

1. INTRODUCTION

In the present era with fast moving lifestyle of human beings, they are affected by many lifestyle diseases. This is more so because, people have moved away from mother nature and natural resources and have become dependent on chemical medicines, synthetic food etc. Many of such diseases are directly related to oxidation process in cell, so antioxidants are needed to fight against oxidants. From various endogenous and exogenous sources Reactive oxygen species (ROS) are induced in cell. Antioxidant defence systems are present almost in all living systems but this system not always capable of complete prevention of the oxidation stress-induced damage in organisms (Khatua *et al.* 2013.)

Generally, normal levels of oxidants in cells are neutralised by cellular mechanism automatically but higher amount can damage cell in many ways. Physiological functions may deteriorate as a result of unbalanced antioxidant system. To rectify this unbalanced antioxidant system there are many synthetic antioxidants such as propyl gallate, tert-butyl hydroxyquinone, butylated hydroxyanisole (BHA) and butyl hydroxyl toluene (BHT) which are out in market with different brand names, but they produce ill effects/side effects after long term use. BHA and BHT cause liver damage and are also suspected to be carcinogenic. As a result, antioxidant containing natural products has created great interest for research since they can reduce the human cellular oxidative damage naturally (Sherwin *et al.* 1990). Special attention is also being given within science community in studying the natural antioxidants in foods. So it is quite obvious that nature becomes very relevant to treat these lifestyle diseases. Nature can heal almost every damage caused by nature. Earlier, medicines were produced from plant sources but with the advancement of science we are now a day's far away from nature and concentrating on synthetic drugs. Now time has come to look back to nature again.

Human society depends on nature and natural products since the beginning of the civilization. As we all know human civilization primarily started its journey from constructing colonies to nearby water bodies. So they must have good knowledge of plants growing nearby water bodies, i.e. wetland plants. The areas of land that are either permanently or temporarily covered by water are termed as wetland, it includes lakes, rivers, mangroves, peat lands, and also human-made wetland, such as fish

ponds, farm ponds, irrigated agricultural land, sewage farms, and canals. The plants growing in submerged, immersed or partially underwater or in nearby moist areas and grows well in moist soil are called wetland plants.

According to Lichvar *et al.* (2012) wetland plants are of following types –

- Obligate (OBL)- plants occurs almost always under natural conditions in wetlands.
- Facultative Wetland (FACW)- plants naturally occurs in wetlands but may also be present in non-wetlands.
- Facultative (FAC) likely to occur equally in wetlands and non-wetlands.
- Facultative Upland (FACU) plants occasionally found in wetlands, but are usually non-wetland plants.

Due to high diversity and richness of different plant species this area attracts itself for different studies related to wetland and its vegetation. Millions of people are directly and indirectly related to wetland such as medicine, food, fibre, clean water supply, educational and recreational benefits etc. According to Millennium Ecosystem Assessment wetlands cover 7% of the earth's surface and deliver 45% natural productivity of the world as medicine, food, fodder, fish production, veterinary support (National Wetland Atlas 2010).

North Bengal covers the northern districts of West Bengal. Districts of West Bengal north to the river Ganga. Malda, Dakshin Dinajpur, Uttar Dinajpur, Darjeeling, Jalpaiguri, Alipurduar and Coochbehar are the districts of North Bengal. These districts are enriched with different wetlands, except the hilly areas where wetlands are restricted only to some points, mainly at seasonal small ponds and nearby fountain areas. This area has different kind of wetlands- including both natural as well as manmade.

Many wetland plants are used as a normal human diet for thousands of years but in last several decades with the advancement of science the use of natural products is almost replaced with the chemical one. Natural foods have vanished from our diet, replaced by capsules, food supplement powders, health drinks etc. But recent studies show the adverse effect of these synthetic products in many ways with different side effects. On the other hand, the people still living in the vicinity of nature and using

natural foods and natural medicines are availing good health with less synthetic medical attention.

In the past decade the traditional medicine globally has regained its interest and attention. In China 40% of all health care covered by traditional healthcare system, 71% of total population use traditional medicine in Chile; in Cambodia it is 40 % of total population using this type of medicine. The rural people of India i.e. 65% of the population depends on medicinal plants, Ayurveda, ethno medicine for their primary health care need. Traditional, complementary and alternative medicines are becoming more popular in developed countries. For care and treatment of life-threatening diseases as AIDS and malaria, traditional medicines have been used in many countries. More than 60% of children with high fever in Mali, Nigeria, Zambia and Ghana are dependent for first line treatment on herbal medicine. In low-income countries traditional medicine is easily available and affordable (WHO 2004). North Bengal is a much diversified area with different communities living in different parts of this area. Some endemic communities like toto, lepcha etc. along with different tribe castes are also found in these areas.

The knowledge of early people regarding the plants and their therapeutic values were based on many years of trial and error experiments, observations and experience. And this knowledge of plant use in different ways were forwarded generation after generation orally in early stages and in some civilisation it is also written in different forms at later stages of civilization. In spite of this many communities are unwilling to circulate their knowledge to outer world in this regard. They keep their knowledge restricted to some specific families within the community. These medical men also have many names in different communities' e.g. Baidya, Janguru, Jhakri, Kabiraj, Hakim etc. Since ancient time world witnessed different medicinal practices in different parts.

Between 3500 B.C to 1800 B.C. earliest report of medicinal plant use by Indian people is found in Atharva Veda, the mother literature of Indian Ayurveda. Charak Samhita written somewhere between 100 to 200 B.C. is another very important literature regarding importance of medicinal plants in ancient Indian medicinal system. This Sanskrit literature describes the etiology, symptomology and therapeutics of many diseases along with human structure (Glucklich 2008). The importance of hygiene, diet prevention and medical education is also discussed in Charak Samhita

China is another very important civilization with great knowledge of Natural medicine. Chinese medical practice is more than 2,500 years old which includes different forms of botanical medicine, acupuncture, massage, exercise and dietary therapy etc (Shang 2007).

In Greece during 460-377 B.C. most probably by Hippocrates Unani medicine system originated. Arabs introduced this system in India. In India this system attains its maximum enrichment due to the availability of rich plant resources in different climatic conditions. Unani System of Medicine also uses various kinds of plants along with other ingredients to treat health problems like intestinal dysfunction, liver dysfunction, diuretic etc. (Kumar 2014).

All civilization had their knowledge related to the medicine source from nature and many of them noted their knowledge in written form. Since many literatures were lost, many unwritten knowledge seems to be lost forever, it is our duty to regain the knowledge for the betterment of our future generations. Phytochemicals are plant products helping us fight against various pathological conditions such as diabetes, blood pressure, tumor, inflammation, viral and microbial infections, nervous system disorders, parasitic infections, gastric ulcer, bone fracture, renal disease, urogenital disease etc. Among many phytochemicals mostly phenols, flavonoids are extensively studied in different parts of world (Dillard & German 2000). According to Harborne there are three major groups of plant phytochemicals:-

1. terpenoids,
2. phenolic metabolites
3. alkaloids and other nitrogen-containing compounds.

The terpenoids includes sesquiterpene lactones monoterpenoids, diterpenoids, triterpenoid, iridoids, sesquiterpenoids, saponins, steroid saponins, cardenolides, phytosterols, cucurbitacins, nortriterpenoids etc. The phenolics contain anthochlors, anthocyanins, benzofurans, coumarins, chromones, flavonoids, flavonol, lignans, phenols and phenolic acids, tannins etc. The alkaloids are represented by betalain, diterpenoid, indole, isoquinoline, monoterpene, sesquiterpene, steroidal compound etc. (Harborne 1990).

Clinical and experimental evidence shows the increased levels of ROS and reactive nitrogen species (RNS) generation in both types of diabetes and this proves the probable relationship between the oxidative stress and diabetes. Similar to other groups of plants, wetland plants are (Rosen *et al.* 2001, Johansen *et al.* 2005,

Matough *et al.* 2012). Ho *et al.* (2012) studied 31 medicinal wetland plants in Taiwan for the possible antioxidant activities of the methanol and water extracts of these plants. The experimental results suggested that the antioxidant parameter is not directly related to polyphenol quantity but proposed that the phytochemicals may play important role in the antioxidant activity of wetland plants.

Bright and Kanagappan (2016) evaluated 5 weeds from aquatic systems for their antioxidative properties. They measured the phenol, flavonoid contents as well as the DPPH radical scavenging activity. *Lemna minor* shows maximum DPPH scavenging activity and *Pistia stratiotes* shows least scavenging activity. Maximum amount of phenol found in *Ceratophyllum demersum* and minimum in *Pistia stratiotes*. Flavonoid content in *L. minor* is maximum where as *Hydrilla verticillata* contains maximum amount of flavonoid. A comparative antioxidant and phytochemical study of methanol extract of different plant parts of *Eichhornia crassipes* were done by Tyagi and Agarwal (2017). They evaluated the phenol, flavonoid content and DPPH radical scavenging activity of this wetland plant. Their study reveals the presence of highest amount of phenol and flavonoid content in leaf extract and the highest radical scavenging activity in petiole extract.

In recent years a number of research articles have been published in relation to ethnomedicinal and antioxidative evaluation of plants. However, much attention has not been received by the wetland plants of North Bengal region of West Bengal in this regard. Accordingly, considering the importance of wetland plants and their potential use in daily life of the inhabitants, the present study has been under taken in North Bengal region of West Bengal

The objectives of this study are as follows:-

- To collect and identify the locally available wetland plants.
- To prepare samples by drying followed by extraction.
- To document the medicinally used wetland plants.
- To perform the phytochemical screening of the active principles of plants.
- To determine the anti-oxidative activity of plant samples.
- To study the anti-microbial properties of plants.
- To study the anti-diabetic properties of plants.
- To select one or more plants showing maximum beneficial activities.