



EVALUATION OF MORPHO-ANATOMICAL CHARACTERS OF PICHAVARAM MANGROVE PLANTS

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ABSTRACT

Mangroves are developed in tropical and sub-tropical coastline spots of the world. In these living space to displays novel tolerant possibilities against the ecological worries with the assistance of morpho – anatomical exceptional characters. Be that as it may, Mangroves were securing the coastline and to keep beach front disintegration from catastrophic event. The Present examination was done anatomical varieties and morphological connections to survey their inter and intra particular connections among the mangrove plants species. In view of the morphological perception morphologically a few modification, for example, stilt root, vivipary germination, crypto vivipary, spread root, succulence leaf and anatomical discoveries distinctive writes stomata saw under same survival environment we finish up the human or non-human exercises seriously harmed and propensity, natural surroundings misfortunes of mangroves decent variety. Thus, in this basic circumstance to improving and to creates exsitu protection procedures of mangroves in pichavaram mangrove woodlands.

KEY WORDS

Morpho – Anatomical, Mangrove, Vivipary, Crypto, Stomata

INTRODUCTION

Mangroves are the predominant woody timberland vegetation's present in the tropical and sub-tropical coastline zones on the planet. It has numerous remarkable physical highlights, particularly for saltiness slope from freshwater to seawater (Odum *et al.*, 1982). Environmental pollution occurs when the environmental degradation crosses limit so that. It becomes lethal to living organisms (Usha *et al.*, 2017) Mangrove species has some uncommon adjustments by morphological character and anatomical adjustment, for example, impossible to miss collection of mangrove plants, create on sloppy shorelines, salt water regions, and tidal ponds and are portrayed by rough leaves, depressed stomata, stilt roots,

pneumatophores and viviparous natural products. These are all adaptations to inspire plants development and improvements are all around adjusted and effectively make due to evolving organic, concoction and physical attributes of different xeromorphic ecological conditions. Chapman, (1976) Mangroves are potentially gainful, naturally various, nutritiously advanced beach front biological community and its vegetation contains roughly eighty plant species having a place with thirty genera in more than twenty families, the greater part of them has a place with Rhizophoraceae are perceived around the world (Tomlinson, 1986). The present examination was engaged for proposed to investigations of morphological characters and anatomical adjustments

were fundamentally assessed in mangrove and Mangrove partners from T.S. Pettai. Pichavaram Mangroves.

The Pichavaram mangrove timberland is rich mangrove decent variety in Tamil Nadu. The present review was directed by T.S. Pettai costal territory in Pichavaram mangrove timberland and Totally 10 species were recorded in the examination time frame including 9 mangroves and 1 mangrove related plants. The Pichavaram Mangrove timberland contains Avicennia and Rhizophora species were observed to be overwhelming species taken after by One predominant partner animal category were discovered, for example, *Salvadora persica* is a jeopardized plant species was recorded in a not very many.

MATERIALS AND METHODS

Study zone

The Pichavaram mangrove woodland is from Thandavarayan Sozhan Pettai, (T.S. Pettai) The Coastal zone is situated at 79047'13" N - 11029'57" E over the MSL is 5m. In East coastline of Cuddalore region of Tamil Nadu, India. (Map. 1. Describes the study area) An appraisal of Morpho – Anatomical investigations the accompanying mangroves and mangrove relate species were basically assessed. i.e., *Acanthus ilicifolius* L., *Aegiceras corniculatum* Blanco., *Avicennia marina* (Forsk.) Vierch., *Avicennia officinalis* L., *Ceriops decandra* (Griff.) Ding Hou., *Excoecaria agallocha* L., *Lumnitzera recemosa* Willd., *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir. What's more, *Salvadora persica* L. They are wealth in the mangrove belt of Pichavaram, on the east shore of Tamil Nadu, India (11°24'N and 79°44'E) around 13km east of Annamalai University grounds. These species were gathered and conveyed to the research centre amid the time of summer and pre-fall seasons the completely developed leaves were disengaged from the plant twigs and surface residue was washed with refined water and the mid-ribs were expelled and laminate were utilized for different investigations Develop leaves of a similar age from the indistinguishable position of the plants were chosen for the estimation of physical parameters, for example, leaf thickness, leaf mass, leaf volume, level

of dampness and for the count of thickness (Linacre 1964). The relative water content was evaluated utilizing the technique of Bars (1968) to gauge the dry weight, leaf tests were dried at 800C for 48 h. in a broiler and after that weighed.

For stomatal examinations, epidermal peels of the completely developed leaves were taken and analyzed under a light magnifying lens. Stomatal index (SI) was computed by tallying the quantity of stomata and number of epidermal cells in the tiny field and utilizing the equation, (Salisbury and Ross 1977)

$$SI = \frac{S}{S+E} \times 100$$

where, S= number of stomata ; E= number of epidermal cells

Stomatal recurrence was ascertained by including the quantity of stomata the tiny field and communicated as number of stomata in 1 sq. cm surface (Sampson 1961)

Anatomical Studies

Hand section of leaves were made at a position around somewhere between the base and summit of a segment from one side of the lamina. Petiole areas were made amidst the petiole. The segments are recolored with fluid safranin and were mounted in glycerine jam. The cover glass is fixed with paraffin wax. The slides were seen under light magnifying lens and captured utilizing Olympus computerized camera joined with Olympus trinocular magnifying lens.

Leaf and Stem Anatomy

For concentrate the interior structure of the leaf and stem, thin transverse segments were taken by utilizing rotating microtome are straightforward hand area cuttings are taken finely cutted areas were chosen and recolored for saw under electron magnifying lens and thickness of leaf was estimated by methods for pre-adjusted visual micrometer.

Morphological Studies

Morphologically watched characters are noted and recorded for variety investigation between same genus and types of mangrove plants

Exceptional Characters are seen in mangrove plants

1. Salt barring species:

Salt Tolerance Adaptations. Adaptions for salt prohibition or salt discharge enable mangroves to live

where other earthbound plants can't. Through physiological adjustments, mangroves can live in cruel saline conditions. The underlying foundations of these species have a Ultra-filtration by which water particles from the seawater are taken in by turn around osmosis process and salts are prohibited in the root zone itself.

2. Salt discharging species:

These species take saline water all things considered however water atoms and fundamental salts are held in the tissue of the plants while overabundance are discharged through salt organs. Case of: Rhizophora and Avicennia Species

3. Salt amassing species:

These species take saline water all things considered however water atoms and fundamental salts are held in the tissue of the plants while overabundance salts are discharged through salt organs Example of the species *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina* and *Avicennia officinalis*.

4. Breathing roots:

Underground tissue of any plant locale for breath and mangrove conditions oxygen in soil is exceptionally restricted or nil. These require mangrove root framework to take up oxygen from the atmosphere. For this reason, mangrove species have concentrated over the ground roots called breathing roots (or) pneumatophores. In a few animal groups, these roots are pencil estimated and pog like while in some different species they resemble a knee. These roots have various pores through which oxygen goes into the underground tissues, in a few plants brace roots work as breathing roots and furthermore give mechanical support to the tree. Example: Avicennia species

5. Stilt roots

In some mangrove species, roots veer from stems and branches and enter the dirt some separation far from the primary stem as on account of banyan trees. On account of their appearance for give principle physical help these are called as stilt roots. These roots likewise have numerous pores through which air oxygen goes into the roots.

6. Vivipary

saline water, unconsolidated saline soil with nearly nothing (or) no oxygen in not a conductive environmental for seeds to sprout and build up to beat this mangrove species have novel method for multiplication, which is for the most part known as vivipary. In this strategy for proliferation, seeds germinate and form into seedlings while the seeds are as yet connected to the parent tree. Example: Rhizophora species

7. Non-vivipary seeds

Excoecaria agallocha L. to produce Non-viviparous seeds having air space inside the seed coat it keeps them above water and empower to seed scatter over long separation through sea streams accordingly shaping diverse populaces. (Pawar umesh ramchandra. (2012)

8. Cryptovivipary

(Greek kryptos, shrouded) alludes to the condition whereby the incipient organism develops to get through the seed coat yet not the natural product divider before it parts open. This condition is shown by Aegiceras, Avicennia species. Consequently, the fundamental goals of this investigation are to know the physiological and anatomical highlights of the mangrove plants.



Fig. 1. Pencil like Pneumatophores



Fig. 2. Salt root



Fig. 3. Aerial root


Fig. 4. *Acanthus ilicifolius* L.

Fig. 5. *Aegiceras corniculatum* (L.) Blanco

Fig. 6. *Avicennia officinalis* L.

Fig. 7. *Avicennia marina* (Forsk.) Vierh.

Fig. 8. *Ceriops decandra* (Griff.) Ding Hou

Fig. 9. *Excoecaria agallocha* L. male

Fig. 10. *Excoecaria agallocha* L. (Female)

Fig. 11. *Lumitzera racemosa* Willd.

Fig. 12. *Rhizophora mucronata* Poir

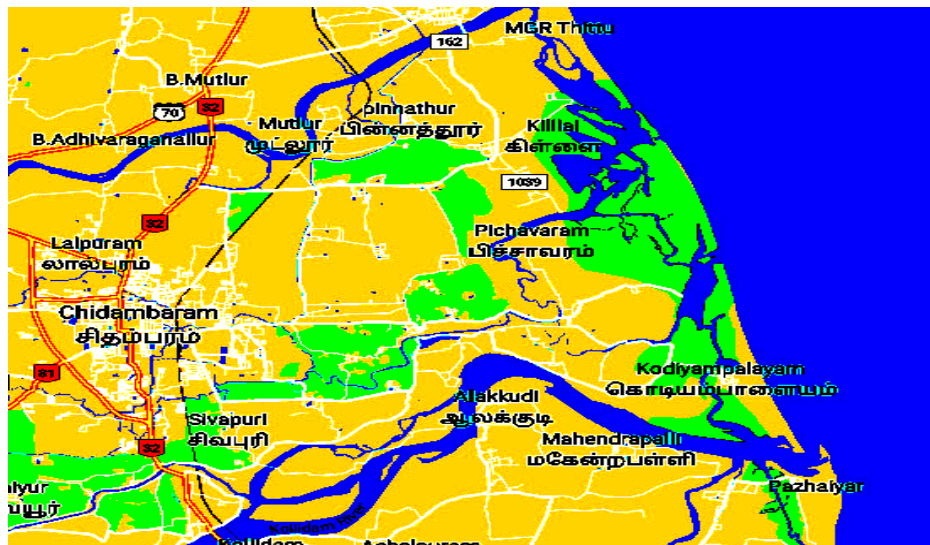
Fig. 13. *Rhizophora apiculata* Bl.

Fig. 14. *Rhizophora apiculata* Bl. fruits

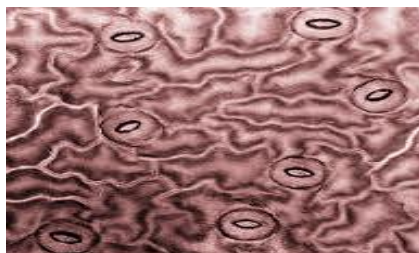
Fig. 15. *Salvadora persica* L. fruit

Fig. 16. *Salvadora persica* L. Tree

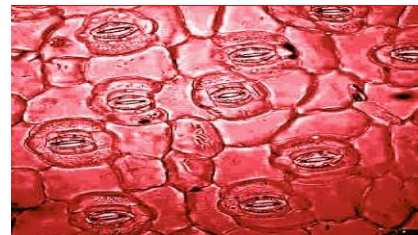
Fig. 1-3. Shows the root Adaptations at Pichavaram dominated mangrove plant genus of *Rhizophora* and *Avicennia* and **(4-16)** are the distribution species of true mangroves



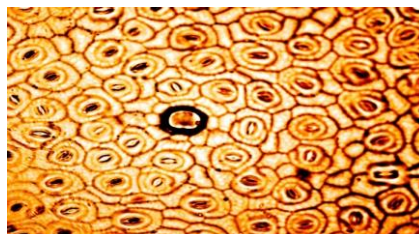
Map 1. Mangroves dispersion in Pichavaram, Tamil Nadu, India.



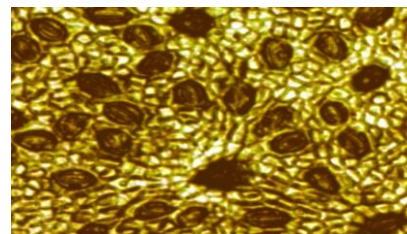
a. *Avicennia marina* (Forsk.) Vierh



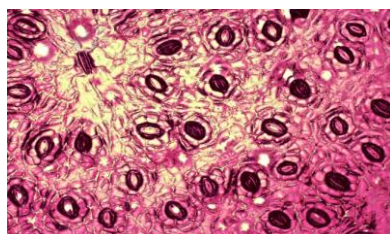
b. *Avicennia officinalis* L.



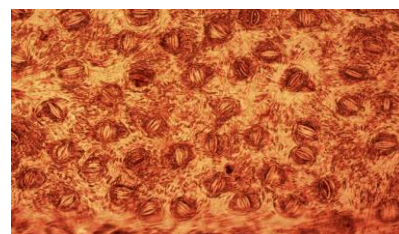
c. *Acanthus ilicifolius* L.



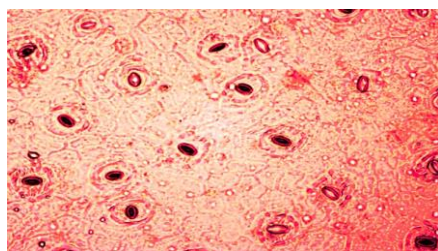
d. *Aegiceras corniculatum* (L.) Blanco



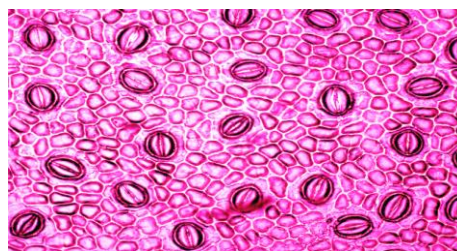
e. *Ceriops decandra* (Griff.) Ding Hou



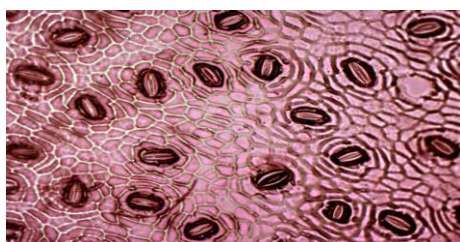
f. *Excoecaria agallocha* L.



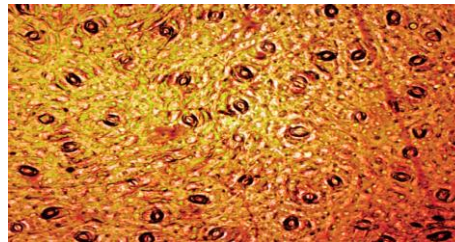
g. *Lumnitzera racemosa* Willd.



h. *Rhizophora apiculata* Blume



i. *Rhizophora mucronata* Lam.



j. *Salvadora persica* L.

(Fig. a-j). Demonstrates the distinctive sorts of stomatal dissemination saw in mangrove plant species

Table. 1. The Meteorological data collected from Agronomy department Faculty of Agriculture Annamalai University.

Year 2016	Temperature		Relative humidity	Hours of bright sun shine	Wind velocity	Rainfall	RD*	EP
	Max°C	Min°C	%	Hrs	Kmph	(mm)		(mm)
January	29.8	21.2	74	08.3	2.9	007.0	1	3.3
February	31.5	22.0	73	09.2	2.4	000.0	-	3.7
March	33.8	23.3	71	08.4	3.0	000.0	-	4.8
April	36.5	26.1	67	08.8	4.7	000.0	-	5.2
May	36.1	26.4	71	07.0	5.0	124.8	4	4.7
June	35.1	25.8	67	05.2	5.1	055.0	5	4.4
July	35.3	25.4	68	05.6	4.5	041.8	5	4.5
August	35.8	24.8	68	06.7	5.1	167.2	8	5.0
September	34.3	24.9	71	04.8	5.8	086.6	6	3.7
October	34.2	25.2	71	06.6	2.5	052.5	4	3.9
November	30.6	22.8	75	05.9	3.6	051.8	7	3.4
December	30.7	19.8	74	06.3	3.7	044.9	5	3.3
Total	403.7	287.7	850	82.8	48.3	631.6	45	49.4
Mean	33.6	23.9	70	06.9	4.0	-	-	4.1

RD* ≥ 2.5 mm consider as a Rainy day

Table 2. Ethno botanical of mangrove plants in pichavaram area

S. No.	Species	Family	Habit	Order	Common name	Local name	Medicinal Value
1.	<i>Acanthus ilicifolius</i> (L.)	Acanthaceae	Shrub	Personales	Sea holly	Kazhi mulli	Pounded organic products are utilized for dressing snakebite. The entire plant is bubbled in water and the patient beverages half of glass each time until the sings and side effects of the kidney stone vanish.
2.	<i>Aegiceras corniculatum</i> (L.) Blanco	Myrsinaceae	Tree	Primulales	Black mangrove or kalsi	Narikandan	extract has analgesic properties
3.	<i>Avicennia marina</i> (L.)	Avicenniaceae	Tree	Lamiales	Grey or white mangrove	Vencandal	Resinous substances prohibited and utilized for conception prevention reason
4.	<i>Avicennia officinalis</i> (L.)	Avicenniaceae	Tree	Lamiales	Indian or white mangrove flat-leaf	Venkandal	Leaves are used for the treatment of joints torment, urinary disarranges, bronchial asthma, stomach issue and detoxification.
5.	<i>Ceriops decandra</i> (Griff.) Ding How.	Rhizophoraceae	Tree	Myrtales	spurred mangrove Milky or	Chiru kandal	The bark is astringent. A decoction is used to treat haemorrhage
6.	<i>Excoecaria agallocha</i> (L.)	Euphorbiaceae	Tree	Euphorbiales	blinding mangrove	Thillai	Latex is utilized as drug for toothache. The wood smoke is utilized as hostile to epileptic. The roots are utilized for hostile to aggravation.
7.	<i>Lumnitzera racemosa</i> Willd.	Combretaceae	Tree	Myrtales	Teruntum Bunga Puteh	Thiparathai	Plant powder used for antifertility, asthma, diabetes
8.	<i>Rhizophora apiculata</i> Blume.	Rhizophoraceae	Tree	Myrtales	Tall-stilt Mangrove	Surapinnai	Leaf, natural product used for treating astringent for the runs, heaving, nauses hepatitis, bug sprays
9.	<i>Rhizophora mucronata</i> Lam.	Rhizophoraceae	Tree	Myrtales	loop-root mangrove	Malattu surapinnai	Bark and leave remove utilized for relieving elephantiasis, haematoma, hepatitis, ulcers, febrifuge, hemorrhage
10.	<i>Salvadora persica</i> L.	Salvadoraceae	Tree	Gentianales	Tooth-brush tree	Ukai tree	Stem separate utilized for hypocholesterolemic, properties, anticonvulsant, antibacterial, antimycolic, pain relieving, subterranean insect richness, antiulcer, narcotic
Total	8	7					

Table.3. describes the Stomatal index value

S. No	Name of the mangrove plant species	Counted value		Stomatal index calculated value
		No of Stomatal cell	No of Epidermal cells	
1.	<i>Acanthus ilicifolius</i> (L.)	46 \pm 1.45	91.4 \pm 3.64	33.53 \pm 0.96
2.	<i>Aegiceras corniculatum</i> (L.) Blanco	67.4 \pm 7.26	459.2 \pm 28.07	12.89 \pm 1.14
3.	<i>Avicennia marina</i> (L.)	22.6 \pm 2.98	59 \pm 6.58	27.86 \pm 3.32
4.	<i>Avicennia officinalis</i> (L.)	29.8 \pm 4.14	69.2 \pm 3.12	29.52 \pm 2.24
5.	<i>Ceriops decandra</i> (Griff.) Ding How.	58.4 \pm 7.47	508.4 \pm 24.72	12.66 \pm 1.78
6.	<i>Excoecaria agallocha</i> (L.)	65.8 \pm 4.95	99.4 \pm 4.20	39.75 \pm 2.57
7.	<i>Lumnitzera racemosa</i> Willd.	62.2 \pm 3.05	170.8 \pm 8.18	26.74 \pm 1.01
8.	<i>Rhizophora apiculata</i> Blume.	43.6 \pm 5.27	257 \pm 9.56	14.35 \pm 1.31
9.	<i>Rhizophora mucronata</i> Lam.	48.6 \pm 7.06	243 \pm 5.79	16.41 \pm 1.76
10.	<i>Salvadora persica</i> L.	46 \pm 4.02	267 \pm 5.31	14.94 \pm 0.97

RESULTS

Ten mangrove species has a place different family were gathered from woodland zone of North Pichavaram Village. Every one of these animal types were accessible in their characteristic territory consistently. Pichavaram is situated in the East bank of Tamil Nadu, India. There are four unique seasons as monsoon and post-storm in the investigation region. Upper east storm sets from October and endures in December. January to June month there was no rain around there and is said to be post-storm or summer. The meteorological information for the year 2016-is exhibited in (Table 1)

The plants are identified in order with their plant name, in bracket, vernacular name, propensity and their ethno medicinal esteems (Table 2). Stomatal index value is calculated and tabulated in (Table. 3) high stomatal index value was observed in the *Excoecaria agallocha* low amount of stomatal index value present in *Ceriops decandra* and *Aegiceras corniculatum* species are observed *Acanthus ilicifolius* L. was a little bush like plants, developing upto 2 m tall with erect stem, leaves are limited at base, serrate edges outfitted with turn. Natural products are container, ovoid-elliptical, and upto 3 cm long, violet shading blossom show. *Aegiceras corniculatum* Blanco. Was a little tree with dark colored bark and glabrous leaves blossoms were white in umbels and fragrant? Organic products are bended 4-8 cm long and crypto-viviparous sort of germination. *Avicennia marina* Vierh. Was a little tree with yellowish, dark colored shading bark is available and leaves are

twisting? Inflorescence axillary on long peduncles. Organic products are pericarp bean-like structure *Avicennia officinalis* L. was a little tree with dark colored bark and long crawling finds which gave various funnel shaped Pneumatophores. The leaves were inverse, coriaceous and whole. Blooms were little, yellow and sessile on a thick. Cymose inflorescence. *Ceriops decandra* (Griff.) Ding Hou was a little tree with yellowish dim with bits of dull dark colored stem pyramidal base the leaves are basic inverse, obovate, leaf tip adjusted, cuneate at base, 3-6 cm long cymose bloom anther longer than the fibers natural product viviparous write Flowering and fruiting in the long stretches of January – March. *Excoecaria agallocha* L. was a medium measured, dioecious tree having white latex. The leaves were basic and spirally organized. Inflorescence were axillary with light green started as catkin like structure. *Lumnitzera racemosa* Willd. Was a little tree and limited to a few spots? This species is additionally called genuine mangrove. The leaves are shinny with brought forth pinnacle bearing a little organ, blooms are white and in axillary racemose. *Rhizophora apiculata* Bl. was an evergreen tree growing up to 30 m tallness. The seeds are developing on the mother plant itself viviparous germination. The leaves are pretty much elliptic, intense or decreasing at the two closures, blooms are in two (almost four) on forceful peduncle. *Rhizophora mucronata* Poir. Was a tree with yellow orange shading inside with huge bark scale on outside? Leaves are circular, aristae 15-20cm long. Cream hued bloom viviparous natural product,

hypocotyls, and slim, long 30-65 cm. *Salvadora persica* L. was a little tree, the leaves are straightforward light green in shading blooms white shading, and organic products are little size purple shading. The stem is erect with stretching. Affiliation mangrove species developed in low saline territory.

The stomata are of anomocytic write in *Aegiceras corniculatum*, diacytic in *Acanthus ilicifolius*, and cyclocytic in *Ceriops decandra*, in all other it is paracytic. cuticular striations emanating from the stomata towards the dividers of the auxiliary cell are recorded in *Excoecaria agallocha*. In *Rhizophora apiculata*, the auxiliary cells having papillary projections. Both glandular and anon-glandular trichomes were seen in leaves of *Avicennia* species. each glandular trichome or salt organ having a stalk cell and a head including variable number of cells found on both adaxial and abaxial surfaces of leaves, while non-glandular trichomes are multicellular with a stalk of 2 to 3 cells with a drawbore molded terminal cell watched richly everywhere throughout the lower epidermis.

Glandular trichomes like that of *Avicennia* are additionally seen in *Aegiceras corniculatum*. The stomatal images are present in (fig. a-j)

CONCLUSION

Certain characters mangrove plants have a few fundamental needs, for example, sun-oriented light, water, air and supplements for better survival. They likewise should have the capacity to repeat keeping in mind the end goal to guarantee that their species survives. A portion of the principle dangers to the survival of plants incorporate a superior atmosphere, for example, absence of daylight, an absence of water, an absence of good soil and a legitimate space similarly a wealth of water, air, sun-based radiation (UV beams) and the exercises of creatures and man makes are likewise hurtful for plants development. There are numerous difficulties that plants look with a specific end goal to survive. How well plants adjust to their changing surroundings will decide their future. It is essential to recall, that all other living things accept on plants somehow and we as a whole accept on plants having the capacity to adjust to their surroundings too.

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