in simple manner on waste disposal in aquaria would take the message to the hobbyists and educate them of the severity of the risk associated with unregulated disposal of propagules into the environment and also the intermediate role that they play as 'vectors'.

Economic analyses and risk assessments

At present, the growing aquatic plant industry in Sri Lanka in particular involves a fair amount of foreign exchange. Therefore, the recommendation made for overcoming their threats to biodiversity should be dealt with the understanding of the tension between sustainable development, and the intention to support the conservation of biodiversity, while giving emphasis to the negative impacts from IAS. Since a total elimination of the potential invaders from the trade is unlikely to happen, Padilla and Williams (2004) highlight the significance of economic analyses in setting trade policies that avoid unwelcome economic and ecological outcomes. According to them, economic models will become very useful tools for minimizing the risks of invasions during trade.

Marambe (2008) at the National Symposium on IAS (Sri Lanka) has highlighted the importance of giving priority for research directed towards economics of invasions. Globally, attempts are being made to evaluate the risk possessed by alien ornamental aquatic plants with invasive/weed potential based on various models and other available data where the information is used for decision making on plants that should be banned from entry, or prevented from deliberate dispersal through nursery trade (Champion and Clayton,

Figure 28: Aliens with no records - *Limnobium laevigatum*, found in a waterbody close to Kandy in 2009. This could probably be an escape from an ornamental aquatic landscape. However this plant was not recorded in any of the data bases.

2000; Petroeschevsky and Champion, 2008). Champion and Clayton (2000) developed a weed risk assessment model for aquatic plants where the model scores features such as habitat versatility, competitive ability, reproductive output, dispersal mechanisms, range of potential impacts, potential distribution and resistance to management activities. The Aquatic Weed Risk Assessment Model (AWRAM) has been adopted to assess potential aquatic weeds in other countries such as New Zealand, Australia and USA (Champion, *et al.*, 2010).

The wetland risk assessment framework proposed under the formal resolution of the Ramsar Wetlands Convention (van Dam *et al.*, 1999) includes several steps in assessing risks such as the risk, risk management and reduction, and monitoring. Such risk assessments on potential invasive ornamental aquatic plants need to be encouraged locally which would result in developing appropriate monitoring programmes and also reducing future risks. Ranwala and Hafiz (2008), developing a protocol for risk assessment for Sri Lankan invasives, assessed twenty local invasive plants which are listed in Global Invasive Species

data base (2001), where each species was evaluated for four aspects *viz.*, ecological impact, invasive potential, current distribution and the feasibility of control of the plant species. The attributes have been assessed using scores and the final output has been presented as a percentage. The study included three ornamental aquatics, *E. crassipes*, *H. verticillata* and *P. stratiotes*, where *E. crassipes* scored the highest value of 85.5% followed by *H. verticillata* (72.3%) and *P. stratiotes* (67.2%). Such protocols should be adopted for assessing ornamental aquatics and, based on the results of such assessments, banning/ monitoring the importation of highly ranked species would be an effective approach in keeping bio-security risks off-shore.

The assessment of aquatic plant trade patterns, especially volumes of high-risk species, along with knowledge of current and potential distribution of those species and ease of management, have been identified by Champion, *et al.*, (2010) as factors that need to be considered when evaluating candidate plants for prevention of sale and distribution.

Invasive aquarium species and ornamentals are a concern of the IUCN and the ICES (International Council on the Exploration of the Sea), however, according to Sandlund *et al.* (1999) their position statements, policies, and guidelines currently do not have any powers. Similarly, the Convention on International Trade in Endangered Species also does not adequately protect the aquatic habitats from invasions as it deals only with the trade on the listed endangered and threatened species (Padilla and Williams, 2004). Kay and Holye (2001) state that in the US every aquatic plant listed as a federal or state noxious weed is available to be purchased over the Internet and identifies it as a major problem which is also a common problem faced by other countries including Sri Lanka. Further, as most of the global trade takes place via this route, enforcement of laws and regulations becomes difficult (Padilla and Williams, 2004). In the Sri Lankan context, a body directly responsible for coordinating towards issues related to IAS must be identified for monitoring.

Present legal status in Sri Lanka

Importation of water plants into the country are prohibited under the Plant Protection Act, therefore all the arrivals of exotic material should be illegal entries. Seven members protected under the FFPO (Fauna and Flora Protection Ordinance, 2009) are listed in the sale list, hence, measures should be taken for continuous monitoring for their source of origin during export. However, a set of new regulations are in progress to permit the export of cultivated or in-vitro cultured aquatic plants protected under FFPO.

Research gaps and research needs

A considerable amount of research has been conducted on the wetlands of Sri Lanka over the years, covering many aspects. However, a

few areas that need focus are, i). Detailed taxonomic studies on wetland plants with their correct identification need to be completed. This would enable the early detection of any potential threats from alien species and detection of possible hybridization between natives and invasive alien species; ii). Research on mode of dispersal of potential invasive plants. This would enable the effective eradication of these plants; and iii) Risk assessments on potential invasive plants.

RECOMMENDATIONS

It is now globally accepted that the unregulated sale of plants for the use of aquarium and aquatic landscaping results in the spread of invasive plants. Further, the easy access for the global markets via the internet makes the situation more complicated. Therefore, the policy makers need to pay more attention to this and introduce stringent guide lines and regulations to prevent further infestations of Sri Lankan water-bodies and wetlands. Further (i) risk assessments on the potential aquatics and developing appropriate monitoring programmes, (ii) outreach activities such as workshops and educational programmes for those engaged in the industry and officers involved in regulating the industry, (iii) establishing a single government body for coordinating issues related to IAS, (iv) educating hobbyists and general public via pamphlets and posters, and conducting school level programmes via societies would be effective methods in minimizing the future risks, (v) implementaion of immediate action on the newly detected and reported naturalized alien aquatics, and (vi), successful biological control methods already identified for IAS should be continued as total eradication is not possible.

CONCLUSIONS

The continuous growth of the ornamental aquatic plant industry in Sri Lanka greatly enhances the release of exotic ornamental aquatics with invasive potential to the natural environment. The industry has also been identified as one of the major pathway of introducing invasive plants globally.

The present study has generated a list of ornamental aquatic plants that are currently traded in Sri Lanka fulfilling the long felt need both for the betterment of the industry and also for the authorities responsible for industry.

As the industry is growing with a potential to establish as a stable foreign exchange generating venture in Sri Lanka the tension between the industry and the regulations implemented has to be taken into account when developing strategies in overcoming the negative impacts on the aquatic plant biodiversity.

The newly compiled list of ornamental aquatic plants would serve as a base for categorising the plants according to their risk factor which would help in reducing the future risks. Further, the list could be used in decision making process at entry or exit points to the country by the relevant authorities.

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REFERENCES

Abbott, R.J. (1992). Plant invasions, interspecific hybridization and the evolution of new plant taxa. *Trends in Ecology and Evolution* 7: 401–405.

Amarasinghe, L. and Eknaligoda, I.A. (1997). Some recent observations on the biological control of *Salvinia*. *Krushi* 16: 44-50.

Bambaradeniya, Channa (2008). Western Province Biodiversity Profile and Conservation Action Plan. Biodiversity Secretariat, Ministry of Environment and Natural Resources, Sri Lanka.

Bambaradeniya, Channa N.B. (2001). The status of Invasive Alien Species in Wetland Ecosystems of Sri Lanka. *Sri Lankan Biodiversity Review* 1: 54-65.

Bastmeijer, Jan D. (2012). The Crypts pages. http://crypts.home.xs4all.nl/Cryptocoryne/index.html (Accessed on 15th May 2012).

Booth, G. (2002). Aquarium Plant List. http://www.thekrib.com/Plants/Plants/big-plant-list.html (Accessed on 25th August 2012).

Bowmer, Kathleen H., Jacobs, S.W.L. and Sainty, G.R. (1995). Identification, Biology and Management of *Elodea canadensis*, Hydrocharitaceae. *Journal of Aquatic Plant Management* 33: 13-19.

Brunel, S. (2009). Pathway analysis: aquatic plants imported in 10 EPPO countries. Organisation Europe´enne et Me´diterrane´ e nne pour la Protection des Plantes/European and Mediterranean Plant Protection Organization Bulletin 39: 201–213.

Champion, P.D. and Clayton, J.S. (2000). Border control for potential aquatic weeds. Stage 1. Weed risk model. *Science for Conservation*: 141.

Champion, P. D., Clayton J. S. and Hofstra, D. E. (2010). Nipping aquatic plant invasions in the bud: weed risk assessment and the trade. *Hydrobiologia* 656:167–172.

Chapin, F. S., Zavaleta, E. S., Viner, V. T., Naylor, R. L., Vitousek, P. M., Sala, O. E., Reynolds, H. L., Hooper, D. U., Mack, R., Diaz, S. E., Hobbie, S. E. and Lavorel, S. (2000). Consequences of changing biodiversity. *Nature* 405: 234–242.

Debarawatta, R.D.N. and Yakandawala, K. (2009). An alien ornamental aquatic *Ludwigia sedioides* L. A threat to Sri Lankan water bodies? Proceedings of the 9th Agricultural Research Symposium, 11th - 12th August, 2009. Wayamba University of Sri Lanka. Pp. 381-385.

de Groot, P.J. (1993). Introduction and summary. In: Greathead, A. and de Groot, P. (Eds). Control of Africa's floating water weeds. Berks, UK: CAB International. p 1–4.

Didham, R. K., Tylianakis, J. M., Hutchison, M. A., Ewers, R.M. and Gemmell. N. J. (2005). Are invasive species the drivers of ecological change? *Trends in Ecology and Evolution* 20: 470–474.

Donlan, C. J., Tershy, B. R., Cambell, K. and Cruz, F. (2003). Research for requiems: The need for more collaborative action in eradication of invasive species. *Conservation Biology* 17: 1850-1851.

Ellstrand, N. C. and Schierenbeck, K. A. (2006). Hybridization as a stimulus for the evolution of invasiveness in plants? *Euphytica* 148: 35–46.

Elton, C.S. (1958). The ecology of invasions by animals and plants. Metheum, London, UK.

FFPO, (2009). Fauna and Flora Protection Ordinance (Amendment) Act, No. 22 of 2009, Published as a supplement to Part II of the Gazette of the Democratic Socialist Republic of Sri Lanka, April 24, 2009.

Gurevitch, J. and Padilla, D. (2004). Are invasive species a major cause of extinctions? *Trends in Ecology and Evolution* 19: 470–474.

Harris, Carla J., Murray, Brad R., Hose, Grant C., and Hamilton, Mark A. (2007). Introduction history and invasion success in exotic vines introduced to Australia. *Diversity and Distributions* 13: 467-475.

IPNI, (2004). International Plant Names Index (IPNI) http://www.ipni.org/index.html (accessed on 2013-01-31).

Kadono, Yasuro (2004). Alien Aquatic Plants Naturalized in Japan: History and Present Status. *Global Environmental Research* ©2004 AIRIES 8(2)/2004: 163-169.

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

Les, D.H. (1996). *Hydrilla verticillata* threatens New England. *Aquatic Exotic News* 3 (1): 1-2.

Les, D.H. and Mehrhoff, L.J. (1999). Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. Greater New England Symposium on the Ecology of Invasive Species, Yale School of Forestry & Environmental Studies, New Haven, CT.

Lowe, S., Browne, M., Boudjelas, S., and De Poorter, M. (2000). *100 of the World's Worst Invasive Alien Species. A selection from the Global Invasive Species Database.* The Invasive Species Specialist Group (ISSG) a specialist group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN).

Maki, K. and Galatowitsch, S. (2004). Movement of invasive aquatic plants into Minnesota (USA) through horticultural trade. *Biological Conservation* 118: 389–396.

Marambe, B. (2000). Need for a coordinated strategy to control alien invasive plants in Sri Lanka. In: Marambe, B. (Ed.) Proceedings of the Symposium on "Alien Invasive Species in Sri Lanka: Impact on ecosystems and management". Ministry of Forestry and Environment, Sri Lanka. 13-24.

Marambe, B. (2001). Alien invasive plants in the central province of Sri Lanka. *Sri Lankan Biodiversity Review* 1: 21-30.

Marambe, B. (2008). Research Priorities on invasive alien plants in Sri Lanka. In: Ranwala S. M.W., (Ed.) Proceedings of National Symposium on Invasive Alien Species (IAS 2008). 11th November 2008, Sri Lanka Foundation Institute, Colombo 07.

MOE (2012). The National Red List 2012 of Sri Lanka; Conservation Status of the Fauna and Flora. Ministry of Environment, Colombo, Sri Lanka. viii + 476pp

Padilla, D.K., and Williams, S.L. (2004). Beyond ballast water: aquarium and ornamental trades as sources of invasive species in aquatic ecosystems. *Frontiers in Ecology and the Environment* 2:131-138.

Petroeschevsky, A., and Champion, P. D. (2008). Preventing further introduction and spread of aquatic weeds through the ornamental plant trade. 16th Australian Weed Conference, Cairns. Pp. 200-302.

Rai, D.N., and Datta Mushi J. (1978). The influence of thick floating vegetation (Water hyacinth: *Eichhornia crassipes*) on the physico-chemical environment of a freshwater wetland. *Hydrobiologia* 62: 65-69.

Randall, J. M. and Marinelli, J. (1996). Invasive Plants: Weeds of the Global Garden. Brooklyn Botanic Garden, Brooklyn, NY.

Randall, R.P. (2012). A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia.

Ranwala, Sudheera M.W. and Rizana, Hafiz (2008). Prioritizing invasive alien plants in Sri Lanka. In: Ranwala S. M.W., (Ed.) Proceedings of National Symposium on Invasive Alien Species (IAS 2008). 11th November 2008, Sri Lanka Foundation Institute, Colombo 07.

Reichard, S. (2001). The search for patterns that enable prediction of invasion. In: Groves, R.H., Panetta, F.D. and Virtue, J.G. (Eds.) Weed Risk Assessment, pp 10–19. CSIRO Publishing, Melbourne, Australia.

Ruiz, G.M., Carlton, J.T., Grosholz, E.D., and Hines, A.H. (1997). Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent, and consequences. *American Zoologist* 37: 621–32.

Ruzek, Kenneth V., Jr. (1996-2007). Master Index of Freshwater Fishes (Aquatic Plant Supplement) http://www.webcityof.com/aplaaan.htm . (Accessed on 15th August 2012).

Sandlund, O., Schei, P., and Viken, Å. (1999). Invasive species and biodiversity management. Dordrecht, Netherlands: Kluwer.

Senaratne, J.E. (1943). *Salvinia auriculata* Aublt. A recently introduced free floating weed. *Tropical Agriculturists*. XCIX: 146-149.

Seneviratne, Nadeera (2002). Island Midweek Review: Selling the wild for a dime http://www.island.lk/2002/03/06/midwee07.html (Accessed on 22nd December 2011)

Slocum, Perry D. (2005). Waterlilies and lotuses: species, cultivars, and new hybrids. Timber Press, Inc., USA. Pp. 1-208.

Slocum, Perry D., Robinson, Peter and Perry, Frances (1996). Water Gardening: Water Lilies and Lotuses. Timber Press, Inc. USA. Pp. 1-208.

Téllez, Trinidad Ruiz, López, Elsa Martín de Rodrigo, Granado, Gloria Lorenzo, Pérez, Eva Albano, López, Ricardo Morán and Guzmán, Juan Manuel Sánchez (2008). The Water Hyacinth, *Eichhornia crassipes*: an invasive plant in the Guadiana River Basin (Spain). *Aquatic Invasions* 3 (1): 42-53.

The Plant List (2010). Version 1. Published on the Internet; http://www.theplantlist.org/ (accessed 2013-07-01).

Tiebre, Marie-S., Bizoux, Jean-P., Hardy, O. J., Bailey J. P. and Mahy, G. (2007). Hybridization and morphogenetic variation in the invasive alien *Fallopia* (Polygonaceae) complex in Belgium. *American Journal of Botany* 94 (11): 1900-1910.

Tropicos.org. Missouri Botanical Garden. http://www.tropicos.org (Last accessed 2013-01-31)

Triet, T., LanThi, N., Storrs, M. J. and Kiet, L. C. (2001). The value of awareness and early intervention in The management of alien invasive species: A case study on the eradication of *Mimosa pigra* at Tram Chim National park and U Minh Thuong Nature Reserve, Vietnam. In *Assessment and management of alien species that threaten ecosystems, habitats and species. Abstracts of keynote addresses and posters presented at the sixth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, held in Montreal, Canada, from 12 to 16 March 2001. Montreal, SCBD, 123p. (CBD Technical Paper no. 11).*

USDA ARS Germplasm Resources Information Network (GRIN) (2009) http://www.ars-grin.gov/ (Last accessed 2013-01-31)

van Dam, R.A., Finlayson, C.M., and Humphrey, C.L. (1999). Wetland risk assessment. In: Finlayson, C.M. and Spiers, A.G., (Eds.) Techniques for enhanced wetland inventory and monitoring. Supervising Scientist Report 147, Supervising Scientist, Canberra, 83–118.

Veitch, C.R. and Clout, M.N. (2002). Turning the Tide: the Eradication of Invasive Species. *Proceedings of the International conference on the eradication of island invasives*. IUCN Species Specialist Group. Gland, Switzerland and Cambridge, UK.

Williams, R.A. (1956). *Salvinia auriculata* Aubl. The chemical eradications of a serious aquatic weed in Ceylon. *Tropical Agriculturist* 33 (2): 143-157.

Yakandawala, Deepthi and Yakandawala, Kapila (2007). Ornamental Aquatics: Potential Weeds in Aquatic Ecosystems. In: Marambe, B., Sangakkara, U.R., De Costa, and Abeysekara, A.S.K. (Eds). 21st Asian Pacific Weed Science Society (APWSS) Conference, 2-6th October 2007, Colombo, Sri Lanka, Pp. 522-525.

Yakandawala, K. (2009). Long term observations on escaped ornamental aquatics in the wet zone of Sri Lanka. National symposium on invasive alien species, 21- 22 May 2009. Negambo, Sri Lanka. Organized by the Biodiversity Secretariat, Ministry of Environment and Natural Resources, in collaboration with Agriculture Education Unit of University of Peradeniya and Institute of Biology, Sri Lanka. p 23.

Yakandawala Deepthi, and Yakandawala, Kapila (2011). Hybridization between natives and invasive aliens: an overlooked threat to the biodiversity of Sri Lanka. *Ceylon Journal of Science* 40 (1): 13-23.

Yakandawala, K. and Dissanayake, D.M.G.S. (2010). *Mayaca fluviatilis* Aubl. : An ornamental aquatic with invasive potential in Sri Lanka. *Hydrobiologia* 656 (1): 199-204.

Annex 1 : List of ornamental aquatic plants generated from the study

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Legends for abbreviations

Status as a Weed (as in 'A Global Compendium of Weeds' (Randall, 2012)) : A = Agricultural Weed; C = Cultivation Escape; E=Environmental; Weed; G = Garden Escape; I = Invasive; N = Naturalised; nc = unconfirmed naturalization; Q = Quarantine Weed; S = SleeperWeed;
U = Casual Alien ; v = Native Weed; W = Weed; X = Noxious Weed ; Z = Contaminant

Origin: N = Native; E = Endemic; Ex = Exotic, C = Cultivated

Invasive Status in Sri Lanka: I = Invasive ; PI = Potential Invasive

Conservation Status (as in The National Red list (MOE, 2012)): NE = Not Evaluated; LC = Least Concern; EN= Endangered; NT = Near Threatened; VU = Vulnerable CR = Critically Endangered.

[1] Species of Echinodorus have been identified as potential invasives in Sri Lanka

Name used in the trade	*Scientific Name*	*Synonym / Comments*	*Status as a Weed* (Randall, 2012)	*Origin*	*Invasive Status*	*Conservation Status*
Acanthaceae						
Hemigraphis rependa	*Hemigraphis repanda* Lindau	-	A	Ex	-	-
Hemigraphis minima	-	Not a scientific name. Plant by this name is available on the web.	-	Ex	-	-
Hemigraphis colorata/ Hemographics colorata	*Hemigraphis alternata* (Burm.f.) T.Anderson	*Hemigraphis colorata* (Blume) Hallier f.	E,N,W,C	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Hemographis species	*Hemigraphis* sp.	-	-	Ex	-	-
Hygrophila ammaniya	-	Not a scientific name.	-	Ex	-	-
Hygrophila difformis	*Hygrophila difformis* Blume/ *Hygrophila difformis* (L.f.) Sreem. & Bennet	Both are unresolved names	C,S,N,W,E	Ex	-	-
Hygrophila difformis submerse	*Hygrophila difformis* 'Submerse'	-	-	Ex	-	-
Hygrophila costata	*Hygrophila costata* Nees	-	C,E,N,I,W,Q	Ex	-	-
Hygrophila corymbosa	*Hygrophila corymbosa* Lindau	-	W,N	Ex	-	-
Hygrophila corymbosa v."Stricta"	*Hygrophila corymbosa* 'Stricta'	-	-	Ex	-	-
Hygrophila corymbosa Compacta	*Hygrophila corymbosa* 'Compacta'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Hygrophila RosaNervis Hygrophylla rosanrivus/ Hygrophilla rosanervis Hygrophila rosaneerva Hygrophila 'Rosanervig'	*Hygrophila polysperma* 'Rosanervis'	-	-	Ex	-	-
Hygrophila salicifolia	*Hygrophila salicifolia* Nees	-	A,W N	-	LC	-
Hygrophylla angustifolia/ Hygrophilla Angustifolia	*Hygrophila angustifolia* R.Br.	-	W	Ex	-	-
Hygrophylla polyspema	*Hygrophila polysperma* (Roxb.) T. Anderson	-	N,W,Q,I, C,X,E,Z	Ex	-	-
Hygrophyla ceylonese	*Hygrophila polysperma* 'Ceylon'	This is a broader leaf type of *Hygrophila polysperma* from Sri Lanka	-	Ex	-	-
Hygrophila polysperma 'Round leaf'	*Hygrophila polysperma* 'Round leaf'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Hygrophylla sticta	*Hygrophila stricta* Hassk. / *Hygrophila stricta* Lindau	Both are unresolved names	Ex	-	-	-
Hygrophylla sinema	-	Could be Hygrophila corymbosa cv. 'Siamensis'[1]	-	Ex	-	-
Hygrophyla lacustris	*Hygrophila costata* Nees	Hygrophila lacustris (Cham. & Schltdl.) Nees	W	Ex	-	-
Hygrophyla salicifolia	*Hygrophila salicifolia* Nees	-	A,W	-	-	-
Hygrophilla Sinemancies	*Hygrophila corymbosa* 'Siamensis'	-	-	Ex	-	-
Hygrophila guyanensis/ Hygrophila guyansis	*Hygrophila costata* Nees	*Hygrophila guianensis* Nees ex Benth.	W,N,Q,E,C,I	Ex	-	-
Hygrophila sp." Red "	*Hygrophila* 'Red'	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Nomophila chereleae / Nomaphila 'Cherry leaf'/ Nomophila cherileaf	*Nomaphila* 'Cherry leaf'	-	-	Ex	-	-
Nomophila corimbosa	*Nomaphila corymbosa* Blume	-	-	Ex	-	-
Nomaphila corymbosa 'Compacta'	*Nomaphila corymbosa* 'Compacta'	-	-	Ex	-	-
Nomophila siamensis	*Nomaphila siamensis* C.B.Clarke	-	-	Ex	-	-
Nomophila sticta	*Nomaphila stricta* Nees	-	A	Ex	-	-
Nomaphila species 'Long leaf'	*Nomaphila* 'Long leaf'	-	-	Ex	-	-
Staurogyne repens	*Staurogyne repens* (Nees) Kuntze	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Acoraceae						
Accorus calamvus/ Acccorus Calamus	*Acorus calamus* L.	-	N,A,I,E,W,C	N	-	NE
Accorus pusillus	*Acorus gramineus* Sol	*Acorus pusillus* Siebold *Acorus gramineus* 'Pusillus' is also an aquarium plant	C,U,N,W	Ex	-	-
Accorus varigatus	*Acorus gramineus* 'Variegatus'					
Acorus species	*Acorus* sp.	-	-	-	-	-
Alismataceae						
Echinodorus acuccularis	-	Not a scientific name. Probably a spelling mistake.	-	Ex	-	-
Echinodorus amazonicus	*Echinodorus grisebachii* Small.	*Echinodorus amazonicus* Rataj	W	Ex	PI[2]	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus angustifolius	*Helanthium bolivianum* (Rusby) Lehtonen & Myllys.	*Echinodorus angustifolius* Rataj	Q	Ex	-	-
Echinodorus aquaris	-	Not a scientific name. Probably a spelling mistake.	-	Ex	-	-
Echinodorus aquatica	*Echinodorus* 'Aquartica'	-	-	Ex	-	-
Echinodorus argentinensis	*Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli.	*Echinodorus argentinensis* Rataj	W	Ex	-	-
Echinodorus aschersonianus	*Echinodorus uruguayensis* Arechav.	*Echinodorus aschersonianus* Graebn.	E,W,A,Q,S	Ex	-	-
Echinodorus barthigensergis	-	Not a scientific name. Probably a spelling mistake.	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus Bartthi	*Echinodorus uruguayensis* Arechav.	*Echinodorus bartthi* H.Mühlberg	E,W,A,Q,S	Ex	-	-
Echinodorus beheri (peniculatus) Echinodorus bleheri.	-	This could be *Echinodorus bleherae* Rataj which is now a synonym of *E. grisebachii* Small	-	Ex	-	-
Echinodorus berteroi	*Echinodorus berteroi* (Spreng.) Fassett	-	W,A,v,Q,S,N	Ex	-	-
Echinodorus cordifolius/ Echinodorus cardifolius	*Echinodorus cordifolius* (L.) Griseb.	-	A,W,Q,S,E,v,	Ex	-	-
Echinodorus decumbens	*Echinodorus decumbens* Kasselm.	-	-	Ex	-	-
Echinodorus Erwindofolius	-	Not a scientific name. Probably a spelling mistake.	-	Ex	-	-
Echinodorus farviflorus	*Echinodorus grisebachii* Small	*Echinodorus parviflorus* Rataj	W	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus grandifolius	*Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli	-	A,W,E	Ex	-	-
Echinodorus Harbich /Echinodorus harbitch	-	Not a scientific name. Probably a spelling mistake. However this name is available on the web	-	Ex	-	-
Echinodorus horemanii	*Echinodorus uruguayensis* Arechav.	*Echinodorus horemanii* Rataj	E,W	Ex	-	-
Echinodorus latifolius	*Helanthium bolivianum* (Rusby) Lehtonen & Myllys	*Echinodorus latifolius* (Seub.) Rataj	E,W	Ex	-	-
Echinodorus major	*Echinodorus major* (Micheli) Rataj	-	-	Ex	-	-
Echinodorus martii v. " Florida Aquatic"	*Echinodorus martii* 'Florida Aquatic'	*Echinodorus martii* Micheli is an illegitimate name	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus muricatus	*Echinodorus floribundus* (Seub.) Seub.	*Echinodorus muricatus* Griseb.	E,W,A	Ex	-	-
Echinodorus osiris	*Echinodorus uruguayensis* Arechav.	*Echinodorus osiris* Rataj	E,W	Ex	-	-
Echinodorus leopard/ Echinodorus leperd	*Echinodorus* 'Ozelot'	*Echinodorus* x "Ozelot" (= E. schluteri 'Léopard' x E. x-barthii)	-	Ex	-	-
Echinodorus ozelto Echinodorus ozelot Echinodorus ozebat	*Echinodorus* 'Ozelot	-	-	Ex Ex Ex	-	-
Echinodorus parva	-	Not a scientific name. But a plant by this name is available on the web	-	Ex	-	-
Echinodorus parvifolius	*Echinodorus grisebachii* Small	*Echinodorus parviflorus* Rataj	W	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus parvifolius 'Tropica'/Echinodorus par. 'Tropica'	*Echinodorus parviflorus* 'Tropica'	-	-	Ex	-	-
Echinodorus pernensis	-	This could be E. parviflorus 'Peruensis'	-	Ex	-	-
Echinodorus Red flame	*Echinodorus* 'Red Flame'	-	-	Ex	-	-
Echinodorus redrubin	*Echinodorus* 'Red Rubin'	-	-	Ex		
Echinodorus Rosea/ Echinodorus Rose	*Echinodorus* 'Rose'	-	-	Ex	-	-
Echinodorus subalatus	*Echinodorus subalatus* (Mart. ex Schult.f.) Griseb.	-	A	Ex	-	-
Echinodorus subalata 'Pornty leaf'	*Echinodorus subalatus* 'Pornty leaf'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echinodorus schlueteri	*Echinodorus cordifolius*(L.) Griseb.	*Echinodorus schlueteri* Rataj	A,W,Q,S,E,N	Ex	-	-
Echinodorus Tenellus/ Echinodorus tenneulus/ Echinodorus tenelus/ Echinodorus tenulusus	*Echinodorus tenellus* (Mart. ex Schult.f.) Buchenau.	*Helanthium tenellum* (Mart. ex Schult.f.) J.G.Sm.	W	Ex	-	-
Echinodorus uruguayensis	*Echinodorus uruguayensis* Arechav.	-	E,W	Ex	-	-
Echinodorus uguensis	-	Not a scientific name. Probably a spelling mistake.	-	Ex	-	-
Echinodorus vivipara	-	This could be *Eleocharis vivipara* Link.	-	Ex	-	-
Echonodorus marblequeen	*Echinodorus cordifolius* 'Marble Queen'	-	-	Ex	-	-
Echonodorus quarricostatus	*Helanthium bolivianum* (Rusby) Lehtonen & Myllys	*Echinodorus quadricostatus* Fassett	Q	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Echonodorus tropica	*Echinodorus parviflorus* 'Tropica'	-	-	Ex	-	-
Echinodorus spp	*Echinodorus* sp.	-	-	Ex	-	-
Hydrocleys nymphoides	*Hydrocleys nymphoides* (Humb. & Bonpl. ex Willd.) Buchenau	-	E,N,W, A,X,Q,U	Ex	-	-
Sagateriya gramini	*Sagittaria graminea* Michx.	-	N,Q,W, E,U,X	Ex	-	-
Sagittaria latifolia 'Flore Pleno'	*Sagittaria latifolia* 'Flore Pleno'	-	-	Ex	-	-
Sagittaria platyphylia	*Sagittaria platyphylla* (Engelm.) J.G.Sm.	-	W,Q,I N,U,E	Ex	-	-
Sagittaria polysphyla	-	Not a scientific name. Probably a spelling mistake.	-	-	-	-
Sagittaria pusilla	*Sagittaria subulata* (L.) Buchenau Nutt.	Sagittaria pusilla	U,W,Q,N,E	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Sagittaria sagittifolia	*Sagittaria sagittifolia* L.	-	A,Q,W,I E,U,X	Ex	-	-
Sagittaria subulata	*Sagittaria subulata* (L.) Buchenau	-	U,W,Q,N,C,E	Ex	-	-
Sagittaria	*Sagittaria* sp.	-	-	-	-	-
Amaranthaceae						
Alternanthera bettzickiana	*Alternanthera bettzickiana* (Regel) G. Nicholson	-	N,W,E,C	C	-	-
Althenethhra bettzickiana red	*Alternanthera bettzickiana* 'Red'	-	-	Ex	-	-
Althenethhra bettzickiana green	*Alternanthera bettzickiana* 'Green'	-	-	Ex	-	-
Althenethhra cardinalis/ Althenethhra Cardinalis	*Alternanthera reineckii* 'Cardinalis'	-	-	Ex	-	-
Althenethhra liliacina/ Althenethhra liliachina	*Alternanthera reineckii* 'Lilacina'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Alternanthera liliensis	-	Not a scientifc name. Probably a spelling mistake and could be *Alternanthera reineckii* 'Lilacina'	-	-	-	-
Altheneththra reinceckii	*Alternanthera reineckii* Briq.	-	N	Ex	-	-
Alternanthera reineckii 'Varigated'	*Alternanthera reineckii* 'Variegated'	-	-	Ex	-	-
Altheneththra sessilis	*Alternanthera sessilis* (L.) R.Br. ex DC.	-	N,I,A,U, W,X,Z,E	N	-	-
Alternanthera spp. 'Green'	*Alternanthera* 'Green'	*Alternanthera bettzickiana* 'Green'/*Alternanthera ficoidea* 'Green' or even could be another	-	Ex	-	-
Alternanthera spp. 'Red'	*Alternanthera* 'Red'	*Alternanthera bettzickiana* 'Red' /*Alternanthera reineckii* 'Red' or even could be another	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Althenetthra osipus	*Alternanthera ficoidea* 'Ocipus'	-	-	Ex	-	-
Alternanthera rubra	*Alternanthera sessilis* 'Rubra'	-	-	Ex	-	-
Alternanthera roseafolia	*Alternanthera reineckii* 'Rosaefolia'	-	-	Ex	-	-
Althenetthra species	*Alternanthera* sp.	-	-	-	-	-
Amaryllidaceae						
Crinum aquatica	-	This could be *Crinum campanulatum* Herb. where *Crinum aquaticum* Herb. and *Crinum aquaticum* Burch. ex Spreng. are synonyms	-	Ex	-	-
Crinum thaianum	*Crinum thaianum* J. Schulze	-	-	Ex	-	-
Hymenocallis caribaea 'Variegata'	*Hymenocallis caribaea* 'Variegata'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Anthericaceae (Now under Asparagaceae)						
Chlorophyllum bicheii / Chlorophytum Buchetii	-	Not a scientific name. Could be *Chlorophytum bichetii* Backer which is a synonym of *Chlorophytum laxum* R.Br. This is an ornamental plant and native	-	-	-	-
Apiaceae						
Lilaeopsis brasiliensis	*Lilaeopsis brasiliensis* (Glaz.) Affolter	-	-	Ex	-	-
Liliopsis novazelandea/ Lilliops novaezelandiae/ Lilaeopsis novaezelandiae	*Lilaeopsis novae-zel andiae* A.W.Hill	-	-	Ex	-	-
Aponogetonaceae						
Aponogeton crispus	*Aponogeton crispus* Thunb	-	-	N	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Aponogeton natans	*Aponogeton natans* (L.) Engl. & K.Krause	-	-	N	-	-
Apponogeton natans 'Round leaf'	*Aponogeton natans* 'Round leaf'	-	-	-	-	-
Aponogeton madagascarensis	*Aponogeton madagascariensis* (Mirb.) H. Bruggen	-	-	Ex	-	-
Aponogeton rigidifolius/regidifolius	*Aponogeton rigidifolius* H. Bruggen	-	-	E	-	-
Aponogeton ulvasus	*Aponogeton ulvaceus* Baker	-	-	Ex	-	-
Aponogeton undulatus	*Aponogeton undulatus* . Roxb	-	Q	Ex	-	-
Araceae						
Anglonema species	*Aglaonema* sp.	-	-	C	-	-
Anubias afzeli	*Anubias afzelii* Schott	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Anobiasbarteri/ Anubias barteri	*Anubias barteri* Schott	-	-	Ex	-	-
Anubias barteri 'Broad leaf'	*Anubias barteri* 'Broad leaf'	-	-	Ex	-	-
Anobias congensis/ conagensis	*Anubias congensis* N.E. Br.	-	-	Ex	-	-
Anubias gigantea	*Anubias gigantea* A. Chev. ex Hutch.	-	-	Ex	-	-
Anubias gracillis	*Anubias gracilis* A. Chev. ex Hutch.	-	-	Ex	-	-
Anobias hastifolia	*Anubias hastifolia* Engl.	-	-	Ex	-	-
Anubias heterophyla	*Anubias heterophylla* Engl.	-	-	Ex	-	-
Anubias lanceolata	*Anubias lanceolata* N.E.Br.	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Anubias nana	*Anubias nana* Engl.	-	-	Ex	-	-
Anubias bonsai	*Anubias* 'Bonsai'	*Anubias barteri* 'Bonsai'/*Anubias barteri* var. nana 'Bonsai' all could be the same plant	-	Ex	-	-
Caladium species	*Caladium* sp.	-	-	C	-	-
Colocasia esculenta 'Black Magic'	*Colocasia esculenta* 'Black Magic'	-	-	Ex	-	-
Cryptocoryne affinis	*Cryptocoryne affinis* N.E.Br.	-	-	Ex	-	-
Cryptocoryne becketi	*Cryptocoryne beckettii* Trimem	-	E,W,N	E	-	VU
Cryptocoryne becketi brown	*Cryptocoryne beckettii* 'Brown'	-	-	E	-	-
Cryptocoryne becketi green	*Cryptocoryne beckettii* 'Green'	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Cryptocoryne walkari	*Cryptocoryne walkeri* Schott	-	-	E	-	CR
Cryptocoryne wenditi	*Cryptocoryne wendtii* de Wit	-	N,C	E	-	VU
Cryptocoryne wendit mioya	*Cryptocoryne wendtii* 'Mioya'	-	-	-	-	-
Cryptocoryne wenditi broadleaf	*Cryptocoryne wendtii* 'Broad leaf'	-	-	-	-	-
Cryptocoryne wenditi green	*Cryptocoryne wendtii* 'Green'	-	-	-	-	-
Cryptocoryne wenditi red	*Cryptocoryne wendtii* 'Red'	-	-	-	-	-
Cryptocoryne willisi	*Cryptocoryne* × *willisii* Reitz.	-	-	E	-	CR
Cryptocoryne blassii	*Cryptocoryne cordata* var. *cordata*	*Cryptocoryne blassii* de Wit	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Cryptocoryne nevilli	*Cryptocoryne nevillii* Trimen	-	-	E	-	EN
Cryptocoryne parva	*Cryptocoryne parva* de Wit	-	-	E	-	EN
Cryptocoryne pigmia/ Cryptocoryne pygmea	*Cryptocoryne pygmaea* Merr.	-	-	Ex	-	-
Cryptocoryne twaitesii	*Cryptocoryne thwaitesii* Schott	-	-	E	-	EN
Cryptocoryne undulatus	*Cryptocoryne undulata* Wendt	-	-	E	-	CR
Cryptocoryne Petchii	*Cryptocoryne beckettii* Trimem	*Cryptocoryne petchii* Alston	-	E	-	-
Cryptocoryne longicauda	*Cryptocoryne longicauda* Becc. ex Engl.	-	-	Ex	-	-
Cryptocoryne lucens	*Cryptocoryne* × *willisii* Reitz.	*Cryptocoryne* × *lucens* de Wit	-	E	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Cryptocoryne pontederifolia	*Cryptocoryne pontederiifolia* Schott	-	-	Ex	-	-
Cryptocoryne spiralis	*Cryptocoryne spiralis* (Retz.) Fisch. ex Wydler	-	-	Ex	-	-
Cryptocoryne lutea	*Cryptocoryne lutea* Alston	-	-	Ex	-	-
Difenbachea species	*Dieffenbachia* sp.	-	-	C	-	-
Lagadandra lancifolia	*Lagenandra lancifolia* (Schott) Thwaites	-	-	E	-	EN
Lagadandra ovata	*Lagenandra ovata* (L.) Thwaites	-	-	N	-	LC
Lagadandra thwaitsii	*Lagenandra thwaitesii* Engl.	-	-	E	-	EN
Lemna gigas	*Lemna gibba* L.	Should be a spelling mistake should be *L. gibba*	N,W,Q,X,E	N	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Lemna minor	*Lemna minor* L.	-	E,W,Q,A, I,N,v,G	Ex	-	-
Pistia stratiots	*Pistia stratiotes* L.	-	N,IA,Q,W X,U,C,E,X	N	I	-
Spythyphyllum wilisi/ Spathyphyllum willisi/ Spthiphyllum Wallisii	*Spathiphyllum wallisii* Regel	-	N,C	Ex	-	-
Syngonium podophyllum	*Syngonium podophyllum* Schott	-	N,I,Q,E,I,W,S	Ex	-	-
Syngonium whitebutterfly	*Syngonium podophyllum* 'Whitebutterfly'	-	-	Ex		-
Syngonium 'Infra red'	*Syngonium podophyllum* 'Infra Red'	-	-	Ex	-	-
Syngonium 'Arrow'	*Syngonium* 'Arrow'	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Syngonium 'Green velvet'	*Syngonium* 'Green Velvet'	-	-	-	-	-
Syngonium Green	*Syngonium* 'Green'	-	-	-	-	-
Syngonium spp.	*Syngonium* sp.	-	-	-	-	-
Araliaceae						
Hygrocotyle verticulata/ Hydrocotyle verticillata	*Hydrocotyle verticillata* Thunb.	-	Q,W,N,I,E,X	Ex	-	-
Hydrocotyle leucoceophala	*Hydrocotyle leucocephala* Cham. & Schltdl.	-	Q,N,I,G,W,U	Ex	-	-
Hydrocotyle sp.	Hydrocotyle sp.	-	-	-	-	-
Asparagaceae						
Cordiline compacta	*Cordyline fruticosa* 'Compacta'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Asteraceae						
Gymnocoronis spiralis	-	Not a scientific name. Probably a spelling mistake.	-	-	-	-
Gymnocoronis spiranthoides	*Gymnocoronis spilanthoides* (D.Don ex Hook. & Arn.) DC.	-	N,E,U,W, A,Q,I,X,S,C	Ex	-	-
T5richocoronis rivularis	*Trichocoronis rivularis* A.Gray	-	U,N,C	Ex	-	-
Azollaceae (Now under Salviniaceae)						
Azolla caroliniana	*Azolla filiculoides* Lam.	*Azolla caroliniana* Willd.	N,A,W, I,X,E, N	Ex	-	-
Azolla filiculoides	*Azolla filiculoides* Lam.	-	I,N,X,Q, A,E,W,N	Ex	-	-
Balsaminaceae						
Impatiens spp.	*Impatiens* sp.	-	-	E	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Impetiens repens	I*mpatiens repens* Moon ex Wight	-	-	E	-	CR
Brassicaceae						
Cardamine lyrata	*Cardamine lyrata* Bunge	-	W,A	Ex	-	-
Cabombaceae						
Cabomba aquatica	*Cabomba aquatica* Aubl.	-	N,Q	Ex	-	-
Cabomba caroliniana	*Cabomba caroliniana* A. Gray	-	N,C,E,W,I, X,Q,U,i	C	-	-
Cabomba piauhyensis	*Cabomba furcata* Schult. & Schult.f.	*Cabomba piauhiensis* Gardner	N,Q	Ex	-	-
Cabomba pulcherrima	*Cabomba caroliniana* var. *pulcherrima* R.M.Harper	*Cabomba pulcherrima* (R.M.Harper) Fassett	A	Ex	-	-
Cabomba var. paucipartita	*Cabomba caroliniana* var. *paucipartita*[1]	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Cabumba red	*Cabomba* 'Red'	This is the common name of *Cabomba furcata* Schult. & Schult.f. where *Cabomba piauhiensis* Gardner is the synonym	-	-	-	-
Ceratophyllaceae						
Ceretophyllum demasum / Ceratophylum demersum	*Ceratophyllum demersum* L.	-	A,I,W,E, C,Q,X	N	-	-
Ceratophyllum demasum maxico	*Ceratophyllum demersum* 'Maxico'	-	-	-	-	-
Ceretophyllum maxico	*Ceratophyllum demersum* 'Maxico'	-	-	-	-	-
Ceratopyllum spp	*Ceratopyllum* sp.	-	-	-	-	-
Ceretophyllum bicheii	-	Not a scientific name. Probably a spelling mistake	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Convallariaceae (now under Asparagaceae)						
Ophiopogan jaburan/ Ophiopogon Juburan	*Ophiopogon jaburan* (Siebold) Lodd.	-	N,v,I	Ex	-	-
Ophiopogón jauran verigatus	*Ophiopogon jaburan* cv. 'Variegata'	-	-	Ex	-	-
Ophiopogan japonica	*Ophiopogon japonicus* (Thunb.) Ker Gawl.	-	N,I,W,U,v	Ex	-	-
Ophiopogon kyota/ Ophiogopon 'Kyoto'	*Ophiopogon japonicus* cv. 'Kyoto'	-	-	Ex	-	-
Cyperaceae						
Cladium species	*Cladium* sp.	-	-	Ex	-	-
Cyperus papyrus/ Cyperus paparise	*Cyperus papyrus* L.	-	N,C,W, I,A,Z	C	-	-
Cyprus alternifolius	*Cyperus alternifolius* L.	-	N,E,I,W,C	N	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Elecharis acicularis/ Eleocharis acciculari	*Eleocharis acicularis* (L.) Roem. & Schult.	-	N,A,E,W,Q	Ex	-	-
Elecharis vivipra	*Eleocharis vivipara* Link	-	W	Ex	-	-
Dracenaceae						
Dracena dermensis striped	*Dracaena deremensis* 'Striped'	*Dracaena deremensis* Engl. This name is a synonym of *Dracaena fragrans* (L.) Ker Gawl.	-	C	-	-
Dracena godseffoana	*Dracaena surculosa* var. *surculosa*	*Dracaena godseffiana* Sander ex Mast	-	C	-	-
Dracena marginata/ Dracena majinata	*Dracaena marginata* hort.	-	U,C,N	Ex	-	-
Dracena sandriana/ Dracena sandriyana	*Dracaena braunii* Engl.	*Dracaena sanderiana* Sander	C,N	C	-	-
Dracenae 'Sellex'	*Dracaena* 'Sellex'	-	-	-	-	-
Dracena varigatus	*Dracaena sanderiana* 'Variegatus'	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservat Status*
Eriocaulaceae						
Eriocaulon species	*Eriocaulon* sp.	-	-	-	-	-
Eriocaulon cinerum	*Eriocaulon cinereum* R.Br.	-	A,U,W,N,I	N	-	LC
Tonina fluitans/ Tonina fluitans spe.	*Tonina fluviatilis* Aubl.	-	A	Ex	-	-
Tonina	*Tonina* sp.	-	-	Ex	-	-
Fabaceae						
Aeschynomeme fluitans	*Aeschynomene fluitans* Peter	-	-	Ex	-	-
Haloragaceae						
Myriophyllum aquatica	*Myriophyllum aquaticum* (Vell.) Verdc.	-	I,E,N,X W,C,Q	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Myriophyllum brasilliense	*Myriophyllum aquaticum* (Vell.) Verdc.	*Myriophyllum brasiliense* Cambess.	I,E,N,X I,Q,W,A,C	Ex	PI	-
Myrophyllum mattogrosense	*Myriophyllum mattogrossensis* Hoehne	-	W	Ex	-	-
Myriophyllum indicum	*Myriophyllum indicum* Willd	This is an unresolved name	W	N	-	-
Myriophyllum paplostrum	-	Could be *Myriophyllum papillosum* Orchard	-	-	-	-
Myriophyllum scabaratum	*Myriophyllum pinnatum*(Walter) Sterns Britton, & Poggenb.	*Myriophyllum scabratum* Michx.	E,W	Ex	-	-
Myriophyllum verticillatum	*Myriophyllum verticillatum* L.	-	W,Q,C,A,N,E	Ex	-	-
Myriophyllum tuberculatum	*Myriophyllum tuberculatum* Roxb.	-	Q	Ex	-	-
Myriophyllum simulans	*Myriophyllum simulans* Orchard	-	U,N,E,W	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Hydrocharitaceae						
Blyxa alternifolius	*Blyxa japonica* var. *alternifolia* (Miq.) C.D.K.Cook & Luond.	Blyxa alternifolia (Miq.) Hartog.	-	Ex	-	-
Blyxa auberacii	*Blyxa aubertii* Rich.	-	N,A,W,E	N	-	LC
Blyxa echinosperma	*Blyxa echinosperma* (C.B.Clarke) Hook.f.	-	A,W	Ex	-	-
Blyxa heteroclita	-	Not a scientific name.	-	-	-	-
Blyxa japonicus	*Blyxa japonica* (Miq.) . Maxim ex Asch. & Gürke	-	N,A,W,I,E	Ex	-	-
Egeria densa / Egeria densa SPP	*Egeria densa* Planch.	-	N,I,Q,X, W,E,A,C	Ex	I	-
Egeria najas	*Egeria najas* Planch.	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Elodea densa	*Egeria densa* Planch.	*Elodea densa* (Planch.) Casp.	A,N,W,X E,Q,U,C	Ex	-	-
Hydrilla crispa Hydrilla (Elodea) Crispa	-	Not a scientific name. But *Hydrilla verticillata* var. *crispa* Casp. is an accepted name.	-	-	-	-
Hydrilla najans	-	Not a scientific name. Plant by this name is available on the web.	-	-	-	-
Hydrilla (Egeria) Najas	-	Not a scientific name. *Egeria najas* Planch. is a valid name	-	-	-	-
Hydrilla natans	-	Not a scientific name. Plant by this name is available on the web.	-	-	-	-
Hydrilla verticulata/ Hydrilla verticillata	*Hydrilla verticillata* (L.f.) Royle	-	A,Q,N,E, I,W,C,X,S	N	I	LC

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Hydrilla species	*Hydrilla* sp.	-	-	-	-	-
Hydrilla assorted	-	This might be a common name for a group	-	-	-	-
Hydrilla Densa	-	Not a scientific name. Could be *Egeria densa*, they are mixed up.	-	-	-	-
Hydrilla spe. 'King'	*Hydrilla* 'King'	-	-	-	-	-
Limnobium laevigatum	*Limnobium laevigatum* (Humb. & Bonpl.ex Willd.) Heine	-	N,Q,A	Ex	-	-
Najans indica	*Najas indica* (Willd.) Cham.	-	-	Ex	-	-
Najas antica	-	Not a scientific name. Probably a spelling mistake.	-	-	-	-
Najas grattenia	-	Not a scientific name. Could be *Najas graminea* Delile	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Otelia alismoides	*Ottelia alismoides* (L.) Pers.	-	A,N,Q,W, E,I,X	N	-	-
Ottelia ulvifolia	*Ottelia ulvifolia* (Planch.) Walp.	-	W	Ex	-	-
Otelia ovalifolia	*Ottelia ovalifolia* (R.Br.) Rich.	-	N,W,S,E	Ex	-	-
Otalia species	*Ottelia* sp.	-	-	-	-	-
Valisneriya americana	*Vallisneria americana* Michx.	-	U,N,W,C,E,I	Ex	-	-
Valisneriya asiatica	*Vallisneria natans* (Lour.) H.Hara	Vallisneria asiatica Miki	W	Ex	-	-
Valisneriya caulescens	*Vallisneria caulescens* F.M.Bailey & F.Muell.	-	-	Ex	-	-
Vallisneria nana	*Vallisneria nana* R.Br.	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Valisneriya gigantia	*Vallisneria nana* R.Br.	Vallisneria gigantea Graebn.	N,W,I,Q E,U,C	Ex	-	-
Valisneriya spiralis	*Vallisneria spiralis* L.	-	N,W,Q, C,E,A,I,U	N	-	-
Valisneriya torata/ Vallisneria torta	*Vallisneria spiralis* cv. 'Torta'	-	-	Ex	-	-
Vallisneria neotropica	*Vallisneria americana* Michx.	*Vallisneria neotropicalis* Vict.	U,N,W, I,E,A,C	Ex	-	-
Valisneriya assorted	*Vallisneria* 'Assorted'	-	-	-	-	-
Valianeria spp	*Valianeria* sp.	-	-	-	-	-
Hypnaceae						
Vesicularia dubyana / Vercicularia dubyana/ Vercicularia gubiana	*Vesicularia dubyana* (Müll. Hal.) Broth.	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Lamiaceae						
Eustralis apecies Brown leaf'	*Eusteralis* 'Brown leaf	-	-	-	-	-
Eustaralis stelata	*Pogostemon verticillatus* (Benth.) Bhatti & Ingrouille	*Eusteralis stellata* (Lour.) Majumdar	W	N	-	-
Lenthibulariaceae						
Utricularia spp.	*Utricularia* sp.	-	-	-	-	-
Lobeliaceae (Now under Campanulaceae)						
Labelia Cardinalis/ Lobeliya cardinalis/ Lobeliya cardinalis	*Lobelia cardinalis* L.	-	W	Ex	-	-
Lobelia zeylanica	*Lobelia zeylanica* L.	-	W,N	N	-	-
Lobella arcuata	-	Not a scientific name. This could be *Ludwigia arcuata* Walter	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Lythraceae						
Ammania gracillis/ Ammaniya grasselis/ Amania grasilis	*Ammannia gracilis* Guill. & Perr.	-	-	Ex	-	-
Ammania senegallensis	*Ammannia senegalensis* Lam.	-	W	Ex	-	-
Didiplis diandra	*Didiplis diandra* (Nutt. ex DC.) Alph.Wood	-	-	Ex	-	-
Nesaea species	*Nesaea* sp.	-	-	Ex	-	-
Rotala mayaka	-	Not a scientific name.	-	-	-	-
Red Rotala	-	Common name for *Rotala macrandra* Koehne	-	-	-	-
Rotala macarantha/ Rotala macrandra	*Rotala macrandra* Koehne	-	U,N	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Rotala macarandra 'Green'	*Rotala macrandra* 'Green'	-	-	Ex	-	-
Rotala macarandra 'Red'	*Rotala macrandra* 'Red'	-	-	Ex	-	-
Rotala Macarandra red small	*Rotala macrandra* 'Red small'	These could be names used in trade	-	Ex	-	-
Rotala macrandra 'Small leaf'	*Rotala macrandra* 'Small leaf'	These could be names used in trade	-	Ex	-	-
Rotala macrandra 'Narrow leaf'	*Rotala macrandra* cv. 'Narrow leaf'	These could be names used in trade	-	Ex	-	-
Rotala rotundifolia	*Rotala rotundifolia* (Buch.- Ham. ex Roxb.) Koehne	-	A,W,Q,N	Ex	-	-
Rotala rotundifolia red	*Rotala rotundifolia* 'Red'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Rotala walichi/ Rotala wallichi	*Rotala wallichii* (Hook. f.) Koehne	-	-	Ex	-	-
Rotala najeshan/ Rotala species nanjenshan/Rotala 'nanjenshan'	*Rotala* 'Nanjenshan'	-	-	-	-	-
Rotala najean	-	This could be a spelling mistake of Rotala 'Nanjenshan', but plants by this name are available	-	-	-	-
Rotala species green	*Rotala* 'Green'	-	-	-	-	-
Rotala spp	*Rotala* sp.	-	-	-	-	-
Trapa bispinosa	*Trapa natans* var. *bispinosa* (Roxb.) Makino .	*Trapa bispinosa* Roxb	A,W	N	-	-
Trapa natans	*Trapa natans* L.	-	W,U,Q, X,C,E,I	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Marsiliaceae						
Marsilea crenata	*Marsilea crenulata* Desv	*Marsilea crenata* C. Presl	A,N,W,I,E	Ex	-	-
Marsilea quadrifolia	*Marsilea polycarpa* Hook. & Grev.	*Marsilea quadrifolia* L.	A,N,W E,Q,I	Ex	-	-
Mayacaceae						
Mayaca sellowiana/ Mayaca sellowiniana	*Mayaca madida* (Vell.) Stellfeld	*Mayaca sellowiana* Kunth	-	Ex	-	-
Mayaka vandellii	*Mayaca fluviatilis* Aubl.	*Mayaca vandellii* (Roem.) Schott & Endl.	-	Ex	-	-
Mayaca fluviatilis	*Mayaca fluviatilis* Aubl.	-	W,Q,N,X	Ex	PI	-
Menyanthaceae						
Nymphoides aquatica	*Nymphoides aquatica* (J.F. Gmel.) Kuntze	-	N,W,Q	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Nymphoides indica	*Nymphoides indica* (L.) Kuntze	-	A,W,I,E,N	N	-	-
Nymphoides pubscens	-	Not a scientific name.	-	-	-	-
Nympoides creneta	*Nymphoides crenata* (F. Muell.) Kuntze	-	E,W	Ex	-	-
Nymphoides crenata (White)	-	This could be a mis-identification of *N. indica?*	-	Ex	-	-
Nymphoides crenata (yellow)	*Nymphoides crenata* (F. Muell.) Kuntze	The color of the flower is indicated inside brackets?	-	Ex	-	-
Nymphodes species	*Nymphiodes* sp.	-	-	Ex	-	-
Nymphaeaceae						
Barclaya longifolius	*Barclaya longifolia* Wall.	-	-	Ex	-	-
Nupher japonica	*Nuphar japonica* DC.	-	W,N	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Nuphar spp - Blue flower Nuphar spp - white flower Nuphar spp - Pink flower	-	According to the images on the sale lists, these are misidentifications and are not *Nuphar* sp.	-	Ex	-	-
Nupher	*Nuphar* sp.	-	-	Ex	-	-
Nymphea assorted bicolour	-	-	-	-	-	-
Nymphea king of blues	-	This is a common name used for *Nymphaea* species including *Nymphaea capensis*	-	-	-	-
Nymphaea Luteum	-	Not a scientific name. This could be *Nymphaea lutea* L which is a synonym of *Nuphar lutea* (L.) Sm.	-	-	-	-
Nymphea Majenta	*Nymphaea* 'Majenta'	-	-	-	-	-
Nymphaea Lotos	*Nymphaea lotus* L.	-	-	-	-	-
Nymphea pink	-	Could be local names	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Nymphea stellata	*Nymphaea nouchali* Burm.f.	*Nymphaea stellata* Willd.	A,Q,W,I	N	-	LC
Nymphaea Stellata Pink flower Nymphaea Stellata White flower Nymphaea Stellata Red flower	-	According to the images on the sale lists, these are misidentifications. Any how these names are not accepted hybrids, but could be locally adopted names	-	-	-	-
Nymphea white	-	Could be local names	-	-	-	-
Nymphaea rubra	*Nymphaea rubra* Roxb. ex Andrews	-	U,N	N	-	-
Nymphaea micrantha	*Nymphaea micrantha* Guill. & Perr.	-	Q	Ex	-	-
Nymphea species green/ Nymphaea 'Green'	-	Could be local names	-	-	-	-
Nymphea tiger lotus	*Nymphaea* 'Tiger lotus'	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Nymphaea spp	*Nymphaea* sp.	-	-	-	-	
Nymphea species red/ Nymphaea 'Red'	-	Could be local names	-	-	-	-
Tiger lotus	-	This could be a common name for many, or *Nymphaea lotus*	-	-	-	-
Onagraceae						
Ludwigia acuata	*Ludwigiantha arcuata* (Walter) Small Walter	*Ludwigia arcuata*	N	Ex	-	-
Ludwia repens	*Ludwigia palustris* (L.) Elliott	*Ludwigia repens* J.R. Forst.	N,U,W, E,C,X,A,v	Ex	-	-
Ludwegia repens ' Variegated'	*Ludwigia repens* 'Variegated'	-	-	Ex	-	-
Ludwegia repens ' Ovalis'	*Ludwigia repens* 'Ovalis'	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Ludwigia repens 'Rubin'	*Ludwigia repens* 'Rubin'	-	-	Ex	-	-
Ludwegia repens spec. red (natans)	-	Not a scientific name, both plant species *L. repens* and *L. natans* are ornamental aquatics	-	Ex	-	-
Ludwigia ovalis	*Ludwigia ovalis* Miq.	-	A,W	Ex	-	-
Ludwigia incilata	*Ludwigia inclinata* (L.f.) M.Gómez	-	-	Ex	-	-
Ludwegia inclinata spe 'Green'	*Ludwigia inclinata* 'Green'	-	-	Ex	-	-
Ludwigia perennis	*Ludwigia perennis* L	-	I,A,W,N	N	-	LC
Ludwigia peruensis/ Ludwejia peruansis	-	Not a scientific name. In some sale lists on the web is it given as similar to *Ludwigia grandiflora*	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Ludwigia pulustris/ Ludwigia palustris	*Ludwigia palustris* (L.) Elliott	-	W,E,N,I,A	Ex	-	-
Ludwigia perruviansis	-	Not a scientific name. Probably a spelling mistake.	-	-	-	-
Ludwigia glandulosa	*Ludwigia glandulosa* Walter	-	-	Ex	-	-
Ludwigia sedioides	*Ludwigia sedioides* (Humb. & Bonpl.) H.Hara	-	-	Ex	PI	-
Ludvigiya Rubin	*Ludwigia repens* 'Rubin'	-	-	Ex	-	-
Ludwigia	*Ludwigia* sp.	-	-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Plantaginaceae (Previousely under Scrophulariaceae)						
Bacopa amplexiculis	*Bacopa amplexicaulis* (Pursh) Wettst.	-	N	Ex	-	-
Bacopa caroliniana	*Bacopa caroliniana* (Walter) B. L. Rob.	-	N,W,E	Ex	-	-
Bacopa caroliniana yellow flame	*Bacopa caroliniana* 'Yellow flame'	-	-	Ex	-	-
Bacopa crenata	*Bacopa crenata* (P.Beauv.) Hepper	-	W	Ex	-	-
Bacopa lanigera	*Bacopa lanigera* (Cham. & Schltdl.) Wettst.	-	W	Ex	-	-
Bacopa moneri	*Bacopa monnieri* (L.) Wettst	-	N, A,W, E ,I	N	-	-
Bacopa myrriophylloides	*Bacopa myriophylloides* (Benth.) Wettst.	-	-	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Bacopa	*Bacopa* sp.	-	-	-	-	-
Bacopa Varigatus	*Bacopa* 'Variegatus'	-	-	-	-	-
Gient bacopa/ Giant Red Bacopa	-	could be the common name of *Bacopa caroliniana* (Walter) B.L.Rob.	-	-	-	-
Hydrotriche hottoniflora	*Hydrotriche hottoniiflora* Zucc.	-	Ex	-	-	-
Limnophylla aquatica	*Limnophila aquatica*	Un-resolved name	-	N	-	LC
Limnophila aquatica Variegates	*Limnophila aquatica* 'Variegates'	-	-	-	-	-
Limnophylla heterophylla	*Limnophila heterophylla* (Roxb.) Benth.	-	I,W,A,E	N	-	NT
Limnophylla sessilifolia	*Limnophila sessiliflora* (Vahl) Blume	-	A,I,X,W, Z,E,N,Q	N	-	LC

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Limnophila aromaticoides	*Limnophila aromatica* (Lam.) Merr.	*Limnophila aromaticoides* Yang & Yen	A, W	N	-	LC
Limnophila aromaticoides 'Purple hybrid'	*Limnophila aromaticoides* 'Purple'	-	-	-	-	-
Limnophila aromatica	*Limnophila aromatica* (Lam.) Merr.	-	A,W	N	-	LC
Limnophila indica	*Limnophila indica* (L.) Druce	-	Q,X,W E,N,A	N	-	LC
Limnophila	*Limnophila* sp.	-	-	-	-	-
Micronthemum micranthemoides	*Micranthemum micranthemoides* (Nutt.) Wettst. ex Wettst.	-	-	Ex	-	-
Micranthemum umbrosum	*Micranthemum umbrosum* (J.F.Gmel.) S.F. Blake	-	W,X	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Polypodiaceae						
Microsorium peteropus	*Microsorum pteropus* (Blume) Copel	-	-	N	-	-
Microsorium pteropus 'Windelov'	*Microsorum pteropus* 'Windelov'	-	-	-	-	-
Pontederiaceae						
Eichonia crassipes	*Eichhornia crassipes* (Mart.) Solms	-	N,Q,U,W, I,E,X,Z,A ,C	Ex naturalized	I	-
Eichornia azzuria/ Eichonia azuerea	*Eichhornia azurea* (Sw.) Kunth	-	N,Q,A, W,E,X,Z	Ex	-	-
Heteranthera zosterfolia	*Heteranthera zosterifolia* Mart.	-	-	Ex	-	-
Potamogetonaceae						
Potamogeton crispus	*Potamogeton crispus* L.	-	W,A,I,N,X,E	Ex	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Potamogeton natans	*Potamogeton natans* L.	-	N,C,W,E,Q	Ex	-	-
Potamogeton pedunteris	-	Not a scientific name, Could be a spelling mistake	-	-	-	-
Potamogeton perfoliantus	*Potamogeton perfoliatus* L.	-	W,Q,I,C, E,N,X	N	-	-
Potomogeton species	*Potamogeton* sp.	-	-	-	-	-
Primulaceae						
Lysimachia nummuloria	*Lysimachia nummularia* L.	-	N,A,E, W,X,I	Ex	-	-
Pteridaceae						
Ceratopteris siliquosa	*Ceratopteris thalictroides* (L.) Brongn.	*Ceratopteris siliquosa* (L.) Copel.	A,N,I,U,C, E,W,v	N	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Ceratopteris thalictroides	*Ceratopteris thalictroides* (L.) Brongn.	-	N,A,W,I,E	N	-	-
Ricciaceae						
Riccia fluittans	*Ricciella fluitans* (L.) A. Braun	-	-	Ex	-	-
Salviniaceae						
Salvimia auriculata	*Salvinia auriculata* Aubl.	-	N,U,Q,A I,E,X,	Ex	-	-
Salvinia cucculata	*Salvinia cucullata* Roxb.	-	A,Q,W,E	Ex	-	-
Salvinia oblongifolia	*Salvinia oblongifolia* Martius	-	Q	Ex	-	-
Salvinia natans	*Salvinia natans* (L.) All.	-	W,A,Q, N,I,A,i	Ex	-	-
Salvinia	*Salvinia* sp.		-	-	-	-

Name used in the trade	*Scientific Name*	*Synonym/ Comments*	*Status as a Weed*	*Origin*	*Invasive Status*	*Conservation Status*
Saururaceae						
Houttunia podophyllum	-	Nqt a scientific name. Probably a spelling mistake of the genus Houttuynia	-	Ex	-	-
Houtuniya species (corvara)	*Houttuynia cordata* Thunb.	-	U,A,Q, W,X,C,E	Ex	-	-
Sarurus cernuus	*Saururus cernuus* L.	-	I,U,N,W,X,E	Ex	-	-
Saurorus chinensis	*Saururus chinensis* (Lour.) Baill.	-	A,Q,W	Ex	-	-
Selaginellaceae						
Selaginella wildenowi	*Selaginella willdenowii* (Desv. ex Poir.) Baker	-	A,N	Ex	-	-

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