

STUDY AND COLLECTION OF HYDROPHYTES OF THE DISTRICT SWABI, PAKISTAN

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ABSTRACT

A survey was conducted to study hydrophytes in various water bodies and wetlands of District Swabi and to pin point infestations of aquatic weeds particularly the invasive aquatic plants during September-December 2012. A total of 32 plant species belonging to 23 families were collected. The specimens were properly identified by using flora of Pakistan. After identification the specimens were submitted to Special Herbarium for Weeds and Medicinal plants in the Department of Weed Science, the University of Agriculture Peshawar. The aquatic plants found during the survey were categorized on the basis of habitat (regarding depth of water), life cycle and type of water body. Regarding habitat there were free floating weeds, anchored floating weeds, emergent weeds, submerged and marshy weeds. Among them 8 % of total hydrophytes studied were free floating and 58% anchored floating emergent, 11% submerged and 17 % marshy weeds. Regarding life cycle of the hydrophytes, 72 % among them were annual and the rest (28 %) were perennial plants. About 38 % of the aquatic plants were associated with streams and river banks, 23 % to drainage ditches and stagnant water conditions, 20 % to irrigation channels and 14 % to wetland and marshy places, respectively. *Persicaria hydropiper* Michx. was the most poisonous weed while *Eichhornia crassipes* (Mart.) Solms., *Pistia stratiotes* L., *Phragmites australis* (Cav.) Trin. ex Steud., and *Typha latifolia* L. were the most problematic weeds and were abundant almost in all habitats and water bodies.

Key words: aquatic weeds, hydrophytes, Swabi, Pakistan

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INTRODUCTION

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Swabi lies between the Indus and Kabul rivers, between 33°-55' & 34°-23' North latitudes and 72°-13' and 72°-49' East longitudes. The entire district precipitations, are mainly concentrated in March (as high as 160 mm) as well as in summer from July-August (Monsoon rains). It is bounded in the North by Buner, on the East by Haripur, in the South by Attock and on the West by Nowshera and Mardan district. The total area of the district is 1543 km² with an Altitude 316 m ASL. The famous Tarbela Dam and electricity power house is located here. Most of the people are associated with agriculture. Wheat, sugarcane, tobacco and maize are the main crops especially tobacco is of very prime quality and leading national and multinational tobacco companies have their factories and warehouses built here (Said, 1978).

The district of Swabi is rich in water resources and has sufficient water bodies presently in the form of streams, canals, drainage ditches, lakes, ponds, marshy areas and wetlands. Some of them are directly used for agriculture, livestock's, fisheries, drinking purpose entertainments. But the rest are only the carriers of the drainage and rain water and often of no use for agriculture, drinking, livestock etc. These water bodies are complex ecosystems composed of distinct habitats influenced by biological, physical and chemical processes. Aquatic plants are a major part of this complex and are actively growing continuously or periodically depending upon seasonal variations, the availability of required amount of water and other ecological factors. They occur submerged below or floating on the surface or growing up through the water surface. These plants play an important role in the structure and function of the aquatic ecosystem (Chambers *et al.*, 2008; Chandrasena *et al.*, 2012; Macdonald, 2012)

The aquatic plants are of various types, some are rooted in hydro-soil some are emergent; often found on the bank or shoreline while others are submerged and live below the water surface for most of the time. Still others are free floating, and some are rooted on the bank of the impoundments, adopting semi aquatic habitat. Some of the plants have a profuse growth pattern, propagate with such rapidity, and infestation is so high that unless timely action is taken it is extremely difficult to keep them under control. Aquatic weeds generally exhibit a variety of vegetative (asexual) reproduction, many of which serve as overwintering, a dispersal mechanism which makes them survive the harsh winters. It has been observed that in some cases the growth is so luxuriant and thick that weeds occupy the entire water surface like a thick carpet which can support small animals to walk on it without being drowned (Anderson, 2003).

Aquatic weeds are those unabated plants which grow and complete their life cycle in water and cause harm to aquatic

environment directly and to related eco-environment indirectly. Water is one of the most important natural resources and in fact basis of all life forms on earth. Fish production is greatly affected by the presence of floating and submerged aquatic weeds. Isolated weed beds may be tolerated, providing shelter and shade for fish, but when the growth becomes thick and covers entire water body, it can be lethal for fish growth. Fish may suffocate from a lack of oxygen and it may cause death. When floating and submerged aquatic weeds become extremely dense, many fish species are unable to exist in such environments and vanish (Lancar and Krake, 2002). Threats to fresh waters such as pollution of different kinds, unfavorable climatic changes, eutrophication, acidification, and alien species invasion lead to reduction in native aquatic plants diversity which also threatens the faunal diversity of aquatic ecosystem (Chambers *et al.*, 2008).

The streams with fresh water were highly infested where their movement is slow and the width is more. While there exist less weeds in water channel, but due to certain problems like siltation and sedimentation, some of the weeds like *Hydrilla*, algae and curly leaf pond weeds are found. In the areas where the water table is high and water logging is prevalent due to less soil gradient and poor drainage system the rain water, sewages and waste water does not percolate down. They become stagnant ponds where mainly exist floating weeds i.e. water hyacinth, water lettuce and duck weeds. Emergent weeds like Typha and common reed are also common.

Keeping in view the importance of water for agriculture, livestock, and other requirements of the common public and the threats to these water bodies from hydrophytes and invasive aquatic weeds the present study were carried out with the objectives to know the aquatic flora and to pin point the aquatic weed infestation in the study area and to investigate the presence of invasive weeds in different water bodies of the study area.,

MATERIALS AND METHODS

A floristic study of the various water bodies and aquatic habitats including running water, lakes, stagnant ponds, paddy fields, streams banks and marshy places was conducted in the district of Swabi-Pakistan during September-December, 2012. Plant specimens were collected from 10 different sites of the district Swabi. During this four months study a total of 32 aquatic and wet land species were collected, cleaned and tagged for proper labeling and identification. Specimens were pressed flat and dried between newspapers for a better drying and well preserved appearance. After complete drying the specimens were chemically preserved through AgNO_3 and CuSO_4 dissolved in ethanol, pasted on a herbarium sheet with the help of glue

and labeled with all the required information collected during study in the field notebook. The equipments used during plant collection, pressing, drying, pasting and labeling were: maps, pencil, field notebook, polythene bags, scissor, digging tools, blotting papers, old newspapers, herbarium sheets, glue, tags, hand lens, plant pressers, & digital camera etc. Field notebook was used recording their complete history in the field and later on using this information while labeling the specimens. This information included date of collection, collection number, plant habitat, plant habit, botanical name, vernacular name, family, plant height, locality, abundance, water type and water depth etc.

The species collected from different water bodies were categorized according to their growing position with respect to water surface (habitat) as floating, emergent, free floating, submerged and marshy plants. The collected specimens were identified by utilizing Flora of Pakistan, Internet and consulting veteran professors from Department of Botany and Weed Science.

RESULTS AND DISCUSSION

During the study, it was observed that streams with no disturbance were densely infested with aquatic vegetation as compared to water channels, where a little bit of sanitation was in use. But again there were certain problems associated to irrigation system like siltation and sedimentation particularly in the on-farm- water-management i.e. the water courses due to no lining and frequent disturbances. Water logged conditions and poor drainage system further aggravated the problem of aquatic weeds and made the water flow to a standstill. These conditions encouraged the free floating weeds like water lettuce, duck weed and water Hyacinth. The emergent weeds like typha and phragmites well flourished on the margins of these stagnant ponds. Different water bodies had different hydrophytes communities like emergent weeds, anchor floating weeds, free floating weeds, submerged weeds and marshy weeds, depending on the flow, depth and quality of water.

The seasonal variations and receding of water also had an impact on the intensity and frequency of certain aquatic plants. Water lettuce (*Pistia stratiotes* L.) and water hyacinth (*Eichhornia crassipes* L.) were observed floating freely in stagnant ponds with a great density, covering the whole surface of the pond. Water hyacinth and water lettuce were also found anchored to the hydrosol in the shallower waters due to water recession and excessive evapotranspiration from the limited waters of the pond. But lotus (*Nelumbo nucifera* L.) was found anchored in shallow as well as in deep waters up to 1.5 meters.

Marsillea minuta was observed floating but anchored to the hydrosol in fresh water streams, water channels and marshy places. *Hydrilla verticillata* (L.f.) Royle., *Najas minor* L., *Potamogeton crispus* L. *Ruppia maritime* L. and filamentous algae were observed in the submerged in fresh water streams. *Alternanthera sessilis* L., *Typha latifolia* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Echinochloa esculenta* (A. Braun) H. Scholz., *Persicaria hydropiper* W.T. Aiton., *Saccharum griffithii* (Monro ex Boiss.) Hack. *Naustursium officinale* W.T. Aiton., *Paspalum conjugatum* (Berg), *Ipomoea aquatica* L., *Eclipta alba* L., *Sagittaria latifolia* L., *Canna indica* L., *Canna cleopatra* L. and *Salix tetrasperma* Roxb. were observed in the emergent form either on the bank or inside the water bodies. *Commelina diffusa* L., *Fimbristylis bisumbellata* (Forssk.) Bubani L., *Cyperus iria* L., *Cyperus strigosus* L. *Cyperus fuscus* L., *Cyperus brevifolius* (Rottb.) Hassk and *Apluda mutica* L. were observed in marshy place and in shallow water habitats. Most of the aquatic vegetation was found in water streams and river banks. Among these 32 species *Persicaria hydropiper* L. was the most poisonous weed while *Eichhornia crassipes* L., *Pistia stratiotes* L., *Phragmites australis* L., and *Typha latifolia* L. were the most problematic weeds and were abundant almost in all habitats and almost all types of the water bodies. Regarding life cycle of the hydrophytes 72% among them were annual and the rest (28%) were perennial plants. According to their growing position regarding to water surface 58% of total hydrophytes were emergent, 17% marshy, 11% submerged and 8% free floating and anchored floating.

On the basis of habitat 38% weeds associated with water streams and river banks. About 20% weeds associated with irrigation channels. 14% to wet land and marshy places and 23% associated with ponds and stagnant water habitat. With respect to their botanical grouping 15% of the total hydrophytes studied belonged to family Poaceae, 14% to Cyperaceae and 5% to Cannaceae, while the rest of the families like Amaranthaceae, Alismataceae, Asteraceae, Araceae, Brassicaceae, Convolvulaceae, Commenelaceae, Zygnetaceae, Hydrocharitaceae, Juncaceae, Lemnaceae, Marsileaceae, Nelumbonaceae, Potamogetonaceae, Pontederiaceae, Polygonaceae, Ruppiceae, Salicaceae, Equisetaceae and typaceae contributed only 3% each, respectively.

CONCLUSION

It is concluded from the results that water bodies and wetlands of District Swabi are full of hydrophytes which is a great threat to water quality and water delivery in the channels for agriculture purposes.

Table-1. List of hydrophytes collected from various water bodies in District Swabi Pakistan during Sep-Dec 2012

V.N	Botanical name	English name	Family	Plant type/ Group	Life cycle	Habitat	Plant size/ Growing habit	Water Type/ depth	Abundance	Date
16	<i>Apluda mutica</i> L.	Mauritian grass	Poaceae	E	A	Irrigation channel	2 feet Erect herb	Fresh water > feet	Rare	26-9-12
12	<i>Echinochloa esculenta</i> . (A.Braun) H.Scholz	Japanese millet	Poaceae	E	A	Stagnant pond	3 feet Erect herb	Waste 1 feet	Rare	23-9-12
11	<i>Paspalum conjugatum</i> . (Berg).	Water pasphalam	Poaceae	E	A	Stream banks	2 feet Spreading herb	Fresh water 6 inch	Very common	23-9-12
1	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Common reed	Poaceae	E	P	Stream banks	6 feet Erect shrub	Fresh water 2 feet	Very common	21-9-12
17	<i>Saccharum griffithii</i> . (Monro ex Boiss.) Hack.	Wild cane	Poaceae	E	P	Stream banks	5 feet Erect shrub	stagnant 5 inches	common	26-9-12
2	<i>Alternanthera sasilis</i> L.	Sessile joyweed	Amaranthaceae	E	A	River bank	2 feet Erect herb	Fresh water 6 inch	common	21-9-12
33	<i>Spirogyra</i> sp.	Filamentous Algae	Zygnematacae	S	A	Stagnant pond	10 feet Spreading	Fresh water 2 feet	Common	20-10-12
4	<i>Cyperus strigosus</i> L.	False nutsedge	Cyperaceae	E	A	Wet land	1.5 feet Erect herb	Marshy 3 inch	Rare	21-09-12
6	<i>Cyperus fuscus</i> L.	Brown flatsedge	Cyperaceae	E	A	Stream banks	4 feet Erect herb	Fresh water 4 inch	Rare	21-09-12
7	<i>Cyperus</i> spp.	nutsedges	Cyperaceae	E	A	Stream banks	3 feet Erect herb	Muddy 3 inch	Rare	21-09-12
28	<i>Cyperus brevifolius</i> (Rottb.) Hassk.	globe kyllinga	Cyperaceae	E	A	Stream banks	> feet Erect herb	Fresh water 5 inch	Rare	07-10-12
31	<i>Cyperus iria</i> L.	Rice flatsedge	Cyperaceae	E	A	Stagnant water	2 feet Erect herb	Fresh water > feet	Rare	12-10-12
35	<i>Naustursium officinale</i> W.T. Aiton.	Water cress	Brassicaceae	E	P	Stream bank	> feet Erect herb	Fresh water > feet	Common	22-10-12
3	<i>Persicaria hydropiper</i> Michx.	Swamp smart weed	Polygonaceae	E	A	Stream bank	1.5 feet Erect herb	Fresh water 1 feet	common	21-09-12
32	<i>Canna cleopatra</i> L.	Canna lillie	Cannaceae	E	P	Stream banks	5 feet Erect rhizomatus herb	Fresh water 2 feet	Common	15-10-12

V.N	Botanical name	English name	Family	Plant type/Group	Life cycle	Habitat	Plant size/Growing habit	Water Type/depth	Abundance	Date
8	<i>Canna indica</i> L.	Canna	Cannaceae	E	P	Stagnant pond	5 feet Erect rhizomatus herb	Marshy > feet	Common	22-09-12
9	<i>Fimbristylis bisumbellata</i> (Forssk.) Bubani.	Juncus	Juncaceae	E	A	Stream banks	1 feet Erect herb	Stagnant & marshy	Rare	23-09-12
10	<i>Hydrilla verticilla</i> (L.f.) Royle.	Hydrilla	Hydrocharitaceae	S	A	Irrigation channel	2 feet Spreading herb	Fresh water 2 feet	Very Common	25-09-12
15	<i>Eclipta alba</i> L.	False daisy	Asteraceae	E	A	Stream banks	1 feet Erect herb	Fresh water 2 feet	Common	25-09-12
13	<i>Marsilea quadrifoliata</i> L.	Pepperwort water clover	Marsileaceae	AF	P	Stagnant pond	8 inch Spreading herb	Hard water 4 feet	Very Common	25-09-12
21	<i>Typha latifolia</i> L.	Cattail	Typaceae	E			5 feet Erect herb	Hard water 5 feet	Very Common	28-09-12
18	<i>Salix tetrasperma</i> Roxb.	Willow tree	Salicaceae	E	P	River bank	12 feet Erect tree	Fresh 2 feet	Common	26-09-12
30	<i>Ipomea aquatic</i> Forssk.	Water spinach	Convolvulaceae	E	P	Stream banks	6 feet Spreading shrub	Fresh water 2 feet	Common	12-10-12
22	<i>Pistia stratiotes</i> L.	Water lettuce	Araceae	F	P	Stagnant pond	> ft spreading herb	Fresh water 4 feet	Abundant	04-10-12
24	<i>Nelumbo nucifera</i> Gaertn.	Lotus	Nelumbonaceae	AF	P	Stagnant pond	2 ft Spreading herb	Hard water 3 feet	Very rare	04-10-12
37	<i>Cystopteris fragilis</i>	Fern	Cystopteridaceae	M	P	irrigation channel	1 feet Erect herb	Fresh water > feet	Very rare	09-12-12
19	<i>Commelina diffusa</i> Burm.f.	Climbing dayflower	Commelinaceae	M	A	Water channel	6" Spreading herb	Hard water 1 feet	Rare	27-09-12

V.N	Botanical name	English name	Family	Plant type/ Group	Life cycle	Habitat	Plant size/ Growing habit	Water Type/depth	Abundance	Date
34	<i>Lemna azolla</i> L.	Duck weed	Lemnaceae	FF	A	Stagnant pond	1 cm spreading	Hard water 3 feet	Abundant	22-10-12
36	<i>Ruppia maritima</i> L.	Wigeon grass	Ruppiaceae	S	A	Stream water	> feet Filamentous	Fresh water 1 feet	Rare	25-10-12
23	<i>Potamogeton crispus</i> L.	Curly leaf pondweed	potamogetonaceae	S	A	Running water	1 feet Spreading herb	Fresh water 2 feet	Common	04-10-12
5	<i>Eichornia crassipes</i> (Mart.) Solms.	Water Hyacinth	pontederiaceae	FF	A	Running water	> feet Spreading herb	4 feet	Very common	21-09-12
25	<i>Sagittaria latifolia</i> Willd.	Duck Potato	Alismataceae	M	A	Stagnant pond	2 feet Erect herb	Hard water 1 feet	Very rare	04-10-12

A = Annual, P = Perennial, E = Emergent, S = Submerged, F = Floating, AF = Anchored Floating, M = Marshy, FF = Free Floating

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