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Ecological and ethnobotanical studies in *Acanthus ilicifolius* Linn.

K.P. Lissy and Thara K. Simon

St. Peter's College, Kolenchery and Union Christian College, Aluva, Kerala

Abstract

Acanthus ilicifolius Linn., a typical mangrove associate grows gregariously along the coasts of Cochin backwaters and marshy wetlands. Typical mangrove adaptations such as presence of pneumatophores and vivipary lack in them. However' they are provided with efficient saline tolerant adaptations such as thick cuticle, well deveoped hypodermis, presence of lipids and salt glands. The soil analysis from two sites in the monsoon season indicate that the species has wide ecological amplitude. Efficiency of the vegetative propagation through the reclining stems adds to its efficiency as a sand binder to prevent soil erosion and to resist winds and currents of the shores. The ethnomedicinal significance of the species is also highlighted.

Wetlands are often world's most productive ecosystems that provide suitable habitats for a number of species. These include a wide range of habitat types such as rivers, lakes, salt marshes, mangroves and estuaries. Tropical coasts of the world support millions of hectars of mangroves and they are depleting rapidly. India, with its dieversity of agro-ecology and socio - cultural conditions, is considered as the store-house of medicinal and aromatic plants. The degradation and destruction of mangrove forests have been the cause for the loss of biodiversity and the present study focuses on *Acanthus ilicifolius* Linn., a medicinal mangrove associate.

Acanthus ilicifolius Linn., often called as 'Sea Holly" coming under the family Acanthaceae is a woddy perennial which grows in mangrove swamps and tidal zones of coastal marshes. They are considered as mangrove associates as they lack typical adaptations such as pneumatophores and vivipary. However, they predominate the saline flats of Cochin backwaters. These plants are succulents with reclining stem and spiny margined leaves. Dwivedi *et al* (1975) have given an account of the west coast mangrove flora. A general account of Indian mangrove flora was given by Blasco (1975). *A. ilicifolius*, considered as a mangrove (Metcalfe and Chalk, 1957), shows a luxuriant growth in halophytic habitat. However, Tomlinson (1986) considered this plant as an associate. Mulik, (1990) reports that *A. ilicifolius* flourishes in the mangrove ecosystem as a pollution indictor. The present study aims at highlighting the ecological, histochemical and ethnomedicinal aspects of the species.

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Material and methods

The species *A. ilicifolius* was identified based on its morphological characters with reference to Gamble (1915). The materials for study were collected from Paravoor and west Eroor by the side of rice fields and 'Kayal" respectively and were fixed in FAA. Fresh materials were also collected for certain tests. For uniform results, variables such as time temperature and concentration of dyes were kept constant as far as possible. The following parameters were studied.

Ecogeographical aspects

a) Ecological adaptations: The plant was completely uprooted and the area that covered the root was noted. The special mode of vegetative propagation with reclining stems was also studied.

b) Soil analysis: The soil samples from two collection spots viz. Eroor and Paravoor were collected and analysed.

Medicobotanical aspects

a) Ethnomedicinal aspects: A compilation of the medicinal properties of the species was also done.

b) Histochemical localisation of various components

The foliar epidermal peelings, T.S. stem T.S. of root and T.S. of leaf were subjected to the histochemical localization of starch, cellulose, lignin, polyphenol, pectin, taruin, sulphated and carboxylated polysaccharides and lipids. Both fresh and chemically fixed specimens were used for the study of histochemistry. In fresh leaves, if possible, the epidermis was peeled off with a fine forceps or blade. T.S. of stem, root and leaves were taken. Tests for Lignin, cellulose, starch, polyphenol, pectin, tannin, lipids, sulphated and carboxylated polysaccharides were done.

The methodologies adopted by Johansen (1940) Jenson (1962), Krishnamurthy (1988) and Vijayaraghavan and Shukla (1990) were followed.

Results

A. ilicifolius grows dense along the side of rice fields and 'Kayal' at Eroor and Paravoor. A single bush covers 2 meters area. The stem shows a runner habit (Fig. 1). Adventitious roots are produced from the nodel region and new shoots are also produced. A single node with shoot and root system act as an independent plant. Number of roots produced from each node varies from 2-8.. The distance between two node ranges from 4 to 6 cm, height of the shoot up to 154 cm and the length of the roots up to 24 cm. The root system acts as a belt or sand binder and thus checks soil erosion. (Fig.1)

Fig. 1. *Acanthus ilicifolius showing the runner habit with advantitious root system*

Positive staining reactions were observed for all the tests except for tannin. The epidermal peeling (both upper and lower), stem root and leaf were subjected to the histochemical localisation of starch, cellulose, lignin, pectine, polyphenols, lipids and sulphated and carboxylated polysaccharides in *A. ilicifolius*. When tested with I_2 KI, starch grains were observed as blue black granules in the guard cells. Starch grains are absent in the subsidiary cells and epidermal cells. I_2 KI - H_2SO_4 test for cellulose shows that the walls of the cells responded quickly and developed blue - violet colour.

Sudan dyes method for lipids:

Positive staining reactions were observed for the presence of lipids in the cell walls and cytoplasm of guard cells, subsidiary cells and epidermal cells. Large lipid globules were seen in the epidermal cells, guard cells and subsidiary cells. The cells of salt glands also turned reddish orange colour.

Toluidine blue '0' (TBO) method for sulphated and carboxylated polysaccharides, phenolics and lignin:-

TBO is a metachromatic stain and with pectins it gives pink colouration. Lignin shows greenish blue shade on the inner walls of guard cells. A turquoise green hue was obtained for polyphenols. In certain cases, the dye localized nuclei and other protenaceous bodies with blue green colour. High phenolic deposit was obseved in the cytoplasm of hypodermal cells of leaves. Test for Tannin gave a negative result. Table I consolidates the data on

Table 1. *Data on histochemical observations*

			TBO					
	I_2KI Starch	I_2KI H_2SO_4 Cellulose	Sulphated carboxylated polysacharides	Lignin	Pectin	Polyphenol	Sudan III lipid	Lugols iodine tannin
T.S.		+	+			+		
Upper epi:		+				+		
E		+				+	+	
Leaves								
Lower epi: S		+				+	+	
G	+	+		+		+	+	
Salt glands		+	+		+			
Stem T.S.	+	+		+	+			
Root T.S.	+	+		+	+			

E - epidermal cell, S - subsidiary cell
G - general cell, + = positive

histochemistry. The analysis of siol was done for two sites in the monsoon season and the data is shown in Table II

Discussion

The species under study is a common halophyte and is a prominent component of the mangrove ecosystem. Recent reports of Mulik (1990) show that in the sites of sewage polluted area, the plant community is dominated by *A. ilicifolius* along with *Avicennia* and *Sonneratia* and have thus gained ecological significance as indicators of organic pollution. *A. ilicifolius* is least affected by the stress of various environmental factors such as change in the climatic conditions and pollution. However, plant is favoured to grow in a polluted halophytic environment.

Soil analysis revealed that both the samples are acidic (Table II). The total soluble solutes (T.S.S.) are medium (0.43 & 0.38). The quantity of nitrogen is medium in sample I and II (0.81 & 0.88), phosphorus is high in both samples (63 and 68.25) and potassium is medium in sample I (224) and low in sample II (112).

Muralidharan (1984) has recorded that the total Nitrogen and available phosphorous content of the soil were found to be in the range of 0.29 - 0.87 % and 0.0043 - 0.013% respectively in three sites viz. Murukkumpadam (A), South west zone of Vypeen (B), Narakkal (C). The soil pH ranged from 6.3 to 7.45. The pH in B was almost constantly slightly higher than other sites followed by A. There was a fall in pH by mid of May, mid June and end of July, of which the first is prominent in A and second in B. The third fall is by mid July in C. After wards pH increases slightly over the period.

The nitrogen values are quite high compared to the values showed by Mukerjee (1975) in Sunderbans (0.02 - 0.09%). Phosphorous values are comparatively lower in the present area while that of Sunderbans are 0.06 - 1%. Both the parameters showed an increase over the season. This may be due to the increase in nitrate and phosphate content of the Cochin backwaters during monsoon as reported by Nair and Tampy (1980).

Starch grains are lcoalised in the guard cells of the plant under study. Cutter (1978) is of opinion that epidermal cells of angiosperms are devoid of well-developed plastids except in some submerged leaves. Esau (1977) comments that with regard

Table 2 *Data on soil analysis*

Estimations		pH	T.S.S Carbon(%)	Organic (Kg./ha)	Phosphorus (Kg./ha.)	Potassium
	Sample I					
Value	Eroor	5.1	0.43	0.81	63	224
	Sample II					
	Paravoor	5.8	0.38	0.88	68.25	112

to plant parts that normally bear cells having phenolic deposits, no tissue lacks polyphenols entirely. In the present work, polyphenols are observed in the hypodermis of leaves. Toluidin blue 'O' being a metachromatic dye, stains pectins as well as lignin. As these compounds universally occur in plant, much significance cannot be attributed to the distribution of these compounds in the epidermis. The lignification of the inner wall of guard cells can be attributed to the physiological functions of stomata (Salisbury and Ross, 1986).

Positive results were obtained for the test of lipids. The biochemical composition of the leaves of *A. ilicifolius* was worked out by Bhosale *et al* (1976) and found to be rich in lipids (13.5%). The halophytic regions are always under stress as these regions are polluted by solid and liquid wastes. The presence of lipids may be an adaptation to resist adverse conditions.

The species is medicinally important. The vernacular names of the plant are 'Uppuchulli', 'Muthalachulli', 'Pannichulli' or 'Vayalchulli' in Malayalam. Tender shoots and leaves ground in water used as application to snake bite. Leaves with abundant mucilage is used in rheumatism, neuralgia and also to accelerate urine. Decoction of the plant is given in dyspepsia. (Kirtikar and Basu, 1981; Nadkarni, 1976).

Local people use this plant to cure mumps. The leaves of this plant are made into paste and are applied to affected areas. This may be attributed to the salt secreting and water holding capacity of the plant, and can thereby reduce swelling. Among the saline secreting halophytes (the salt secreting and non-secreting group), the concentration of the cell sap in the saline secreting group is ten times greater than that of the other type and their ionic concentrations is almost similar to that of the marine. *Acanthus* is provided with numerous salt secreting glands and has high adaptation to physiological dryness of the soil. This may be attributed to the property of reducing swelling.

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