FINAL REPORT FOR
UGC MAJOR RESEARCH PROJECT

(From 01.07.2012 to 30.06.2015)

UGC- F. No.: 41-454/2012 (SR) Dated 16.07.2012

A STUDY ON THE MECHANISM OF ADAPTABILITY OF MANGROVE ASSOCIATE TO SALINE CONDITION

Submitted to

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110 002

By

Dr. S. NATARAJAN M.Sc., M. Phil., Ph. D.,

Associate Professor
(Principal Investigator)

DEPARTMENT OF BOTANY
(DST-FIST & UGC-SAP SPONSORED DEPARTMENT)
ANNAMALAI UNIVERSITY
ANNAMALAI NAGAR - 608 002
TAMIL NADU

ज्ञान-विज्ञान विमुक्तये

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110 002

Final Report of the work done on the Major Research Project

1	UGC Reference No. & Date	F. No. 41-454/2012 (SR) Dated 16.07.2012
2	Name of the Principal Investigator	Dr. S. Natarajan
3	Address	**Office:** Associate Professor in Botany Principal investigator UGC-Major Research project Annamalai University Annamalainagar - 608 002 Tamilnadu, India. **Cell:** 9443046137 **E-mail:** s.natarajan20@yahoo.com **Residential:** 19-C. Ponnambalam Nagar, Chidambaram.
4	Department and University/ College where the project has undertaken	Department of Botany Annamalai University
5	Title of the Project	A study on the mechanism of adaptability of mangrove associate saline condition
6	Date of Implementation	01.07.2012
7	Date of the project	From 01.07.2012 to 30.06.2015
8	Grants Received	**1st installment : Rs. 6,90,800/-** (Rupees Six lakh ninety thousand and eight hundred only) **2nd installment: Rs. 3,07,045/-** (Rupees Three lakh seven thousand forty five only) **Total Grant: Rs. 9,97,845/-** (Rupees Nine lakh ninety seven thousand eight hundred forty five only)
9	Objectives of the Project	Enclosed
10	Methodology	Enclosed

11	Work done so far	Enclosed
12	Work remains to be done	Nil
13	Has the progress been according to original plan of work and towards achieving objectives if not, state reasons	Yes
14	Whether Project work was delayed.	No
15	Please indicate the approximate time by which the project work is likely to be completed	Completed on 30th June 2015
16	Please indicate the difficulties, if any, experienced in implementing the project	Nil
17	Collaboration, if any	Nil
18	Ph. D Enrolled, if yes, details	Yes, Enclosed
19	Details of the Publications resulting from the project work (please attach reprints) letter of Acceptance of paper communicated	Yes, Enclosed
20	Any other information which would help in evaluation of work done on the project	Nil

21. Financial Assistance provided/ Expenditure incurred:

Sl. No.	Items	Amount Approved (Rs.)	Amount received (Rs.)	Expenditure incurred so far (Rs.)	Balance (Rs)
1	Books & Journal	-	-	-	
2	Equipments	2,00,000.00	2,00,000.00	1.99,801.00	199.00
3	Honorarium	-	-	-	Nil
4	Contingency	60,000.00	54,000.00	54,135.00	-135.00
5	Travel/fieldwork	60,000.00	54,000.00	54,000.00	Nil
6	Chemicals & Glassware	1,50,000.00	1,35,000.00	1,34,776.00	224.00
7	Hiring Services	30,000.00	27,000.00	27,000.00	Nil
8	Overhead Charges	76,800.00	76,800.00	76,800.00	Nil
9	Any other items (please specify)	-	-	-	-
10	Honorarium to Principal Investigator	-	-	-	-
Staff date of appointment: From 22.08.2012 to 30.06.2015.		5,01,161.00	4,51,045.00	4,37,099.00	13946.00
	Total	**10,77,961.00**	**9,97,845.00**	**9,83,611.00**	14234.00

It is certified that the grant of **Rs.9, 97, 845.00 (Rupees Nine lakh ninety seven thousand and eight hundred forty five only)** received from the University Grants Commission out of Rs. **10, 77, 961.00 (Ten lakh seventy seven thousand and nine hundred sixty one only)** under the scheme of support for Major Research Project entitled **"A study on the mechanism of adaptability of mangrove associate to saline condition"** vide UGC letter **No. F. 41-454/2012 (SR) Dated 16.07.2012** and **9, 83,611.00 (Nine lakh eighty three thousand and six hundred eleven only)** has been utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

Signature of the
Principal Investigator **Registrar**

Signature of the
Co-Investigator

UNIVERSITY GRANTS COMMISSION
BAHADHUR SHAH ZAFAR MARG
NEW DELHI – 110 002

UTILIZATION CERTIFICATE
01/07/2012 to 30/06/2015

Certified that an amount of **Rs.9, 97, 845.00 (Rupees Nine lakh ninety seventy thousand and eight hundred forty five only**) has been received out of **Rs. 10, 77, 961.00 (Rupees Ten lakh seventy seven thousand and nine hundred sixty one only)** sanctioned to **Dr. S. Natarajan, Associate Professor, Department of Botany, Annamalai University** by the University Grants Commission vide their letter number **No. F. 41-454/2012 (SR) Dated 16. 07. 2012** and **Rs. 9, 83,611.00 (Rupees Ten lakh eighty three thousand six hundred eleven only)** has been utilized for the purpose for which it was sanctioned and in accordance with the terms and Conditions as laid down by the University Grants Commission.

Signature of the Principal Investigator | **Registrar** | **Statutory auditor**

Signature of the Co-Investigator

Objectives of the Research Project are:

- To study the effect of salinity on the mangrove associates *Sesuvium portulacastrum* and *Clerodendron inerme*.
- To estimate the antioxidant metabolism at higher salinity.
- To estimate the variation in mineral absorption and accumulation in the mangrove associate during salinity adaption.
- To understand the osmolyte changes during adaption to salinity.

Methodology:

Plant collection:

The mature stem cuttings with 3-4 leaves of *Sesuvium portulacastrum* and *Clerodendron inerme* were collected from salt marshes in the mangrove area of Pichavaram, on the east coast of Tamil Nadu, India about 10km east of Annamalai University Campus. Uniform sized and healthy cuttings after a through wash in the tap water were planted individually in polythene bags (7" X 5") filled with the homogenous mixture of the garden soil containing red soil, sand along with farmyard manure mixed in the ratio of 1:2:1. The cuttings were irrigated with tap water and maintained in the Botanical Garden of Annamalai University for about one month. After, the cuttings were fully stabilized in the polythene bags for 30 days, about 300 healthy and uniformly grown plants were screened for saline treatments.

Treatment:

After 30 days, well established plants each with 3-4 leaves were selected for salt treatment. The cuttings could tolerate and survive a wide range of exogenously added NaCl. The treatments constituted control, 100, 200, 300, 400, 500, 600, 700, 800, 900 and 1000 mM NaCl. The control plants were irrigated with tap water. The treatments continued until the plants received the required concentration of salt. The cuttings treated with NaCl above 500mM in the case of *Clerodendron inerme* and 900mM in the case of *Sesuvium portulacastrum* did not survive after 10 days of treatment. The experimental plants treated with NaCl up to 500mM and 900mM were alone maintained in the experimental site. The salt

solutions were prepared with NaCl (Laboratory Grade, Glaxo Laboratory, India) and tap water. After this, all the plants were irrigated with the tap water.

The samples for various studies were collected on the **60th**; **90th** and **120th** day after NaCl treatment.

Summary on progress: (Period from 01-07-2012 to 30- 06- 2015)

In the present study, the effect of different concentrations of sodium chloride on the growth and development, inorganic constituents, photosynthetic pigments characteristic and changes in the activity of few enzymes were studied in the seedlings of *Sesuvium portulacastrum* and *Clerodendron inerme*. The seedlings of both the species tolerated and survived a wide range of NaCl salinity. The extreme level of salinity for survival of the seedlings of *S. portulacastrum* to NaCl salinity was 900mM and *Clerodendron inerme* survived upto 500mM NaCl salinity. The growth and development of both the species were stimulated in the presence of NaCl.

The optimal salt concentration for the survival of the seedlings of *S. portulacastrum* was 600mM NaCl where as for *C. inerme* 200mM it was NaCl. The growth parameters such as shoot and root length, number of leaves, leaf area, fresh and dry weight increased with increasing salinity in both the species upto their respective optimal salinity. Both the species accumulated, Na and P ions in their tissue upto the extreme level of salinity. The inorganic constituents like Ca content increased upto the optimal level of salinity.

The accumulation of the proline and glycinebetaine increased considerably upto the extreme level of salinity. These two compounds are suggested to function as compatible solutes and to act as intracellular osmoticum to protect the plants from salt injury. Sodium chloride stimulated the chlorophyll and carotenoids synthesis and both the pigments increased upto the optimal level salinity and at higher salinity these activities declined steadily.

The non- enzymatic antioxidant such as ascorbic acid and α-tocopherol increased in both the species, with increasing salinity upto the extreme level of NaCl concentration. On the other hand, enzymatic antioxidant such as riboflavin, superoxide dismutase and ascorbate peroxidase showed an enhanced activity upto the optimal level of salinity and at higher salinities the activity was inhibited.

Of the two species of halophytes, *S. portulacastrum* exhibited more tolerance to NaCl salinity than *C. inerme*. Tolerance to NaCl salinity was essential for better growth, mineral constituents, organic constituents and certain key enzymes up to the optimum level of salinity concentrations. Hence, it is concluded that this species could be recommended for cultivation in salt affected soils to reduce the soil salinity level.

References

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Annexure-IX

UNIVERSITY GRANTS COMMISSION
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PROFORMA FOR SUPPLYING THE INFORMATION IN RESPECT OF THE STAFF APPOINTED UNDER THE SCHEME OF MAJOR RESEARCH PROJECT

UGC FILE NO (SR) YEAR OF COMMENCEMENT: **No. F. 41-454/2012 (SR) Dated 16.07.2012**

TITLE OF THE PROJECT: A study on the mechanism of adaptability of mangrove associate saline condition

1	Name of the Principal Investigator:	**Dr. S. Natarajan**				
2	Name of the University/College:	Annamalai University				
3	Name of the Research Personnel appointed:	N. Silambarasan				
4	**Academic qualification:**	**S. No.**	**Qualification**	**Year**	**Marks**	**% age**
		1	M.Sc.	2009-11	1543-2100	74.17
		2	M.Phil	-	-	-
		3	Ph.D	-	-	-
5	Date of Joining:	22.08.2012				
6	Date of Birth of Research Personnel:	08.01.1989				
7	Amount of HRA, if drawn;	-				
8	Number of Candidate applied for the post:	Seven Candidate				

CERTIFICATE

This is to certify that all the rules and regulations of UGC Major Research Project outlined in the guidelines have been followed. Any lapses on the part of University will liable to terminate of said UGC project**.**

Principal Investigator **Head of the Dept.** **Registrar**