

## GROWTH PERFORMANCE OF *RHIZOPHORA MUCRONATA* IN FIELD AND LABORATORY CONDITIONS

### ABSTRACT

Large scale mangrove plantations are undertaken for the west coast of Maharashtra State in India. The attempts are being made for the first time and base line data for successful afforestation programme is not available. Therefore, to generate necessary scientific data, present study was undertaken. The species used is *Rhizophora mucronata*. It is found that the survival percentage is more under fresh water conditions. However, the growth measured in terms of height is more under field conditions. This is attributed to the altitudinal difference. However, survival/mortality is a direct effect of salinity.

THE GLOBAL status of mangrove ecosystem was reported to be endangered (Pannier, 1979). These ecosystems in last decade suffered from lot of human pressure. Pannier (1979) emphasized the conservation of mangroves as an 'urgent need'. In India, especially, mangroves face extensive human interferences. The mangroves along the coast of Maharashtra State are under constant stress due to human activities, large areas have become devoid of mangroves. So as to change this situation steps are being taken to afforest the barren mangrove areas (Social forestry reports). However, for this kind of afforestation necessary information is not available. From this point of view present study was undertaken.

*Rhizophora mucronata* (Lamk.) is a common species of this area. It is an important species for afforestation programme. The regeneration of this species under laboratory conditions is studied by Bhosale (1978, 1985). However, a study on its growth under fresh water and field conditions was lacking.

#### *Material and methods*

The experiment started on 5th June 1987 in a view of celebrating the world Environment day. It was a joint effort of Social Forestry Department, Ratnagiri and the mangrove

group of Shivaji University, Kolhapur. Nearly twenty thousand propagules of *R. mucronata* were planted directly in the field at a distance of 1 m. The location was Shirgaon area near Ratnagiri city. This area had some plantations of previous year (1986) also. The observations were continued on growth performance after plantation by social forestry.

Another site of direct plantation with *R. mucronata* propagules is along Kalbadevi Estuary, planted in June 1988 by Social forestry group. The nursery was raised at Kolhapur in June 1987 and 1988. The growth performance of the seedlings is given in Tables 1 to 5.

#### *Results and discussion*

The study was carried out by belt transect method. At Shirgaon two belts are considered with three rows in each belt. The Table 1 gives the performance of seedlings planted directly in the field in June 1986. In the 1st belt, total seedlings considered were 66 (sample size) while in II<sup>nd</sup> there were 60. The monthly observations on seedling survival and height above collar were recorded. The survival was 91 to 92% in November 1987. However, in December 1988 it was found declined to 63 to 74%. It indicates

that even after one year growth, there can be mortality.

The height above collar is 33.95 cm in November 1987 which in November 1988 reached upto 63.74 and 59.5 cm in two belts respectively. In December 1988 it reaches to 66 and 61 cm respectively. In the month of December 1988 the number of primary and secondary branches was recorded. In both transects the record of average number of primary branches

In 1987, additional area was covered for plantation at Shirgaon. The total area under plantation is 15 ha. Table 2 depicts the results recorded for plantations of 1987. In this case the two belts with 285 and 213 seedlings in each belt were considered. In November 1987 the survival was 75 and 76% while in November 1988 it is lowered down to 23 to 30%. The mortality is observed where soil has hard and tidal flow is restricted.

TABLE 1. Growth performance of *R. mucronata* propagules after direct plantation in the field in June 1986

|                          | Belt | Nov. '87 | Dec. '87 | Jun. '88 | Nov. '88 | Dec. '88 |
|--------------------------|------|----------|----------|----------|----------|----------|
| Sample size              | I    | 66       | 66       | 66       | 66       | 66       |
|                          | II   | 60       | 60       | 60       | 60       | 60       |
| Living seedlings         | I    | 61       | 60       | 60       | 49       | 49       |
|                          | II   | 55       | 55       | 54       | 40       | 38       |
| Survival %               | I    | 92.42    | 90.90    | 90.90    | 74.24    | 74.24    |
|                          | II   | 91.66    | 91.66    | 90.00    | 66.67    | 63.33    |
| Mortality %              | I    | 7.58     | 9.10     | 9.10     | 25.76    | 25.76    |
|                          | II   | 8.34     | 8.34     | 10.00    | 36.33    | 36.67    |
| Height above collar (cm) | I    | 33.95    | 37.84    | 51.30    | 63.74    | 66.47    |
|                          | II   | 33.94    | 39.09    | 51.63    | 59.55    | 61.23    |

per plant is 7 while secondary branches are 5 in 1st belt and 6 in the 2nd one. In September 1988, flower buds were recorded for the 1st time after plantation (more than two years). In December 1988 15.03% plants (from two belts) were found with flower buds, while the prop roots were recorded in 45.08% plants. The observation on flowering and prop root formation indicates that two-year old *R. mucronata* seedlings can be taken as mature plant. The area where these propagules were planted in muddy with fine textured soil and receives daily tidal water. Hordjowigeno (1986) has reported that *Rhizophora* is found in muddy soil. This may be the reason why the seedlings at this place show better growth.

The height above collar recorded was 19.73 cm and 16.53 cm in November 1987 while in November 1988 it reached upto 38.44 and 30.36 cm. In December 1988, the height reached 39.94 and 32.56 cm respectively. Average number of branches recorded in two belts is 4 and 3 while total number of leaves are 18 and number of scars are 24 in each belt. In these belts branching is observed from the collar.

The growth performance of *R. mucronata* under the nursery condition is given in Table 3. The survival is more than that in the field (1987). The survival percentage decreased from 67 and 69% (June 1988) to 23 to 30% (November 1988) under field conditions while in nursery the decrease is upto 63 and 60%.

The plantation area is 13 ha along Kalbadevi Estuary (June 1988). The total number of propagules planted was 32,500. Four belts with 75 seedlings in each were considered. The belt I is towards main stream while IV

in December 1988 to 37.07 cm as lowest and 48.46 cm as highest average record. The average number of leaves in three belts are 6 while in IVth belt number of leaves are 8. The leaf scars in all belts are 6 in number.

TABLE 2. Growth performance of *R. mucronata* propagules after direct plantation in the field in June 1987

|                          | Belt | Nov. '87 | Dec. '87 | Jun. '88 | Nov. '88 | Dec. '88 |
|--------------------------|------|----------|----------|----------|----------|----------|
| Sample size              | I    | 285      | 285      | 285      | 285      | 285      |
|                          | II   | 213      | 213      | 213      | 213      | 213      |
| Living seedlings         | I    | 216      | 216      | 193      | 68       | 67       |
|                          | II   | 164      | 164      | 149      | 64       | 63       |
| Survival %               | I    | 75.79    | 75.08    | 67.72    | 23.86    | 23.50    |
|                          | II   | 76.99    | 76.99    | 69.48    | 30.04    | 29.57    |
| Mortality %              | I    | 24.21    | 24.92    | 32.28    | 76.14    | 76.50    |
|                          | II   | 23.01    | 23.01    | 30.52    | 69.96    | 70.43    |
| Height above collar (cm) | I    | 19.73    | 22.15    | 26.87    | 38.44    | 39.94    |
|                          | II   | 16.53    | 17.69    | 21.14    | 30.36    | 32.56    |

is away from stream (Landward side). Here the belts are right angle to tide direction. The results recorded in Table 4. The survival percentage varied from 77.33 to 97.34. The height above collar recorded in August 1988 ranges from 19.85 to 30.47 cm. It increased

TABLE 3. Growth performance of *R. mucronata* propagules under nursery condition (Plantation June 1987)

|                             | Nov. 1987 | Dec. 1987 | Jun. 1988 | Dec. 1988 |
|-----------------------------|-----------|-----------|-----------|-----------|
| Total propagules ..         | 30        | 30        | 30        | 30        |
| Living seedlings ..         | 28        | 28        | 19        | 18        |
| Survival % ..               | 93.33     | 93.33     | 63.33     | 60.00     |
| Mortality % ..              | 6.67      | 6.67      | 36.77     | 40.00     |
| Height above collar (cm) .. | 21.85     | 24.96     | 27.29     | 30.04     |

Simultaneous experiment with sample size and living seedlings 20, was run under laboratory conditions. The propagules were planted in June 1988. Under nursery conditions all the seedlings are living upto December 1988 in which the height above collar increased from 4.76 (Aug.) to 9.91 (Sep.), 14.00 (Oct.) 18.83 cm in December 1988.

From Table 4 it is clear that under field conditions initial growth above collar is fast upto August. However, the rate of further growth measured in terms of height is low as compared to garden conditions. Further, it should be noted that the plants under laboratory conditions are at 667 m from MSL. Therefore, the difference in height may be attributed to altitudinal difference. However, survival/mortality may be a direct result of salinity. The effect of salt on mangroves is reported to adverse (Shinde, 1981)

Adrini, 1958; Henckel, 1973; Bosale *et al.*, (1983). Further, Henckel (1963) has pointed out that vivipary in Rhizophoraceae itself is

mann, 1967). In the present study it is found that leaf fall is greater under salinity conditions than under fresh water. This supports our

TABLE 4. Growth performance of *R. mucronata* under field trials by direct plantation in the field in June 1988

|                          | Belt | Aug.  | Sep.  | Oct.  | Nov.  | Dec. 1988 |
|--------------------------|------|-------|-------|-------|-------|-----------|
| Living seedlings         | I    | 64    | 64    | 63    | 58    | 58        |
|                          | II   | 73    | 63    | 62    | 59    | 58        |
|                          | III  | 74    | 69    | 67    | 66    | 66        |
|                          | IV   | 74    | 74    | 74    | 74    | 73        |
| Survival %               | I    | 85.34 | 85.34 | 84.00 | 77.33 | 77.33     |
|                          | II   | 97.34 | 84.00 | 82.66 | 78.67 | 77.33     |
|                          | III  | 98.67 | 92.00 | 89.33 | 88.00 | 88.00     |
|                          | IV   | 98.67 | 98.67 | 98.67 | 98.67 | 97.34     |
| Height above Collar (cm) | I    | 19.85 | 29.68 | 31.31 | 34.34 | 37.07     |
|                          | II   | 24.66 | 35.87 | 39.74 | 44.38 | 46.28     |
|                          | III  | 28.62 | 39.45 | 42.40 | 46.20 | 48.18     |
|                          | IV   | 30.47 | 40.33 | 43.62 | 46.85 | 49.46     |

Sample size 75 propagules per belt.

an adaptive features for escape of seed from the hazardous effect of salt. The salt tolerance is slowly acquired during the ontogeny (Henckel, 1963; Joshi *et al.*, 1972; Lotschert and Lie-

view that salinity is responsible for higher mortality under field conditions.

Department of Botany, Shivaji University, Kolhapur-416 004.

P. K. KULKARNI  
L. J. BHOSALE

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