A Study on *Ludwigiasedioides*: An Alien Ornamental Aquatic with Threats to Aquatic Ecosystems of Sri Lanka

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Abstract

Ornamental aquatic plant trade has been implicated as a significant pathway of plant introductions into new regions and this sector has grown substantially during the last decade in Sri Lanka. Most of the plants that have been introduced are not invasive; however, some of the introduced plants escape from cultivation and become pests of natural areas. *Ludwigiasedioides* (Humb. &Bonpl.) H. Harais a popular ornamental aquatic plant used in aquatic landscapes. It is a perennial, herbaceous plant belongs to the family Onagraceae and native to South America. A study revealed that the plant is naturalized in water bodies of the Gampaha District in Sri Lanka. Though this plant is not identified as a problematic plant elsewhere in the world, due to its rapid spread it can become a problematic plant in near future in Sri Lanka. Thus this plant has been recognized as a potential invasive plant in Sri Lanka. Hence, the present study was conducted with the objective of identifying the biology and effective control measures to prevent further spread of *L. sedioides*in Sri Lanka.

Site visits were made to Gampaha district and the exact location of the *L. sedioides* populations were detected by Geographic Information System (GIS) and the extent of the spread were recorded and the locations of the populations were mapped.*Ludwigiasedioides* was identified in two different locations at Pugoda and PahuruEla in Gampaha district. In PahuruEla, it was recorded over 2Km distance while inPugodaitwas recorded in 42 locations and scattered around 4 Km^2area. To detect the genetic variability, five individuals each were collected from Pugoda, PahuruEla and plant outlets from Colombo and Kandy. Based on 33 polymorphic bands obtained from the molecular marker study, a genetic distance matrix and a dendogram were constructed using RAP Distance software. As revealed by the distance matrix, the average genetic distance between all combinations of germplasm accessions was 0.09, indicating a close genetic relatedness among all genotypes. The plant is propagated through vegetative means and this could be the reason for close genetic relatedness among genotypes. Therefore, control methods need to be implemented immediately before the development of genotypes, adapted to the local environmental conditions.

A propagation study was conducted to identify the most effective cutting type and the length that is capable of regenerating into a plantlet. Six different lengths (viz. 1, 2, 4, 6, 8 and 10 cm) belong to two different cutting types (top and stem cutting) were used as treatments. All cutting types of the six different lengths produced roots. However, significantly high length increments and root dry weights were recorded in the top cuttings.

Therefore, top cuttings performed better than stem cuttings. Among top cuttings, 4 and 6 cm long cuttings recorded significantly high length increment while 6 cm cuttings recorded significantly high root dry weights. Therefore, compared to other cutting types, the best performance was recorded in 6 cm long top cuttings. All the stem cutting types indicated a very good potential to survive as all cutting types irrespective of the stem length recorded above 70% survival rates. It is imperative to note that even a 1 cm long pieces of top and stem cuttings survived and recorded a 80% and 12% survival rates respectively. Therefore, during management of *L. sedioides*, any attempts in mechanical control may result in fragmentation and even a 1 cm fragment could lead to further spread.

To determine the efficacy of chemical control of *L. sedioides,* four herbicides (viz., M.C.P.A 60 600g/I SL, Glyphosate 360g/L SL, Solid Pretilachlor 300g/I EC and Bispyribac-sodium 100SC) were tested with two different concentrations (recommended rate and the half of the recommended rate). When compared with the control, the lowest survival (highest mortality) was recorded in Haydol (M.C.P.A 60) with recommended rate (3%) and the half of the recommended rate (18%). Therefore, Haydol is the most effective herbicide and recommended rate could be used to manage *L. sedioides* populations when compared to other treatments. As regrowth occurred in at least two replicate multiple applications is recommended.

Water directly obtained from *Ludwigia* grown containers (30, 60 and 90 Days after planting) were used to test the potential allelopathic effect of the plant while tap water was used as the control. A bioassay was carried out in vitro under culture room conditions with *Raphanussativus* (Raddish) seeds. Seed germination percentage, lengths of radicle and hypocotyl were recorded 15 days after germination. Significantly high Radish seed germination percentage ($p< 0.05$), mean hypocotyl and radicle lengths were recorded in control compared to the water taken from the *L. sedioides* grown containers. This indicates the negative effects of *L. sedioides* exudates on radish seed germination and subsequent growth.

The present study revealed the possibility of regeneration of *L. sedioides* plants through fragmentation and low genetic variability among populations. Further, the presence of allele chemicals may have a negative effect on other aquatic plants hence the presence of *L. sedioides* may decrease the biodiversity in aquatic ecosystems. Hence immediate action is recommended to control the further spread.

Keywords: Fragmentation; Genetic diversity; Herbicide control; *Ludwigia sedioides;* Potential invasive alien

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