Eco. Env. & Cons. 28 (3) : 2022; pp. (1139-1143)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i03.010

Aquatic Plants at an Agricultural Station, Vietnam

D. H. Truong[1], T. M. Duong*[2] and V. L. Loi[1]

[1]College of Environment & Natural Resources, Cantho University, 94115 Ninh Kieu, Can Tho, Vietnam
[2]Mekong Conservancy and Research Assistance Foundation, 216 College of Environment & Natural Resources, Cantho University, 94115 Ninh Kieu, Can Tho, Vietnam

(Received 2 October, 2021; Accepted 25 November, 2021)

ABSTRACT

The study aims to provide useful information on the composition and quantity of higher aquatic plants capable of purifying natural water, serving water quality management and biodiversity conservation planning at the agricultural station, Phung Hiep district, Hau Giang province, Vietnam. Identified 25 aquatic species of higher plants belonging to 20 different plant families. In which, 3 aquatic plants can be used in organic water pollution treatment: *Lemna minor* L., *Azolla pinnata* Br. and *Eichhornia crassipes* (Mart) Solms.

Key words : *Aquatic plants, Agricultural station, Vietnam*

Introduction

The Agricultural Station is located in Tan Phuoc Hung Commune, Phung Hiep District, Hau Giang Province, Vietnam with a total natural area of 1,434.89 hectares. It is characterized by a community of Melaleuca trees, and this place is also an ideal habitat for many species of birds. Therefore, for a long time, the amount of Melaleuca leaves falling along with bird droppings will cause the water environment here to be polluted. Therefore, the role of aquatic plants in cleaning polluted water is very important. They play an important part in the ecosystem here. They provide oxygen to the water body, stabilize the bottom and reduce the turbidity of the water. They are also a habitat and breeding ground for fish, invertebrates and waterfowl (White *et al.*, 2005). In the field of environment, aquatic plants are the object of research with many goals of different authors such as environmental indicators, environmental change, wastewater treatment, especially heavy metals.

Because of the above reasons, the implementation of the topic "Research on higher aquatic plants, capable of natural water purification at Agricultural Station, Phung Hiep district, Hau Giang province" was carried out. The study aims to provide useful information on the current status of composition and quantity of higher aquatic plants capable of purifying natural water for water quality management and biodiversity conservation planning at this station.

Methods

Survey to select survey route and select sampling point.

Collecting and preserving samples.

Analyze, identify and classify samples in the laboratory for identification of higher aquatic plants.

Qualitative analysis

Walk along the selected channels, recording the species occurring in the water body. Using the botanical

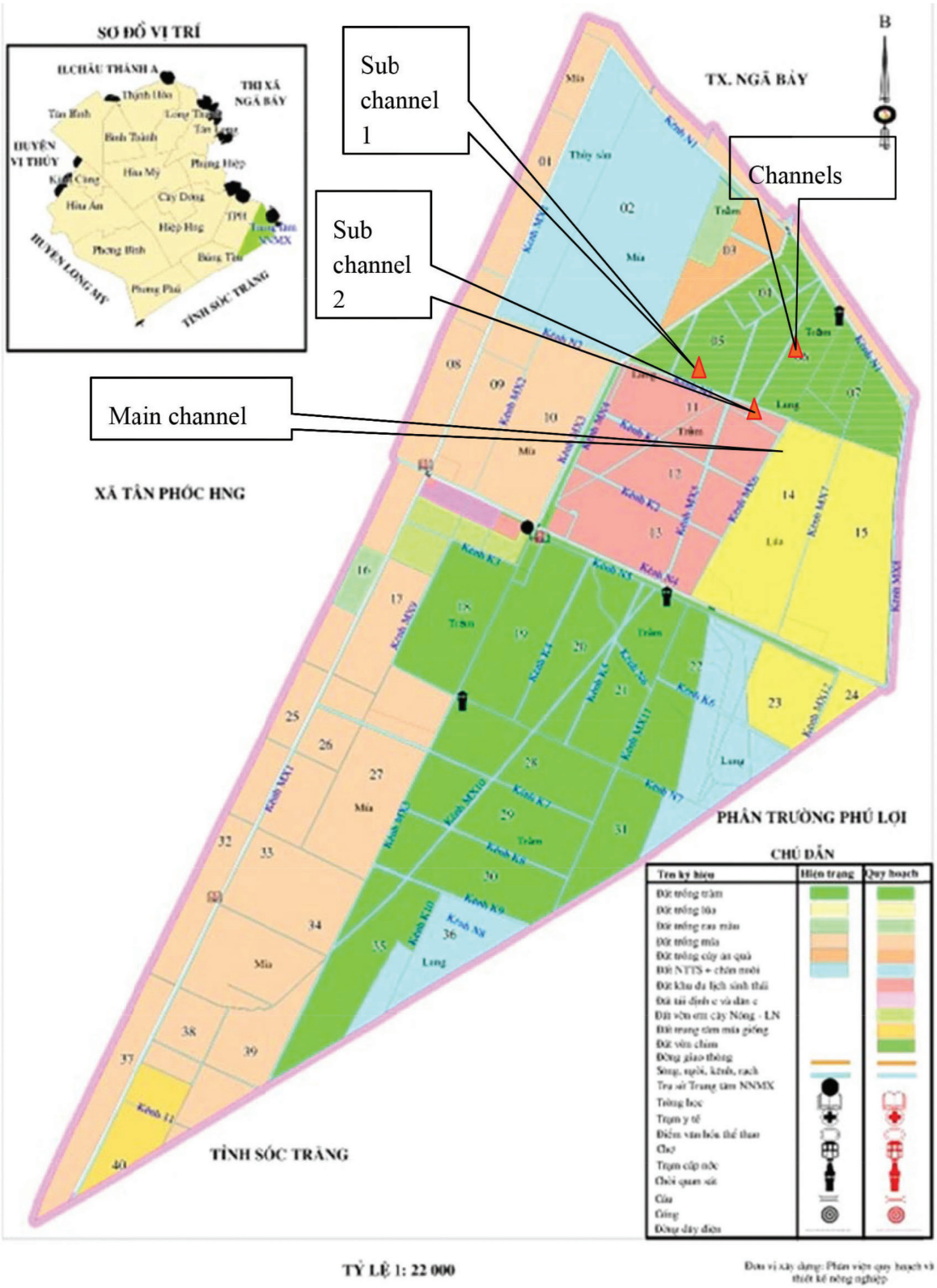

Fig. 1. Location of water sample collection at Agricultural Station.

Table 1. Coordinates of water sample collection locations

Location	East longitude	North latitude
Main channel	105⁰50′09.01"	9⁰45′07.03"
Sub channel 1	105⁰50′09.06"	9⁰45′56.6"
Sub channel 2	105⁰50′19.9"	9⁰45′51.5"
Channel	105⁰50′28.7"	9⁰46′06.0"

taxonomy key of Vietnamese Plants, Pham Hoang Ho (Volume I, II, III).

1. Plants commonly found in Vietnam by Pham Hoang Ho, (2000).
2. Common weeds in Vietnam by Duong Van Chinh and Hoang Anh Cung, (2000).

Quantitative analysis

Place a standard plot of 1 m^2 in cross section, collect 3 plots from the shore to determine the frequency of occurrence (%). Count individuals of each species in each standard plot to determine the density of plants. Collect all instances in each cell:

1. For aquatic species, collect all samples in each standard plot in plastic wrap, record the time and place of sampling.
2. For species with roots attached to the soil, use a shovel to dig the roots, wash off the mud and put it in a nylon bag, record the time and place of sampling.

Calculate the indicators

Frequency of appearance (%): $F_i = \frac{a}{b} * 100$

Fi: frequency of occurrence of species i (%)
a: number of standard cells of species i appearing
b: total number of research standard cells

Based on the frequency of occurrence Raunkier, (1934) divided plants into 5 groups:

- Group A (1-20%): rarely appear
- Group B (21-40%): Moderate appearance
- Group C (41-60%): good appearance
- Group D (61-80%): appear a lot
- Group E (81-100%): appear a lot

Results and Discussion

The composition of aquatic species and higher plants

Fig. 2. Main channel (sampling location 1).

Fig. 3. Sub channel 1 (sampling location 2).

Fig. 4. Sub-channel 2 (sampling location 3).

Fig. 5. Channel (sampling location 4).

Through research at the Spring Agriculture Center, 25 aquatic plant species belonging to 20 different plant families have been identified. In which, the family Hoa Ban (Poaceae) and the Mon family (Araceae) have the highest number of species with 3 species (accounting for 12% of the total number of species), and the family Nymphaceae with 2 species (accounting for 8% of the total number of species occurring).), the remaining plant families, each with only one species (accounting for 4% of total species occurrence).

When considering the life forms of higher aquatic plants, according to Lam My Lan, (2000), there are 3 main forms: submerged, floating and mud-living. Of the 25 aquatic plant species identified in the studied water bodies, 15 species (accounting for 60% of the total species) belong to the mud-living group, 8 species (accounting for 32% of the total species) belong to the floating and submersible group has only 2 species of submersible group.

Through the above results, the group of aquatic plants living in floating and living in mud prevails over the group living in submerged life. Due to the high organic matter content in the studied water bodies, plus the rather dense growth of higher aquatic plants at the surface of the water bodies, preventing light from entering the water bodies. Light is a determining factor in the distribution of aquatic plants in the water body. Therefore, aquatic plants belonging to the submerged group cannot grow in organic polluted water bodies.

The frequency of occurrence of aquatic plants

From the plotting in the main channel, 4 species appearing in the 3 plots were identified: *Lemna minor* L., *Azolla pinnata* Br., *Pistia stratiotes* L. and *Eichhornia crassipes* (Maret) Solms).

The frequency of occurrence of a species reflects the ability to adapt, through the frequency of encountering that species at the study site. Specifically, when studying the frequency of occurrence, the following results were obtained: The frequency of occurrence of species ranges from 66.67% to 100%.

The species with the most distribution and the highest frequency of encounters are *Lemna minor* L. and *Azolla pinnata* Br. with 100%, belonging to the group that occurs a lot (group E 81-100%).

The lowest were *Pistia stratiotes* L. and *Eichhornia*

Table 2. Aquatic plant species in Agricultural Station in Hau Giang province, Vietnam.

No	Species	Genus	Family	Order
1	*Acrostichum aureum* L.	Acrostichum	Pteridaceae	Polypodiales
2	*Aglaodorum griffithii* (Schott) Schott.	Aglaodorum	Araceae	Alismatales
3	*Annona glabra* L.	Annona	Annonaceae	Magnoliales
4	*Azolla pinnata* Br.	Azolla	Salviniaceae	Salviniales
5	*Ceratopteris siliquosa* (L.) Copel.	Ceratopteris	Pteridaceae	Polypodiales
6	*Ceratophyllum demersum* L.	Ceratophyllum	Ceratophyllaceae	Ceratophyllales
7	*Colocasia esculenta* (L.) Schott.	Colocasia	Araceae	Alismatales
8	*Commelina diffusa* Burm. F.	Commelina	Commelinaceae	Commelinales
9	*Cyperus digitatus* Roxb.	Cyperus	Cyperaceae	Poales
10	*Eichhornia crassipes* (Maret) Solms	Eichhornia	Pontederiaceae	Commelinales
11	*Enydra fluctuans* Lour.	Enydra	Asteraceae	Asterales
12	*Hymenachne acutigluma* (Steud.) Gilliland	Hymenachne	Poaceae	Poales
13	*Ipomoea aquatica*	Ipomoea	Convolvulaceae	Solanales
14	*Lemna minor* L.	Lemna	Araceae	Alismatales
15	*Limnocharis flava*	Limnocharis	Alismataceae	Alismatales
16	*Ludwigia adscendens* (L.) Hara.	Ludwigia	Onagraceae	Myrtales
17	*Nelumbo nucifera* Gaertn.	Nelumbo	Nelumbonaceae	Proteales
18	*Nymphaea pubescens* Willd	Nymphaea	Nymphaeaceae	Nymphaeales
19	*Nymphaea rubra* Roxb. ex Salisb.	Nymphaea	Nymphaeaceae	Nymphaeales
20	*Nypa fruticans* Wurmb.	Nypa	Arecaceae	Arecales
21	*Panicum sarmentosam* Roxb.	Panicum	Poaceae	Poales
22	*Phragmites vallatoria* (L.) Veldk.	Phragmites	Poaceae	Poales
23	*Pistia stratiotes* L.	Pistia	Araceae	Alismatales
24	*Typha angustifolia* L.	Typha	Typhaceae	Poales
25	*Vallisneria natans* (Lour.) Hara	Vallisneria	Hydrocharitaceae	Alismatales

crassipes (Maret) Solms) with 66.67%, but belonged to the most common group (group D 61-80%).

Characterized by low disturbance and high organic pollution, the growth of *Lemna minor* L. and *Azolla pinnata* Br. is very high through their frequency of occurrence. Thereby, species *Lemna minor* L. and *Azolla pinnata* Br. have high adaptability to organic polluted water bodies and less disturbed water bodies.

Conclusion and recommendations

Through the results of research on the distribution of aquatic plants at the Spring Agriculture Center, the following conclusions are drawn:

Identified 25 aquatic species of higher plants belonging to 20 different plant families.

Three species of aquatic plants can be used to treat organic water pollution: *Lemna minor*L., *Azolla pinnata* Br. and *Eichhornia crassipes* (Maret) Solms).

Continue to expand research on the distribution of higher aquatic plants in organically polluted water bodies in different regions: saltwater, alum, etc.

Research on the tolerance as well as the level of adaptation of proposed aquatic plants in organic pollution treatment.

References

Boer, T.A. 1983. Vegetation as an indicator of environmental changes. *Environmental Monitoring and Assessment*, 3: 375-380.

Brix, H. 1997. Do macrophytes play a role in constructed treatment wetlands. *Wat. Sci. Tech.* 35 : 11-17.

Demars, B.O.L. and Edwards, A.C. Distribution of aquatic macrophytes in contrasting river systems: A critique of compositional-based assessment of water quality. *Science of The Total Environment.* 407(2): 975-990.

Duong Van Chin and Hoang Anh Cung 2000. *Common Weeds in Vietnam*. Agricultural Publishing House. 2918 pages.

Ghavzan, N.J., Gunale, V.R., Mahajan, D.M. and Shirke, D.R. 2006. Effects of Environmental Factors on Ecology and Distribution of Aquatic Macrophytes. *Asian Journal of Plant Sciences.* 5(5) : 871-880.

Grasmuck, N., Haury, J., Leglize, L. and Muller, S. 1995. Assessment of the bio-indicator capacity of aquatic macrophytes using multivariate analysis. *Hydrobiologia.* 300/301 : 115-122.

Hamid, A. and Khedr, A. 1999. Aquatic macrophyte distribution in Lake Manzala, Egypt. *International Journal of Salt Lake Research*. 5(3) : 221-239.

Kent, M. and Coker, P. 1992. *Vegetation Description and Analysis: A practical Approach. Published in 1994 by John Wiley and Sons Ltd.* 363.

Khedr, A.H.A. and Demerdash, M.A.E. 1997. Distribution of aquatic plants in relation to environmental factors in Nile Delta. *Aquatic Botany.* 56(1) : 75-86.

Lam my Lan 2000. *Lecture on Aquatic Plants.* Faculty of Agriculture Can Tho University, 135 pages.

Melzer, A. 1999. Aquatic macrophytes as tools for lake management. *Hydrobiologia*. 395/396, pp. 181-190.

Nurminen, L. 2003. Macrophyte spices composition reflecting water quality changes in adjacent water bodies of lakes Hiidenvesi, SW-Finland. *Ann. Bot. Fennici.* 40 : 199-208.

Penning, W.E., Dudley, B., Mjelde, M., Hellsten, S., Hanganu, J. and Kolada, A. 2008. Using aquatic macrophyte community indices to define the ecological status of European lakes. *Aquat Ecol.* 42 : 253-264.

Penning, W.E., Mjelde, M., Dudley, B., Hellsten, S., Hanganu, J. and Kolada, A. 2008. Classifying aquatic macrophytes as indicators of eutrophication in European lakes. *Aquat Ecol.* 42 : 237-251.

Pérez-lópez M. E., M.S. González-elizondo, C. López-gonzález, A. Martínez-prado and Cuevas-rodríguez, G. 2009. Aquatic macrophytes tolerance to domestic wastewater and their efficiency in artificial wetlands under greenhouse conditions. *Hidrobiologica.* 19 (3): 233-244.

Pimentel, D., Lach, L., Zuniga, R. and Morrison, D. 2000. Environmental and economic costs of nonindigenuos species in the United States. *Bio Science.* 50 : 53-65.

Pham Hoang Ho 2000. *Vietnamese plants.* Volumes I, II, III. Young Publishing House - Ho Chi Minh City.

White, K.H., Marquez, R.B., Soward, L.R. and Shankle, G. 2005. *A Guide to Freshwater Ecology*, Texas Commission on Environmental Quality, 122p.

Web:

http://www.haugiang.gov.vn/Portal/Default.aspx?pageindex=5&pageid=3348&siteid=1

http://www.haugiang.gov.vn/Portal/OtherNewsView.aspx?pageid= 3378&Item ID=7323& mid= 6007&pageindex=5&siteid=1

http://www.vietnamplus.vn/de-bien-o-ca-mau-doi-mat-voi-nguy-co-sat-lo-lon/224261.vnp.