CHAPTER - IV

SUMMARY AND CONCLUSIONS

Eichhornia crassipes Solms. is popularly known as 'water hyacinth'. It is a native of Brazil, now very common in USA, Australia, Java, Siam, Burma and India. It is very likely that this plant species has been purposely introduced in all these countries as a garden plant for the sake of its pretty flowers and fine foliage. Perhaps there is no other weed in any country, that proved so notorious as E. crassipes.

The plant is either free-floating or partly fixed in mud in shallow waters. It is extremely gregarous in habit and thrives only in fresh water. Plant has very fine roots which are clothed with numerous rootlets. It mainly multiplies by stolons. Stem is large, rather thick and densely covered all over with the bases of leaf-stalks. The leaves 10 to 15 cm across, and green shining since they are upright, thus serving as sails before the wind. Petiole is long, round and swollen in the middle, assuming a shape of a bladder. Such a structure is common in floating specimen and it helps the plant to keep it self-buoyant.

E. crassipes proves to be very harmful for aquatic animal life. Canals and water courses are chocked and navigation is made impossible. Sometimes, many rivers may also be affected by this weed. In infested tanks, drinking water becomes contaminated. Water bodies are so thickly infested with this pest that they resemble a green terrestrial field in eastern India. The plant when floating freely has large bladder-like swollen petioles, but much ecological variation in the form of petiolate folats have been observed in the same pond by Sen (1959).

Since this aquatic weed is present in enormous quantities, attention has been diverted to find out some uses of this plant, so that its eradication would entail some financial returns. Sharma (1971) has listed the manifold uses to which this weed has been put to :

(i) as fertilizer, compost and mulch;
(ii) as fodder, silage and food for pigs, cattle, sheep and fish;
(iii) in providing raw material for industry; and
(iv) as protein source for other chemicals. Being rich in potash it makes a valuable manure when properly decomposed. Papers of inferior quality are also prepared from the pulp of this weed.

The present dissertation on eco-physiology of Eichhornia crassipes is divided into four chapters. Review of literature on aquatic weeds is taken in Chapter I. Chapter second deals with the material and methodology employed during present investigation. Obtained results are discussed in light of available references in the third chapter of results and discussion. For eco-physiological studies of Eichhornia crassipes we have started from its origin and distribution, studied its morphology, various constituents of the plant body with respect to polluted habitat. Nitrogen metabolism is worked out little deep which covers the study of behaviour of enzyme nitrate reductase. The significant output of present study can be summarised as follows,

1. *Eichhornia crassipes* is a very common aquatic weed which thrives well in fresh water habitats - from small ponds and ditches to large lakes, wells and reservoirs and from small streams to rivers in the Western Ghat region of India. The plant in form of aquatic weed was found at Karad (L 21°, 10′ N, L 72°, 50 E) at Khodshi weir built on river Krishna. Some plant samples were collected from pond (polluted habitat), from Sangli.

2. *Eichhornia crassipes* is an aquatic weed - a free floating stoloniferons herb. It consists of rhizomatous stem [offset, stolon], a rosette of the leaves and numerous pendulous roots.

3. The multiplication of *Eichhornia crassipes* taken place mainly by vegetative means. Ten plants of *E. crassipes* can multiply to 600000 in eight months.Once established, water hyacinth forms a dense mat in the waterbody.

   E. crassipes shows horizontal sympodial branching pattern. Each stolon on the plant is the producer of vegetative growth and is genetically identical to the parent plant. Harper (1977) classifies these as rametes. Thus each ramet is a component of the genet. Two separate groups of ramets are genetically identical but they appear to be two separate plants after decay of stolon.

4. The growth performance of E. crassipes vary according to ecological conditions. We have studied the morphological differences in leaf parts from the plants grown in heliophytic and sciophytic habitats. In heliophytic plants the petioles are in form of floats. In sciophytic conditions petioles are long and thin and its length is about 5 to 6 times more than heliophytic plants.

5. Stomatal frequency ratio in the leaves of E. crassipes is about 2.5 ± 0.6 in the plants from river and pond habitats.

6. The moisture percentage is about 94, 86 and 92% in leaf lamina, petiole and root respectively of E. crassipes from river habitat. The plants from pond habitats show about 90, 83 and 88% moisture in leaf lamina, petiole and root respectively.

7. The chlorophyll content of the lamina and petiole of E. crassipes from river habitat, differs considerably. However in pond water plants the chlorophyll content of leaf lamina

and petiole is almost same. This indicates that, in polluted environment petiole contributes towards the photosynthetic function.

Chlorophyll a/b ratio of leaf lamina is 1.38 and 1.74 and for petiole 1.59 and 1.29 in the river and pond water plants respectively.

8. The stomatal frequency ratio and chlorophyll content takes us to predict that there can be C_3 path of carbon assimilation in *E. crassipes*.

9. Maximum nitrogen content is observed in leaf lamina of *E. crassipes*, from both river and pond habitats. The values are 7.19% and 8.91% respectively. The nitrogen content of root and offset ranges between 4.94 to 7.78%. Lowest nitrogen is observed in petiole.

10. Comparatively more nitrogen content is recorded in the different plant parts of *E. crassipes*, from pond (polluted) habitat.

11. The values of crude proteins ranges from about 51% to 29%. Highest in the leaf lamina and lowest in the petiole.

12. Nitrate reductase activity in different plant parts of *E. crassipes* is comparable with other weeds. However the

Eichhornia plants growing in polluted (pond) habitat show reduced NR activity.

13. Nitrate reductase from *E. crassipes* shows optimum activity at 20 mM concentration of KNO_3 in the incubation medium.

14. In *E. crassipes* activity of nitrate reductase is directly proportional the tissue weight (upto 500 mg) in the incubation medium.

15. Presence of Triton *X*-100 in the incubation medium is beneficial for NR activity in *E. crassipes*. The optimum value of buffer pH, for *in vivo* NR activity is 6.2.

16. The normal temperature range for optimum activity of nitrate reductase in *E. crassipes* is from 22° to 32°C. Above this, the enzyme activity is adversely affected.

17. Inorganic constituents from different parts of *E. crassipes* reveal that, the minerals are absorbed at different rates and are accumulated in different parts in different concentration according to the requirement of the plant.

- Water hyacinth appears to be sodium absorbing plant and maximum accumulation of sodium is observed in the offset.
- Maximum potassium accumulation is observed in the offset.
- Offset shows maximum calcium content while least calcium content is observed in roots of *E. crassipes*.

- The amount of microelements 'Mn' and 'Fe' in different parts of E. crassipes shwo that, highest Mn value is in offset while iron remains accumulated in the roots.

18. The water surrounding E. crassipes in river and pond habitat, when analysed, shows different values of dissolved oxygen while the pH range of the surrounding water remains the same.

From the study it appears that Eichhornia crassipes thrives well in river and pond (polluted) water habitats. It continues its life cycle mainly by vegetative means throughout the year. Different constituents of the plant body vary according to the surrounding environment. Stomatal and chlorophyll studies leads us to predict C_3 path in E. crassipes. Water hyacinth has an efficient machinery of nitrogen metabolism.

It is clear that, the present work takes us to understand something more about the eco-physiology of E. crassipes. Inspite of limited available library and laboratory facilities we have tried maximum to keep the data upto date. To understand the clear picture of nitrogen cycle during waste water treatments with E. crassipes further probe is expected.

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