STUDIES ON REGENERATION IN TWO SPECIES OF *RHIZOPHORA* UNDER LABORATORY CONDITIONS

ABSTRACT

An attempt is made to study the Regeneration and growth performance in two species *Rhizophora mucronata* and *R. apiculata*. In this investigation on the *Rhizophora* plantation with propagule cutting was carried out and to decide the proper depth of plantation of propagule an experiment was designed.

MANGROVE vegetation is a peculiarity of the estuaries in Maharashtra. In some of the mangroves seed germination takes place on the mother plant itself, this phenomenon is commonly known as viviparity. The seedlings thus formed are termed as propagules. The propagules after maturation drop down in the muddy soil and get established naturally. However, in present-day artificial regeneration of mangroves has become a need, because of lot of human pressures on the ecosystems. The mangroves all along the coastal line are degrading very fast due to human activities. It is observed that some species are disappearing because of over exploitation.

With this background an attempt is made to study the regeneration in two species of *Rhizophora* and plantation with cuttings obtained from propagules was carried out under laboratory conditions and to decide the proper depth of plantation of propagules, an experiment was designed.

Material and methods

The mature propagules of *Rhizophora mucronata* Lamk. and *R. apiculata* Blume were collected from Ratnagiri in April and May. Only the mature, healthy and unaffected propagules were selected and were carried to the laboratory. For the cultivation by cuttings, the cut was taken transversely as well as obliquely (Fig. 1 a). Both upper and lower pieces were planted in separate polythene bags. To study the plantation depth, the propagules were planted with ¼ part of propagule burried in the soil and for deep plantation only narrow portion of propagule was kept on the soil. (Almost half the length) (Fig. 1 b).

Rooting of propagule was also observed under water culture. For this experiment, radicular end of propagule was dipped in the fresh water and rooting and other characters were studied. The water was changed once in a week.

Results and discussions

In India work on mangrove seed germination has been reported by Bharucha and Shirke (1947), Joshi *et al.* (1972), Jamale (1975) and others. It has been reported by Watson (1928) that members of Rhizophoraceae do not coppice when ordinary cutting practices are used. Therefore, according to him, forest regeneration became a matter of seed production and dispersal.

Table 1 gives the performance of the upper portion of the propagule which is having a plumule part, after 18 weeks of plantation in soil. The survival is cent per cent except for that of *R. apiculata* with transverse cut (80%). Though the two leaf condition is observed more frequently in the obliquely cut propagules the leaf length and breadth of *R. mucro*

nata and *R. apiculata* is more in transverse cut propagules.

The second half of the cut propagule was separately planted in soil with cut surface exposed and tappering radicular end burried. These cuttings are alive and produce buds along the top edge of the propagule. This is observed in the oblique cut lower part of *R. apiculata* propagules within 19 weeks (Pl. I A). However, this type of sprouting is expected in *R. mucronata* bit later.

It is found in one year plants that even though the upper portion of propagule is dried due to some reason, sprouting still takes place from some point on the hypocotyle region. It is interesting to note that if some part from

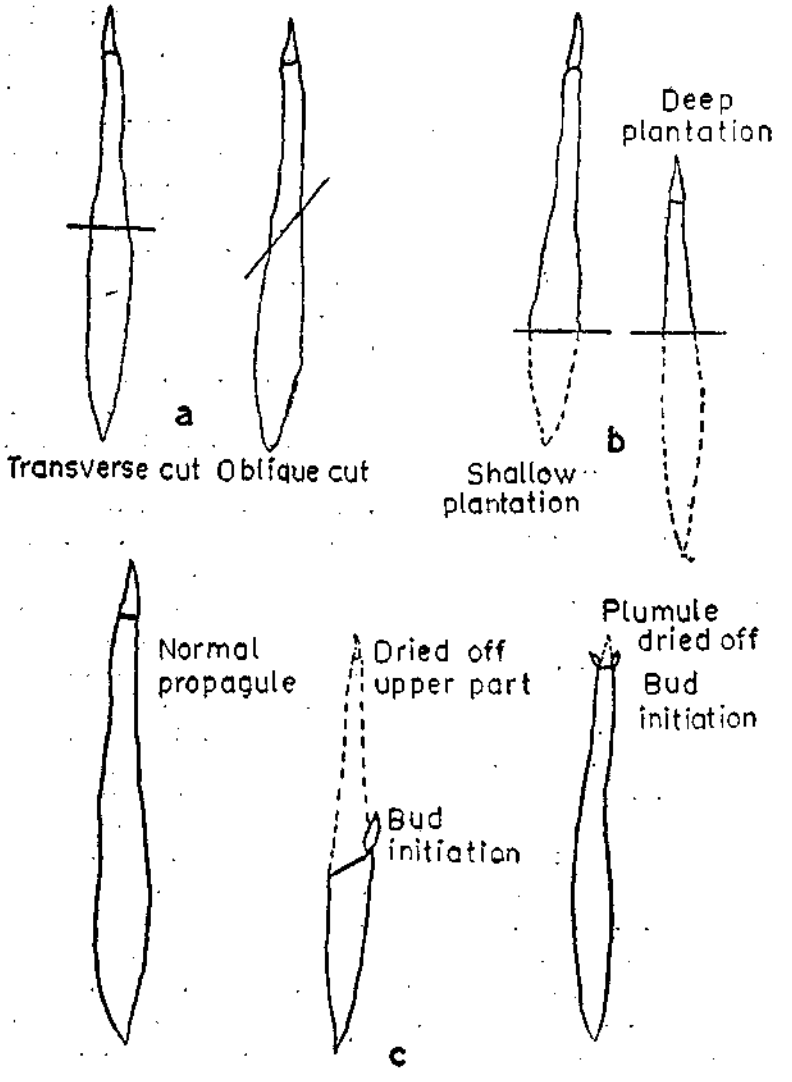

FIG. 1 a. Type and position of cut taken on the propagule, b. depth of plantation of the propagule and c. diagrammatic presentation of sprouting in *Rhizophora* propagule.

TABLE 1. *Physical properties of* Rhizophora mucronata *and* R. apiculata *propagule cuttings after* 18 *weeks of growth*

		R. mucronata	*R.apiculata*
Living cuttings (%)	O	100	100
(Survival Tare)	T	100	80
Cuttings with 2 leaves (%)	O	80	100
	T	60	80
* Leaf length (cm)	O	3.92± 0.8	3.78± 1.3
	T	4.12± 0.6	4.26± 0.8
* Leaf breadth (cm)	O	1.68± 0.5	1.80± 0.45
	T	1.96± 0.3	2.06± 0.2
* Total height from collar (cm)	O	4.4 ± 1.6	4.98± 2.35
	T	5.16± 2.4	6.37± 2.8

O — Oblique cut
T — Transverse cut
* — Average of Five replicate

plumular end dries/dies when propagule is not still established into the seedling, hypocotyle acts as a stem (mature) and produces buds which sprout to give rise to shoot. This kind of sprouting is important because it shows potentiality of the species to coppice. Though Watson (1928) could not observe, coppicing a cutting of *Rhizophora, Bruguiera Kandelia* and *Ceriops*, present study shows coppicing is possible with cuttings from propagules. The Plate I B and C records that if the plumule part is dried off the bud initiation takes place from the collar region (Fig. 1 c). Some times more than one buds are developed. It is a common phenomenon in many angiosperms that if terminal bud is removed apical dominance is lost and axilary buds start developing. However, this kind of observation in very sensitive plants like mangrove is especially important from the point of view of establishment of the species.

Further the attempt was made to study hydroponic culture of *R. mucronata* propagules indicates that rooting occurs in intact (not cut) propagules as well as lower portion cut in both ways (transversely and obliquely). However, the upper portion with plumular end, shows late initiation of rooting. The root initiation is observed within 2 weeks. The secondary roots are initiated within 7 weeks and leaf unfolding is recorded in about 10 weeks. It should be noted here that the propagules of *R. mucronata* can be preserved for later use upto four-five months or even more. This is done by keeping the lower portion of the propagule in moist conditions (may be wrapped in moist gunny bag, etc.). The radicle produces small roots, but the terminal bud remains dormant. These can be planted. This experiment is conducted with fresh water. Davis (1940) reported that *R. mangle* propagules can be kept alive for a year by submerging in sea water. Nevertheless, Tease (1979) reported that in this type of experiment conditions became anaerobic within a few weeks. Further he pointed out that not roots developed in years time. From this point of view present finding is important. These experiments suggests that rooting potential is very high especially in *R. mucronata*. This shows very high reproductive capacity of the species, but the further growth of the seedling is affected due to some external ecological factors in natural environment.

Depth of plantation of propagule in the substratum is also an important character in the artificial regeneration technique. Depending upon the softness of the substratum the depth of penetration of propagule in the mud varies. So as to judge the effect of the depth of plantation on seedling growth an experiment was designed. Deep planted propagules of the *R. mucronata* and *R. apiculata* shows good performance (Table 2). First leaf pair unfolding is observed within a month, but the shallow planted propagules take more time for leaf unfolding. It appears that for better shoot development deep plantation is more suitable.

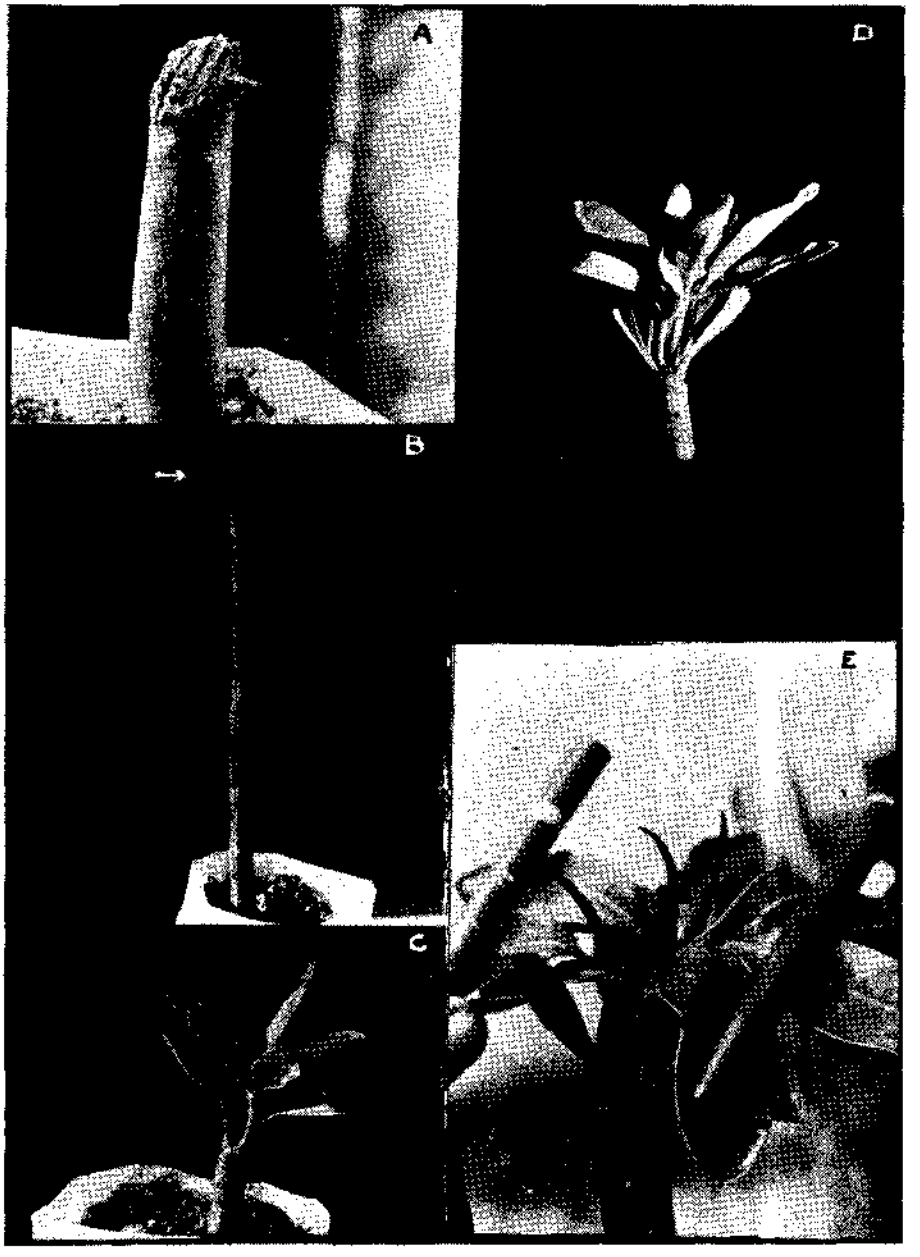

PLATE I A. propagule-cutting of *R. apiculata*, planted in soil (A bud is developed from cut surfaces), B. Propagules of *R. mucronata* and C. *R. apiculata* (After a part of propagule dries, sprouting takes place from alive part), and unique observation on the multishoot development in *R. mucronata* : D. Side view and E. Three shoots with six apical buds.

In *R. mucronata* the 1st two leaves are yellowish green in colour, the midrib is also yellowish in colour. The leaves are mucronate, pointed at apex. The unfolding of the leaves takes place pushing the scales downwards without elongation of 1st internode. In *R. apiculata* the 1st two unfolded leaves are having reddish tinge with prominent reddish mid rib. The leaves are ovate and rounded at the tip. The unfolding of leaves takes place outside the scale leaves, after the folded leaves are raised nearly by 1 cm above the scales.

Unique observation is due to *R. mucroatna* propagule. Usually a single shoot emerges out of the scales. However, in one specimen it is found that three shoots are given out form single pair of scales. Further, each of these three has a peculiarity (Pl. I D and E). One of the shoot on one side shows three apices, the middle one has two whereas, the third has a single apex covered with scales. This development is possibly recorded for the first time. Poly-embryony or occurrence of twin propagule in Rhizophoraceae is already reported. In *Bruguiera cylindrica* the double seedling condition has been recorded by Rao *et al.* (1982). Twin propagule of *R. mucronata* was reported by Mulik (1987) from the areas near Ratnagiri. Further Rao *et al.* (1987) presented an account of twin propagules in Rhizophoraceae members. The twin propagule indicate two seeds fertilized, giving rise to two hypocotyle and two plumules in one fruit

TABLE 2. *Comparison between shallow and deep planted propagules of* R. mucronata *and* R. apiculata

		Shallow		Deep	
		April	May	April	May
Total propagules ..	Rm	30	30	15	30
	Ra	30	30	15	30
Average total length (cm) ..	Rm	42.38	40.21	41.28	40.34
	Ra	22.96	22.04	22.79	21.03
Sprouting (%) ..	Rm	96.66	100	100	100
	Ra	13.33	63.33	100	93.33
1st leaf pair unfolding (weeks) ..	Rm	8-12	8-12	4-11	4-12
	Ra	6-11	8-12	4-11	4-9
Seedlings with 2 leaves ..	Rm	26	30	8	30
	Ra	1	16	12	27
Seedlings with 4 leaves ..	Rm	3	—	7	—
	Ra	3	3	3	1
Initial length of plumule (cm) ..	Rm	2.46	2.48	2.54	2.51
	Ra	1.56	1.65	1.58	1.78
Seedling height above Collar (cm) ..	Rm	9.03	9.19	12.77	11.28
	Ra	17.17	18.28	15.96	21.19

Observations recorded after 13 weeks. Rm — *R. mucronata*; Ra — *R. apiculata*.

wall. In the present case there was no external indication of multi-shoot development of the propagule. It emerged after the plantation only.

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REFERENCES

BHARUCHA, F. R. AND V. S. SHIRKE 1947. *Linn. J. Univ. Bombay,* **15** : (5) : 1-14.

DAVIS, J. H. JR. 1940. *Carnein Inst. Wash. Publ.,* **3** : 305-412.

JAMALE, B. B. 1975. *Physiological studies in saline plants.* Ph.D. thesis, Shivaji University, Kolhapur.

JOSHI, G. V., M. PIMPLASKAR AND L. J. BHOSALE 1972. *Bot. Mar.,* **15** : 91-95.

MULIK, N. G. 1987. *Studies on some aspects of mangroves.* Ph.D. thesis, Shivaji University, Kolhapur.

RAO, T. A., S. CHAKRABORTHI AND R. K. PREMANATH 1982. *Bull. Bot. Surv. India,* **24** : 183.

RAO, T. A., P. V. SURESH AND A. N. SHERIEFF 1987. *Cur. Sci.,* **14** : 725-727.

TEASE, J. H. 1979. *Silviculture with saline water Biosaline concept.* Alex under Holiaender, 117-171.

WATSON, J. D. 1928. *Malayan Forest,* **6** : 1-275.

A PRELIMINARY SURVEY ON NEWLY RECORDED *SOLETELLINA VIOLACEA*

ABSTRACT

Soletellina violacea (Lam.) recorded for the first time, in India at Mithbav Creek (16° 20′ N 73° 25′ E), is highly nutritious and forms major resource in food chain. It is a good candidate species for aquaculture studies.

MOST of the publications have contained references to the growth, reproduction respiration and siphon regeneration of different species in Lamellibranchs. This study is important for three main reasons. *Soletellina* has food value and contains more than ten types of essential amino acids. It is one of the rare species around the west coast of India and the study on *Soletellina* may suggest general principles which could be applicable to other marine bivalves especially for aquaculture.

Material and methods

The specimens collected from Mithbav Creek in Sindhudurg District, over a period of 15 months, were examined for gut contents. The methods adopted here are mostly based on works of Hynes (1950) and Pillay (1952).

Results and discussions

Shell

Shell is fairly large, equivalve, more or less elongated and with a strong periostracum. Ligament pit is short and broad. The pallial sinus is very deep, narrowing anteriorly. Hinge has two teeth in each valve. The shell valves are moderately thick, covered by a dark brown periostracum and marked with concentric growth lines.