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HABITAT OF *CYNOMETRA IRIPA* KOSTEL. ALONG WEST COAST OF MAHARASHTRA

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ABSTRACT

The present investigation deals with the habitat of mangrove *Cynometra iripa*. *C. iripa* which is critically endangered species along the coast of Maharashtra. Habitat is an ecological or environmental area that is inhabited by a particular species. The soil-water-plant relationship and the role of soil-plant–atmosphere is unique and species specific. Therefore, soil-water analysis was carried out site wise and seasonally. Soil supporting *C. iripa* is sandy. EC of the soil is in the range of 0.27 to 20.84 mS/cm. Soil pH fluctuates greatly in the range of 3.48 to 8.10. Mineral represents exchangeable cations. Mineral percentage is found to be higher at Karivane site. Organic matter is comparatively lower at Parwadi. Relative humidity is high during winter at Aadbander and lowest in monsoon. Highest air temperature was recorded at Achara estuary (38.2^{0}C) during summer at Aadbander site while lowest (25.2^{0}C) at Parwadi. Physiochemical properties differ seasonally and site wise. Mineral contents also vary site wise. Thus, habitat plays a key role in the distribution of mangrove species..

Keywords:- *Cynometra iripa, habitat, minerals, E.C., pH, water and soil* etc.

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INTRODUCTION

Mangroves are found in tropical and sub-tropical tidal areas, which have a high degree of salinity. Areas where mangroves occur include estuaries and marine shorelines. Plants in mangles are diverse; but all are able to exploit their habitat (the intertidal zone) by developing physiological adaptations to overcome the problems of anoxia, high salinity and frequent tidal inundation.

Habitat is an ecological or environmental area that is inhabited by a particular species (Dickinson, 1963; Abercrombie *et al*., 1966). It is natural environment in which an organism lives, or the physical environment that surrounds, influences and is utilized by the species population. In other words, it is a place where a species grows and lives. Estuarine ecosystem is characterized by both erosional and depositional processes. The mangrove ecosystem is dynamic ecosystem and

constantly changing (Blasco *et al.,* 1998).Therefore, the present attempt is made to study the habitat of this critically endangered mangrove species *Cynometra iripa* Kostel. having restricted distribution at Sindhudurg district of west coast of Maharashtra.

Mangroves grow luxuriantly in alluvial soils (loose, fine textured mud or slit, rich in humus). Because mangrove roots exclude salts when they extract water from soil. Soil salts could become very concentrated, creating strong osmotic gradients (Passioura *et al.,* 1992). However, viscous, polymeric substances in the sap limit flow rate and decrease transpiration (Zimmermann *et al.*, 1994). This helps the mangroves to conserve water and regulate internal salt concentrations (Ball and Passioura, 1993; Ball, 1996). *Cynometra iripa* grows where there is greater influence of fresh water due to tidal flats nearer to riverine fresh water sources. There are two views regarding growth of mangroves under fresh water condition. Bowman, (1917); Warming and Vahl (1909); Roseveaar, (1947); have reported good growth of mangroves under fresh water. Nevertheless, Conner (1969) and McMillan (1971) have emphasized the need of salinity for good growth of mangroves.

Usually plants are grown in the soil and soil properties directly affect the availability of water and nutrients to plants. Soil water affects the plant growth directly through its controlling effect on plant water status and indirectly through its effect on aeration, temperature and nutrient transport, uptake and transformation. The soil- water- plant relationship and the role of soil-plant atmosphere is unique and species specific. Therefore, soil-water analysis was carried out site wise seasonally along with some major climatic factors viz., temperature, humidity, E.C. pH, minerals, organic matter, chlorides and salinity along with granulometry.

MATERIAL AND METHODS:

Season wise soil samples were collected along with plant material. In each season soil from the base of the plants and around the roots was collected for analysis. It was allowed to dry in the air and dried soil samples were sieved and fine part was used for analysis. Seasonal changes with respect to temperature and humidity were recorded by using thermometer and humidiometer.

Granulometry**:** The particle size distribution of soil was determined by using sieves of different mesh size by following the method of Misra, 1989.

pH, electrical conductivity, chlorides and Salinity: Methods used for these parameters are as follows and used for soil and water analysis.

For the analysis of water standard methods were used as described by Trivedy and Goel (1986). Following parameters were studied for water analysis.

The temperature of water was measured by using ordinary thermometer. It is expressed in degrees Celsius (°C). pH is a measure of the concentration of hydrogen ions in the water. The pH of water was measured by using pH meter (Elico LI 120 and control Dynamics APX 175 E).

The Electrical Conductivity of sample was measured by using systronic Electronic conductivity meter.

Chlorides were calculated using method by Trivedy and Goel (1986). Salinity was calculated from chlorinity according to Knudsen (1901).

Soil organic carbon and organic matter was determined using Walkley and Black (1935) method as described by Trivedy and Goel (1986).

Soil minerals were detected on atomic absorption spectrophotometer (Perkin Elmer, U.S.A.) from acid digests. For digestion the method given by Toth *et al*., (1948) was followed.

Method described by Trivedy and Goel (1986) was followed for estimation of Sulphates, total Solids, and minerals.

RESULTS AND DISCUSSION:

Broad idea of the nature of mangrove soil can be obtained from pH, Electrical conductivity, chlorides and minerals. Organic matter indicates status decomposition and recycling of nutrients. These parameters are the result of physical and chemical processes taking place in the soil. Soil

substrate acts as a major geomorphological constraint in mangrove development (Thom, 1967).

Temperature is the first climatic factor controlling all the vital processes. Mangroves can not tolerate low temperature and grow only in tropics and up to some extent in subtropics.

According to Walsh (1974) and Chapman (1975, 1976) extensive mangrove development occurs only when the average air temperature of the coldest month is higher than 20^{o}C. Gokhale (2004) has recorded air temperature which is in between 24^{0}C to 34^{0}C for Achara estuary.

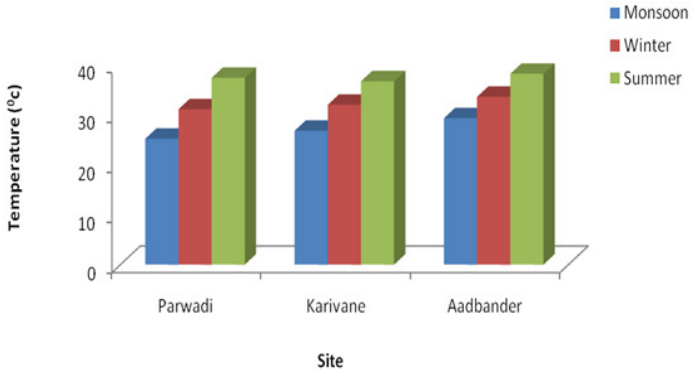

Fig. 1 : Seasonal variation in temperature.

Fig.1 shows seasonal variation in the air temperature for three sites. The present data highlights the fluctuations in air temperature of three sites seasonally. The lowest temperature was recorded in Parwadi site (25.2°C) in monsoon. While in summer season, the temperature ranges between 36.7°C to 38.2°C. Temperature in winter season ranges from 31.1°C to 33.6 ^{0}C. Temperature of Aadbander varies between 29.3^{0}C to 38.2°C. In the present study highest air temperature recorded at Achara estuary is 38.2°C in summer at Aadbander site, and lowest 25.2 ^{0}C at Parwadi site.

As humidity directly affects the rate of transpiration, the mangroves grow in the regions with high relative humidity. During present investigation 46 to 91 % relative humidity was recorded. It approaches lowest during rainy while highest during winter season (Fig. 2).

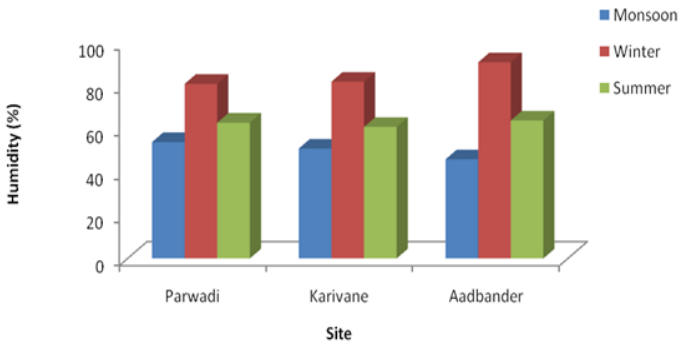

Fig. 2: Seasonal variation in humidity.

Though in the estuarine ecosystem the water is plentiful, the soil is physiologically dry due to high salt contents. Water absorbance is therefore a problem for mangroves. Mangroves show water economy by means of some xerophytic characters (Bhosale and Mulik, 1992). Gokhale (2004) recorded relative humidity 50 to 90% from Achara estuary.

From (Fig. 2) it is clear that relative humidity at Parwadi is 54 to 63%, at Karivane 51 to 61% and at Aadbander 46 to 64%. Relative humidity is high during winter at Aadbander and lower in monsoon at Aadbander. On an average, the humidity is 62% which is requirement of *Cynometra iripa*.

In the present study, soil samples from Parwadi, Karivane and Aadbander were analyzed for Granulometry (Table 1). From the table it can be observed that most of the soils show maximum Gravel and coarse sand content with very low fine and clay silt content.

pH is the measure of the degree of acidity or alkalinity of an aqueous solution. pH is governed by various factors like nature of substratum, type of parent rock, precipitation and microbial activity in the related environment. The pH of mangrove soil is depending upon the amount of organic substances mixing in the soil. According to Bhosale (1990b), the pH values in the estuarine soil changes as per the location.

Table 1 Granulometry of mangrove soil surrounding *C.iripa* from sites of Achara estuaries.

Site	Season	Soil texture				Soil type
		Gravel (%)	Coarse sand (%)	Fine sand (%)	Silt clay (%)	
Parwadi	Summer	52.00	38.18	8.18	1.64	Gravel
	Winter	41.20	53.40	4.12	1.28	Sandy
	Monsoon	24.16	51.10	19.00	5.74	Sandy
Karivane	Summer	45.33	31.97	16.04	6.66	Sandy
	Winter	34.46	47.56	17.68	0.30	Sandy
	Monsoon	24.71	44.89	19.08	11.32	Sandy
Aadbander	Summer	30.62	50.76	17.10	1.52	Sandy
	Winter	39.20	54.78	3.78	2.24	Sandy
	Monsoon	21.10	50.19	23.67	5.04	Sandy

The present investigation deals with the pH of soils from different mangrove sites in the study area. The range of pH recorded during the study is from 4.31 to 7.74. The pH of soil shows wide range from acidic to alkaline (Fig. 3). The soil supporting *C. iripa* showed lower soil pH in monsoon months in all three sites. In summer months, soil pH was neutral to slightly alkaline at all three sites. Only at Parwadi soil is found to be gravel during summer. Otherwise it is sandy for all sites.

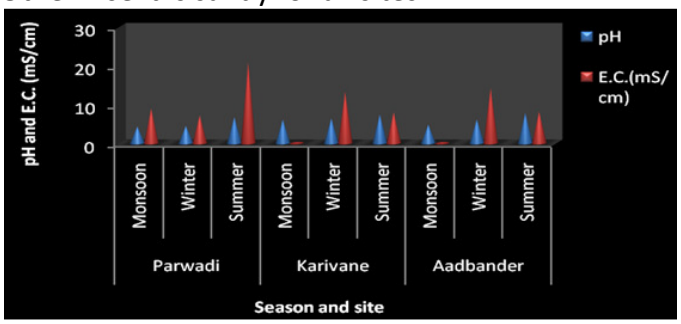

Fig. 3: Seasonal variation in soil pH and E.C.

In estuarine habitat the electrical conductivity is usually governed by salinity, therefore, the values are parallel to salinity (Bhosale, 1990a). In the present work the electrical conductivity for soils from different sites was recorded (Fig. 3). It is seen that the range of electrical conductivity for the soils from Achara is 0.27 mS/cm to 20.84 mS/cm. The values for electrical conductivity change with respect to the location and environment.

Chlorides and salinity are positively correlated factors. According to Gaykar (1991), mangrove litter contributes 4.94 g Cl/100 g of dry litter. The increase in the chloride level in estuarine environment increases the salinity. The chloride range recorded for different locations is different. The range of chlorides for Achara is from 0.142 to 1.63%. For Parwadi it is 0.171 to 0.572% and 0.396 to 1.431% for Karivane. For Aadbander it is 0.142 to 1.63%.

The values of levels of salinity (%) of soil are depicted in Fig.4. Salinity of soil substrate of *C. iripa* varies from 0.338 - 2.972 (%). It is noted that higher values of salinity (2.97) are found during summer season. The lowest value of salinity is recorded in monsoon (0.338%) at Parwadi at Achara estuary.

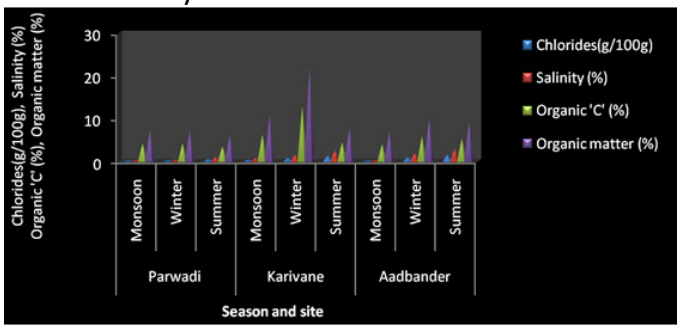

Fig. 4: Seasonal variation in soil Chlorides, salinity organic 'C' and organic matter.

Generally organic matter is high at midstream region and goes on decreasing towards mouth and upstream. During present study, the range of organic matter recorded is 6.006 to 22.270% of soil (Fig. 4). The sites near mouth i.e. Aadbander show comparatively low organic matter than upstream regions. It may possibly due to high tidal action near mouth. Karivane site show high organic matter content during winter months.

Minerals play key roles in the physiological mechanism in the mangroves. The minerals are recycled between water, soil and plants. Various mineral constituents are required for normal functioning of the ecosystem. In the present study, the soil from various sites of Achara, were analyzed. The results are depicted in Fig. 5.

In the present study, sodium has been analyzed from the soils around the mangroves. The results reveal that the sodium content of soil varies from site to site. Sodium in the mangrove soil of Achara is found in the range of 0.557% to 1.940% (Fig. 5). Higher values are obtained during summer and lower in monsoon. At Parwadi and Karivane the range is 0.557% to 1.430% and 1.076 to 1.940% respectively. At Aadbander sodium is in the range of 0.995 to 1.525%.

Potassium is in the range of 0.097% to 1.399% (Fig. 5). At Parwadi and Karivane the range is from 0.097% to 0.667% and 0.109% to 1.399% respectively. At Aadbander it is found in range of 0.079 to 0.997%. Potassium in soil substratum of *Cynometra iripa* is higher in summer and lower in monsoon.

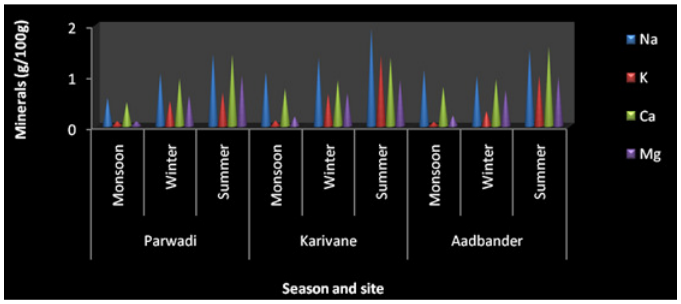

Fig. 5: Seasonal variation in soil minerals.

In the present study, Calcium values from Parwadi, Karivane and Aadbander ranges between 0.470% to 1.420%; 0.736 to 1.356% and 0.778 to 1.569% (Fig. 3) respectively which are higher than those reported by Kotmire (1983).

Magnesium from soil substratum ranges between from 0.099% to 1.00% from sites of Achara under study. Magnesium values from Parwadi, Karivane and Aadbander are 0.099 to 1.00%; 0.186 to 0.916% and 0.209 to 0.968 respectively (Fig. 5). Magnesium values were found to be higher in summer months and lower during monsoon. Mineral content varies from site to site, estuary to estuary and seasonally.

Water in mangrove ecosystem is important entity in dynamism of the ecosystem. It is so because there are two high and two low tides daily, in general.

Water inundating *C. iripa* is slightly acidic to alkaline at all sites of Achara in all seasons. The pH values ranges between 3.47 to 8.10. At Parwadi the range is from 3.47 to 7.40. At Karivane it is 5.89 to 8.10. At Aadbander range is 6.18 to 7.58 (Fig. 6). The lowest pH 3.47 is recorded at Parwadi of Achara.

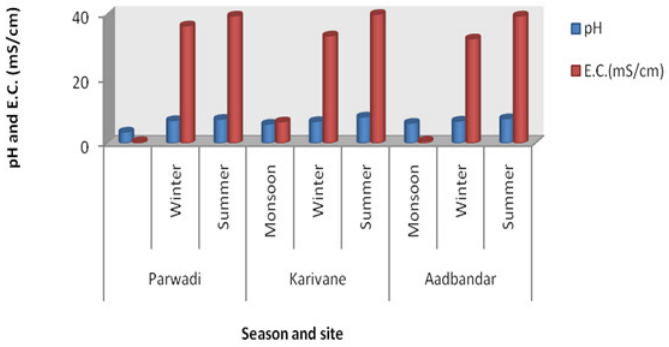

Fig. 6: Seasonal variation in water pH and E.C.

Electrical conductivity of water is 6.60 to 39.78 mS/cm at Karivane, 0.52 to 39.28 mS/cm at Parwadi. E.C. of water is 0.68 to 39.29 mS/cm at Aadbander. Values are maximum in summer months, comparatively more in winter and lower in monsoon (Fig. 6).

Values of Na remained higher in summer and lower in monsoon and in between in winter (Fig. 7). At Parwadi, Na range is 0.191 - 9.85 g/l, and it is 0.709 - 13.69 g/l at Karivane. At Aadbander Na ranges from 2.176 to 12.89 g/l.

The range of Potassium is 0.093 - 1.28 g/l at Parwadi and 0.101 to 1.69 g/l at Karivane and 0.084 to 2.711g/l at Aadbander. The values of Potassium for Achara estuary are (0.004 to 3.019 g/l) given by Gokhale (2004). The values of Potassium for Achara, Purnagad and Jaigad were given by Jugale (2010) in the range of (0.053 - 2.698 g/l), (0.043 - 1.623 g/l) and (0.002 - 1.319 g/l) respectively.

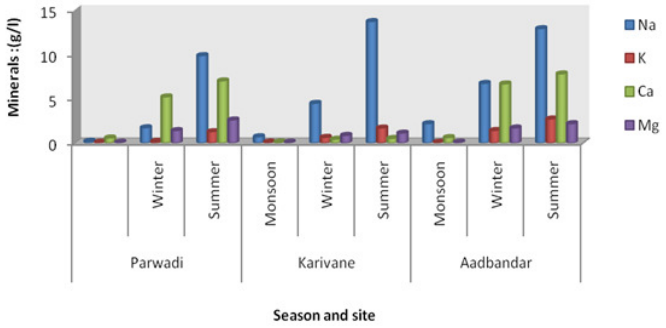

Fig. 7: Seasonal variation in water minerals.

Calcium range is 0.116 to 7.789 g/l at Achara and at Parwadi it ranges from 0.570 to 7.00 and 0.116 to 0.510 g/l at Karivane. At Aadbander it ranges from 0.611 to 7.789 g/l.

Magnesium is in the range of 0.078 to 2.60 g/l at Parwadi. At Karivane, it ranges from 0.094 to 1.112 g/l and 0.093 to 2.179 g/l at Aadbander.

The levels of Chloride content (g/l) of water are depicted in Fig. 8. In Parwadi, Chlorides in water inundating *C. iripa* vary from 0.198 to 22.00 g/l at Karivane it is from 0.41 – 25.15 g/l. At Aadbander, chlorides in water range from 16.08 to 48.82g/l.

At site Parwadi, Karivane and Aadbandar, salinity inundating *C. iripa* varies from 0.387 g/l to 62.8 g/l. At Aadbander salinity of water ranges from 29.054 to 62.80. Salinity is highest at Aadbander site in summer.

The levels of sulphate (g/l) from water are 0.19 to 0.53 at Parwadi and 0.21 to 5.26 g/l at Karivane. At Aadbander sulphates range is 0.87 to 6.24g/l. The values of sulphates are higher at Aadbander in summer and lower at Parwadi in monsoon.

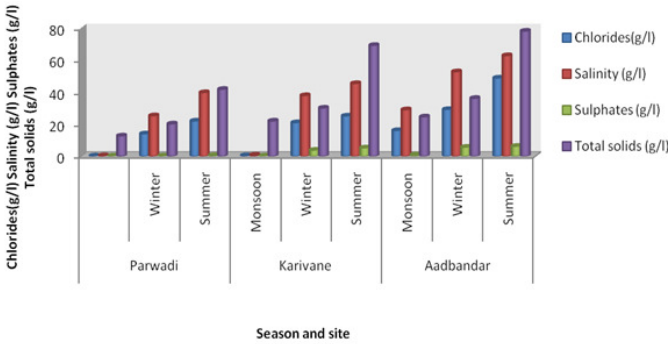

Fig. 8: Seasonal variation in water chlorides, salinity, sulphates and total solids.

The presence of dissolved solids in considerable amount is characterization of estuarine water. The present results of total solids range in between 12.70 to 78.08 g/l (Fig. 8). It shows the sequence for total solids as summer followed by winter and monsoon.

SUMMARY AND CONCLUSION:

Soil supporting *Cynometra iripa* is sandy; EC of the soil is in the range of 0.27 to 20.84 mS/cm (Achara). Soil pH fluctuates greatly in the range of 4.31 to 7.44. pH of water has range of 3.48 to 8.10. Minerals represent exchangeable cations. Mineral percentage is found to be higher at Karivane and lowest organic matter is found at Parwadi. Relative humidity is high during winter at Aadbander and lowest in Monsoon. Highest air temperature recorded at Achara estuary is 38.2 ^{0}C in summer at Aadbander site and lowest 25.2 ^{0}C at Parwadi.

Physico-chemical properties differ seasonally and site wise. Mineral content also varies from site to site. Habitat play key role in the distribution of the species. Soil substrate acts as a major geomorphological constraint in mangrove development. System's habitat is determined by geomorphological features such as tides, fresh water input sea level change, local factors and other disturbances. Therefore these features govern the development of system.

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