add that barren tillers arose by somatic elimination of a chromosome. This work confirmed the cytological explanation for barrenness and gives a simple method of picking out 23 chromosomed plants in the field.

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REFERENCES

Anandan and Krishnaswamy (1934) — 'Barren-Sterile'—A new mutant in rice and its inheritance. Current Science, 3. 22.

Sampath and Krishnaswamy (1948) — A chromosome dificient Paddy type. Current Science, 17, 271.

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Distribution of Rhizophora Mucronata, Lam., in the 'Back-Water' of the West Coast and its Economic Importance*

By

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Introduction: India possesses nearly a third of the cattle wealth of the world. Though it is far behind other countries regarding its dairy products, it stands in the forefront in the manufacture of skins and hides. In the early days, before the advent of the wattles, several indigenous tanning materials were used, namely barks of *Cassia auriculata*, L; *Cassia fistula*, L; *Acacia arabica*, Willd; pods of *Caesalpinia digyna*, Rottl. and *Caesalpinia coriaria*, Willd. and fruits of myrobalans (*Terminalia chebula*, Retz.). Prior to the first World War (1914—1918) South African wattle bark was unknown to the tanning industry of India. The war made a very big demand on the Indian tanning industry, with the result investigations were taken up at various Leather Research Institutes

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to explore the possibility of finding out a suitable tanning material for manufacturing large quantities of tanned leather. During an experiment conducted in Madras in 1917 with wattle bark received as a trial consignment from South Africa, it was found that satisfactory results were obtained; from that time onwards the use of wattles for tanning purposes increased at a very rapid rate and within a period of about 25 years indigenous tan stuffs were practically eliminated. The wattles were first introduced in 'Tea Estates' about the middle of last century as shade trees, but their importance as tanning material was realised only when the 'South African bark' became popular. Two species of wattles, namely *Acacia mollissima* and *Acacia decurrens* were found to be most successful, as they contained 32 to 38% of tannin; the area under these two species is now increasing in the Nilgiris and Kodaikanal. It is now estimated that nearly 4 to 5 lakhs tons of wattle barks are required annually for tanning purposes (K. N. Nair, 1950). Regarding the use of the mangrove barks as tanning material, preliminary investigations have been carried out in other countries. Brown and Fischer (1918) quoted by Villanuera (1926) report that the mangrove bark constitutes the greatest single source of tanning material in Phillipines and that *Rhizophora candelaria*, D. C., *R. mucronata*, Lam., *Bruguiera conjugata*, Merr, and *Ceriops* Sp. etc., are the most important of the mangrove trees which furnish the greatest amount of tanning materials. Das (1944) records that *Ceriops roxburghiana*, Arn, of Sunderbans, *Rhizophora mucronata*, Lam. *Bruguiera conjugata*, Merr, and *Ceriops candolleana*, Arn, of the Andamans tried at the Bengal Tanning Institute, have proved that they can be satisfactorily used for tanning purposes. Tardinot F. (1922) reports that barks of *Rhizophora*, *Bruguiera* and *Kandelia* were tried for tanning purposes in Tonkin (Hanoi) and that though the tanning was satisfactory, the colour of the skin was not attractive. Chevalier (1924) states that in Indo-China, the barks of *Rhizophora*, *Bruguiera*, *Ceriops* and *Carapa* were successfully used for tanning purposes.

The occurrence of *Rhizophora mucronata*, Lam, along the salt marshes, tidal creeks, estuaries of rivers and 'Back-waters' has been recorded in the tropical belt of the world by Gamble (1915), Hooker (18.9), Cook (1903), Trimen (1894), Watt (1892). The same authors also mention about its high calorific value and of having extremely hard heart wood, giving charcoal of high calorific value. A preliminary survey of the 'Back-water' flora of the West Coast has been recorded by Chandrasekhara Ayyar (et al 1949), wherein they have mentioned about the occurrence of *Rhizophora mucronata*, Lam and the possible uses of the plant and how some of the 'Back-waters' of the West Coast could be profitably planted with this plant.

Material and Methods: In the present investigation, one of those 'Back-water' areas was taken up for detailed study and the distribution

of *Rhizophora mucronata*, Lam along the whole length of the 'Back-water' was studied. This 'Back-water' is known as Karinghote river and situated near Nileshwar (South Kanara). This river extends from the sea coast to a distance of about 12 miles to the interior. *Rhizophora mucronata*, Lam was found to occur only up to a particular distance from the sea-coast, and thereafter not a trace of this plant could be seen. It was therefore, decided to test the salt content of the 'Back-water' to see if any relationship exists between the salt content and the distribution of this plant. Water samples were taken in the middle of February, at intervals of about one or two miles throughout the course of the 'Back-water' to see if any relationship exists between the salt content and the distribution of this plant. Water samples were taken in the middle of February, at intervals of about one or two miles throughout the course of the 'Back-water' and simultaneously the occurrence of this plant was recorded. The water samples were analysed by the Government Agricultural Chemist and the results are given in Table No. 1.

TABLE I

Sample No. & Stage	Name of place & distance from sea coast	Total solids at 105° C	Chloride (Cl)	Sodium chloride (calculated)	PH	Occurrence of Rhizophora
		Parts per 100,000				
I	Near Nileshwar (4 miles)	2048	1036	1707	6·70	Yes
II	Chattoth (6 miles)	2003·4	1050	1730	6·47	Yes
III	Kayyar (7 miles)	1150·8	658	1084	6·77	No
IV	Thalampadh (9 miles)	408·0	210	346	6·80	No
V	Kunnan Kayi (11 miles)	16·4	8·4	13·85	6.90	No

It will be seen from Table No. I that from the 6th mile (Stage II) onwards, *Rhizophora* gradually disappears until at the 7th mile (Stage III) it is practically absent. The total solids at Stage II is 2,003·4 parts in 100,000; chloride 1,050; and sodium chloride (calculated) 1,730; while at stage III the total solids are 1,150 8; chlorides 658, sodium chloride (calculated) 1,084. The minimum solids required for the growth of this plant, therefore, appears to be a little above 1150 8, but it is clearly seen that this plant never thrives if the salt-content of the 'Back-water' is less than 1,150. It will be also seen from the table that there is no appreciable change in the PH value throughout the length of the river.

To evalute the percentage of tannin in the barks of *Rhizophora*, bark were taken from medium sized trees at different intervals to see whether any variation in total solids in the 'Back-waters' affected the

tannin content. In Table No. II, the total solids at definite intervals of the 'Back-water', are given for the months of February and May. It is seen from the Table that the percentage of tannin is not affected even if the total solids in the water fall down.

TABLE II

Tannin content of Rhizophora mucronata

Date of sampling	Tans.	Non-tans	Moisture	In. Sols.	Colour $\frac{1}{2}$% tan. Sol. $\frac{1}{2}$ cm. all
February, 1950	11.3	16·9	10·2	61·6	Y–16·2 R–15·0
May, 1950	15·3	14·0	..	..	Y–12·0 R– 6·2

From the tannin content, it is seen that *Rhizophora* barks collected at Nileshwar contain on an average 12 to 15% of tannin, it is reported by the Leather Technologist that this quantity is enough to carry out trials in leather tanning.

Discussion: It will be of interest to note that the distribution of *Rhizophora* seems to depend upon the presence of certain amount of Chlorides particularly Sodium Chloride; and in the particular area selected for trial, it has been found to range from 1150 to 1730 parts per 100,000. It was also thought that the pH of the 'Back-water' may vary at different intervals and this may affect the distribution of mangrove plants but from the results obtained, it will be seen that there was no change in *pH* value, all along the course of the "Back-water". This aspect of the, distribution of mangrove plants in relation to the total solids of the "Back-water" has not been recorded so far. Regarding the the tannin content of the barks of mangrove plants, some work has already been done. In the present investigation, dry barks only were analysed, and according to Villanuera (loc. cit) these barks on drying, lose a certain percentage of tannin and that it increases with the size and age of the tree; the same author quotes that in Philippines, species of *Rhizophora* and *Bruguiera* possess an average of 28 to 30% of tannin on the dry weight and that the mangroves constitute the greatest single source of tanning material Das (1944 – loc cit) states that though mangrove bark had been unpopular in tanning, on account of the ugly red colour and the harsh gained leather it produces, ways have been devised for minimising the defects. The same author is of the opinion that not only mangrove barks should be used for direct tanning but an extract should be made from Indian Mangroves just as in British North Borneo; this extract blended with those of babul and myrobalans produces a good quality tanning material In the present investigation the authors found 12 to 15% tannin in the barks of *Rhizophora mucronata*,

Lam., occurring in Nileshwar, but according to Das (1922) the tannin content of this plant in Borneo was recorded as 20·5% and that from Malaya as 30 to 40% and that it may vary in different places. Apart from *Rhizophora mucronata*, Lam., species of *Ceriops*, *Kandelia* and *Bruguiera* have been recorded by Gamble (1915) to occur in the tidal forests of Quilon in Travancore, Godavari and Krishna deltas. Das (loc. cit) is of opinion that both in yield of extract and pertentage of tannin barks of *Rhizophora mucronata*, Lam., *Ceriops roxburghiana*, Arn., and *Bruguiera Conjugata*, Merr., stand out conspicuously. The authors are of the opinion that this material wealth, hitherto untapped can be turned the best advantage and to a certain extent, meet the deficit which the State is now experiencing with regard to the tanning materials. No estimate has, however, been made of the extent of the mangroves in peninsular India; apart from tidal forests of the estuaries of big rivers, "Back-waters", no systematic efforts have been made to plant them along the sides of the "Back-waters". In the West-coast, coconut plantations have encroached to the very edge of these "Back-waters" and already some reports have been recorded as to how best to check the erosion along the sides of the "Back-waters". The authors are of opinion that planting the mangroves trees upto a depth of 6 to 10 feet on either embankments will be the most promising method of preventing erosion of the sides of these "Back-waters". The authors have noticed that wherever such thick belts of mangroves occur as in Gangolly river of Coondapur (South Kanara) erosion is practically eliminated; and that on a conservative estimate 150 to 200 miles of this foret can be developed in the West Coast alone. The yield of bark that can be expected, may be roughly estimated at 5,000 tons. Chevalier (loc. cit) is of opinion that "*Rhizophora* can be cultivated and subjected to extensive exploitation as is already being done in other countries"; the same author considers that it is an "important reserve of firewood which is precious in a country where wood is often scarce". Watts (1892) also has recorded that it is good for purposes of firewood and the charcoal made out of it is also of good quality. The authors are of opinion that in the coastal districts where forests are rare, exploitation of the mangroves for fuel purposes also, is well worth a trial.

Since presenting this paper to the Science Congress the authors have found that some more plants along the "Back-waters" of the *East-Coast* have a good percentage of 'tannin' in their bark; these are under investigation.

Summary and Conclusions: 1. *Rhizophora mucronata*, Lam., gradually disappears from the 6th mile of Nileshwar river upto 7th mile and thereafter it is completely absent. This plant flourishes when the total solids in the "Back-water are 2003·4 (in 100,000) parts which includes chlorides to the extent of 1050. The minimum solids (chlorides)

required for the growth of this plant appears to be a little above 1150·0 and if the chlorides are below this level this plant does not appear to thrive

2. In the whole length of the "Back-water" no variation in *pH* value was recorded.

3. The tannin content from the barks of middle aged trees varied from 12 to 15% and the variation in the total chlorides of the "Back-water" in different seasons of the year did not affect the tannin content.

4. It is suggested that sides of "Back-water' can be planted with mangrove trees, for obtaining the valuable 'tannin' which is in short supply and, incidentally, to protect the sides of "Back-water" from erosion.

5. The mangrove trees may also serve as good fuel especially in coastal tracts where forests are rare.

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BIBLIOGRAPHY

1. Chandrasekhara Iyer, S N. and Rajasekhara Mudaliar, C. .. Madras Agricultural Journal, Vol. 36. 1949.
2. Chevalier .. Tropical Agriculture, 63, 1924.
3. Cook .. Flora of Bombay, 1903.
4. Das, M. .. Journal of Scientific and Industrial Research, Vol. 2, 1944.
5. Do. .. Int. Rev. Rome, 1922.
6. Gamble .. Flora of Madras, 1915.
7. Hooker .. Flora of Br. India, 1879.
8. Nair, K. N. .. 'Hindu' dated 11th June 1950.
9. Trimen .. Flora of Ceylon, 1894.
10. Villanceura .. Philippine Agriculturist, No. 9, 1926.
11. Watt .. Dictionary of Economic Products, 1892.