PRELIMINARY STUDIES IN THE NITROGEN DYNAMICS OF ESTUARINE ECOSYSTEM

ABSTRACT

Estuarine ecosystem serves as a living buffer between land masses and the open sea. It filters the drain water from the land masses and restores the nutrients. Different halophytes constituting this ecosystem follow an efficient modified C_4 path of carbon assimilation.

Preliminary study in the nitrogen dynamics of this productive ecosystem was carried out during present investigation. Total nitrogen, protein content and nitrate reductase activity was estimated in mangroves. The soil and water surrounding the root zone was also analysed for nitrogen content. The results are discussed in light of protein content and the path of carbon assimilation.

THE MANGROVE ecosystem serves as a living buffer between land masses and open sea. All nutrients such as nitrogen, carbon, water and oxygen are cycled in this ecosystem. The major uses of the mangrove swamps are for fishing and fish farming because of the high nutritional value. The mangrove forest area of India comes to 356,500 ha as cited by Untawale (1985) which is based upon the survey of Blasco (1977).

Nitrogen is an important element for plant life and plays central role in metabolism, growth and reproduction and heredity. Many plants contain 1 to 2 per cent nitrogen on dry weight basis. Most of the nitrogen exists in the form of proteins and aminoacids. Nitrogen is also present in the form of other compounds such as nucleic acids, chlorophylls, cytochromes, etc. Considering the high nutritive value of the mangroves it was

thought worthwhile to study the nitrogen dynamics. In the present investigation an attempt is made to study the nitrogen dynamics of the estuarine ecosystem. The paper covers the estimation of nitrogen from soil, water and the mangroves of the estuarine ecosystem along with the activity of nitrate reductase enzyme from the mangroves.

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Material and methods

An estuarine ecosystem near Ratnagiri, along the west coast of India was selected for the present study.

Green and healthy leaves/twigs of the mangroves were collected at random alongwith surrounding soil and water at the estuarine locality. The material was sealed airtight in the polythene bags and brought to laboratory as early as possible. Oven dried material was used for estimation of nitrogen by the method of Hawk *et al.* (1948). Nitrate reductase was assayed *in vivo* in fresh plant material by the method of Evans (1982).

Results and discussions

Estuarine ecosystems are highly productive (Teas, 1977). Bhosale (1983) while considering the aspects of conservation and utilisation of mangroves, has cited various uses of the mangroves. Lakshmanan *et al.* (1983) have cited that biologial nitrogen fixation associated with the mangroves is a new field to be explored. Considering these recent views and the background of previous work done (Joshi, 1976 ; Joshi *et al.*, 1984 ; Waghmode and Joshi, 1982), it was interesting to carry out the present study. Nitrogen dynamics of the estuarine ecosystem are depicted in Table 1 and 2.

Table 1 deals with the nitrogen level of estuarine soil, water and mangroves. Protein content of the mangroves also shown in the same Table. From the Results shown in Table 1, it is clear that inspite of low level of nitrogen in surrounding soil and water the mangroves have restored enough nitrogen inside them. The protein value of the mangrove leaves is also significant and that is the reason why it is the basic resource of food for fish, prawns, oyster, etc. Joshi and Bhosale (1982) have stated that salinity and temperature controls the nitrogen metabolism in the estuarine plants. Present results of nitrogen level and protein content can be the response of the mangroves to the saline environment and efficient modified C_4 path of carbon assimilation (Waghmode, 1983), though mangroves show much complexities in their morphological and ecological adaptations.

TABLE 1. *Nitrogen content of the estuarine ecosystem* (*g/100 g of soil or g/100 ml of water)

Material	Nitrogen content (g/100 g dry wt)	Protein content (g/100 g dry wt)
Estuarine soil ..	0.075*	—
Estuarine water ..	0.035*	—
Mangroves :		
Lumnitzora racemosa ..	0.25	1.43
Ceriops tagal ..	1.14	6.50
Avicennia marina ..	0.89	5.05
Sonneratia alba ..	2.72	3.25

TABLE 2. *Activity of nitrate reductase in mangroves*

Mangrove species	Activity (μ mol $NO_2h^{-1}g^{-1}wt$)
Lumnitzora racemosa ..	2.72
Ceriops tagal ..	1.58
Avicennia marina ..	2.27
Sonneratia alba ..	2.72

To support the present study, the activity of nitrate reductase a, key enzyme of nitrogen metabolism was studied from the mangroves

and the results are depicted in Table 2. Bhosale and Shinde (1985) have studied the nitrate reductase activity in different mangroves. The results show that the activity of the enzyme can be detected in the root, stem and leaf of the halophytes. Present results of the enzyme activity when compared with the results of Puranik and Shristawa (1983) from the bean plants, it shows that the activity is about 50% of a typical legume. This reduced activity may be the result of salt stress as indicated by the work of Sinha and Nicholas (1981).

Venkataramana and Rama Das (1985) have studied nitrate reductase activity in four different C_4 plants. They have correlated the high nitrogen assimilation potential with the active respiratory metabolism of these plants. The present work is very preliminary step towards the understanding of nitrogen dynamics of the estuarine ecosystem. Further probe in this aspect is essential.

Department of Botany,
Yashwantrao Chavan College of Science,
Karad-415 110.

A. P. WAGHMODE

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