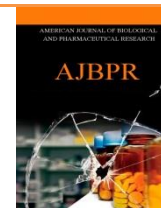




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SEASONAL VARIATION OF HEAVY METALS IN *Catenella repens* IN INDIAN SUNDARBANS

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ABSTRACT

The concentrations of heavy metals (Fe, Zn, Cu and Pb) were analyzed in *Catenella repens* collected from three stations in Indian Sundarbans using AAS during 2014. The heavy metals from different anthropogenic sources accumulated in the thallus body of the selected seaweed species. The order of accumulation is Fe > Zn > Cu > Pb. A unique seasonal variation of accumulated heavy metals is also observed from our first order analysis.

INTRODUCTION

Seaweeds are the group of marine plants that survive either in marine or brackish water environment. They are attached to the bottom in relatively shallow coastal waters and are also found in estuaries preferably on the solid substrata such as rocks, dead corals, pebbles, shells and tree trunks (like mangroves). They occupy the primary position in food chain *i.e.* they are capable of synthesizing food through photosynthesis.

Seaweeds are classified mainly into three major groups *viz.* Chlorophyta, Phaeophyta and Rhodophyta on the basis of pigmentation colour, morphological and anatomical characters [1,2]. The Indian Sundarbans is a Gangetic delta at the apex of Bay of Bengal in the north east coast of the Indian sub - continent. The dominant

seaweed species in the intertidal zone of this mangrove dominated deltaic complex are *Enteromorpha intestinalis* (Chlorophyceae), *Ulva lactuca* (Chlorophyceae) and *Catenella repens* (Rhodophyceae) [3,4].

Seaweeds contain 5-20% protein, ~ 50% carbohydrates, 1-3% lipids, and 7-38% minerals in their dry mass [5-7]. They contain more than 60 trace elements, minerals, iodine, vitamins and other bioactive substances of economic value and also serve as both feeding and breeding grounds for invertebrates and fishes [8].

Seaweeds have the capacity of absorbing nutrients and other substances, like heavy metals from ambient media [9]. The present study aims to analyze the concentrations of Fe, Zn, Cu and Pb in the thallus body of *C. repens*, a red seaweed species widely available in the high saline zone of Indian Sundarbans (where average salinity is usually greater than 15 psu).

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MATERIALS & METHODS

Study site

The Indian Sundarbans (between 21°13' N and 22°40' N latitude and 88°03' E and 89°07' E longitude) is bordered by Bangladesh in the east, the Hooghly River (a continuation of the River Ganga) in the west, the Dampier and Hodges line in the north, and the Bay of Bengal in the south (Figure 1).

The important morphotypes of deltaic Sundarbans include beaches, mudflats, coastal dunes and sand flats, estuaries, creeks, inlets and mangrove swamps [3]. Three stations were selected in the present study (Table 1 and Figure 1) to analyze the seasonal variation of heavy metals in the *C. repens* during 2014.

The samples were collected during low tide and thoroughly washed with ambient water followed with double distilled water and brought to the laboratory for analysis in ice-frozen condition.

Heavy Metal Analysis

10 gm of the collected samples (from each station) were dried at 105°C overnight. Each dried sample (1 gm on dry weight basis) was digested with a mixture of nitric acid and hydrogen peroxide followed by addition of hydrochloric acid [10]. The digested samples were analyzed for Fe, Zn, Cu and Pb against standard concentration of each metal on a Perkin Elmer Atomic Absorption Spectrophotometer (Model 3030) equipped with an HGA-500 graphite furnace atomizer and a deuterium background corrector. Blank correction was done to bring accuracy to the results.

RESULT

The concentrations of selected heavy metals in *C. repens* collected from three different islands of Indian Sundarbans during three different seasons are highlighted in Figures 2-4. The metals accumulated as per the order Fe > Zn > Cu > Pb and the spatial variation was Gosaba > Jharkhali > Bali Island.

Table 1. Location of sampling stations

Station	Geographical Location	
	Latitude	Longitude
Gosaba	22°08'53.66" N	88°56'34.20" E
Jharkhali	22°05'52.82" N	88°41'47.25" E
Bali Island	22°04'35.17" N	88°44'55.70" E

Fig 1. Sampling stations in Indian Sundarbans

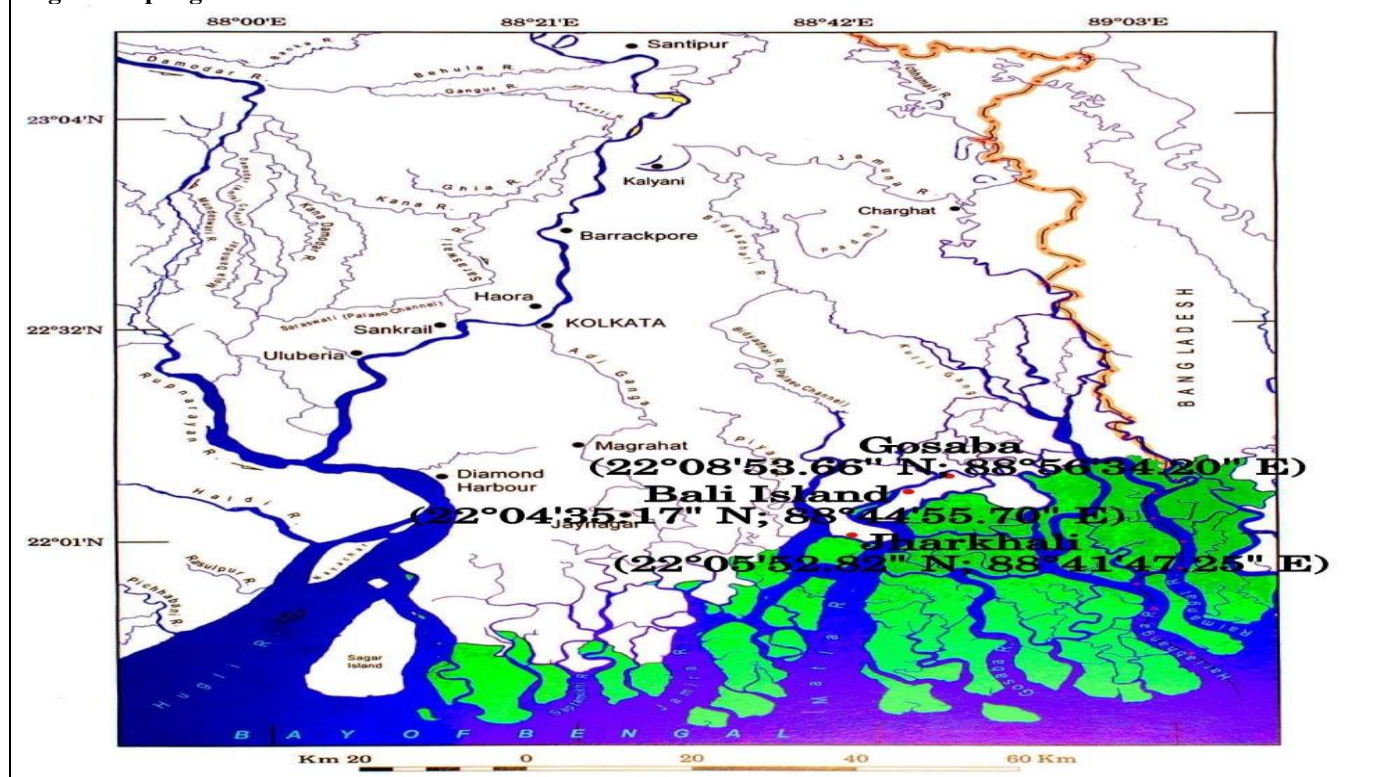


Fig 2. Concentrations of selected heavy metals in *C. repens* at Gosaba during 2014

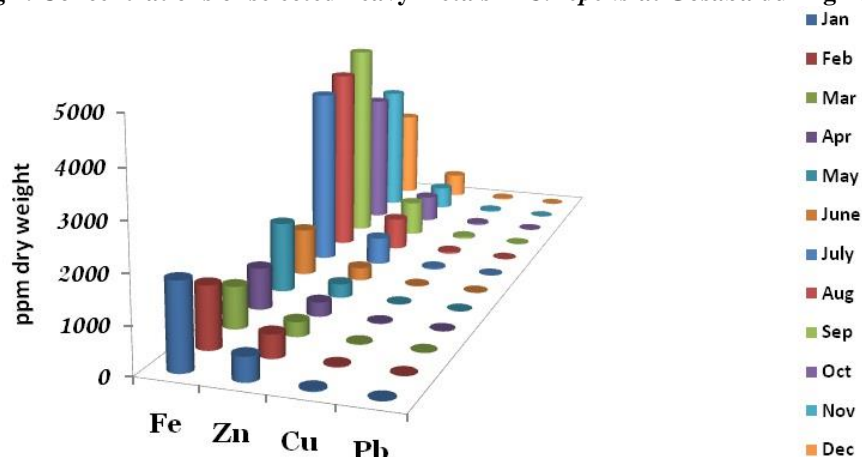


Fig 3. Concentrations of selected heavy metals in *C. repens* at Jharkhali during 2014

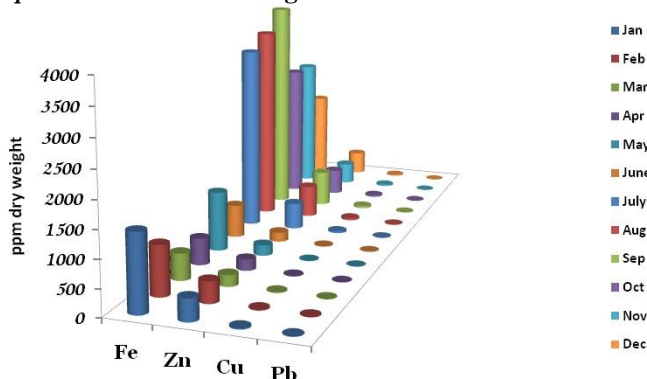
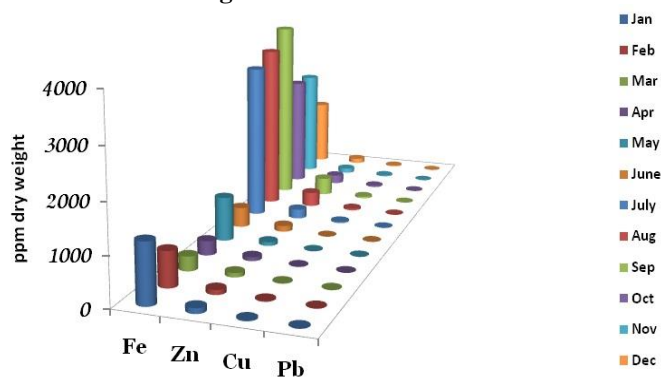


Fig 4. Concentrations of selected heavy metals in *C. repens* at Bali Island during 2014



DISCUSSION AND CONCLUSION

C. repens exhibited unique seasonal variation in context to heavy metal accumulation with highest value during monsoon (June - September) followed by postmonsoon (October - January) and premonsoon (February - May). The seaweed species also exhibited pronounced spatial variation with highest value in Gosaba followed by Jharkhali and Bali Island. Irrespective of time and space, the order of accumulated metal is Fe > Zn > Cu > Pb. The level of heavy metals in *C. repens* may serve as proxy to anthropogenic activities operating in and around the sampling stations. Gosaba, being the entry point to central and eastern Indian Sundarbans experiences extreme tourism pressure. The presence of busy market and trawler repairing activities multiply the magnitude of such pressure, which is reflected through highest heavy metal levels in *C. repens* collected from the station. Jharkhali

also has tourism pressure almost throughout the year that may be the reason for considerable heavy metal level in the seaweed thallus. The lowest concentrations of heavy metals in samples collected from Bali Island speaks in favour of least anthropogenic activities in this zone due to proximity of the sampling station to Reserve Forest area. A long term study of some 5 years encompassing sediment and dissolved heavy metals is, however, needed to establish *C. repens* as indicator of heavy metals in Indian Sundarbans region.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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