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Morphometrics and Germrination Biology of Seeds from Two Coastal Sand Dune Plants of South East Coast of India

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Coastal sand dunes (CSD) are important marine ecosystems which received less attention. The coastal sand dune plants also little explored. India has a vast coast line of a coastline of 7,517 km was reported to have 338 species of CSD flora, of which 92 species are found to be common to the west and east coasts. The coastal sand dune plants of west coast of India are studied for their diversity, biology and bioprospecting adequately. However, the coastal sand dune plants though less approached for diversity and bioprospecting knowledge on the biology is rarely attempted. Hence, in the present study we have taken two coastal sand dune plants such as *Canavalia* sp. and *Ipomoea* sp. and studied the morphometrics and germination biology of their seeds. Both *Canavalia* sp. and *Ipomoea* sp. The fresh weight of the *Canavalia* sp. seeds from different locations exhibited little temporal variations. The the average fresh weight of the *Canavalia* sp. in the Chennai coastal sand dunes was 0.84 g. The dry weight of *Canavalia* sp. was in the range of 47.90 – 64.73 g (100 seeds weight). Average moisture content of *Canavalia* sp. seeds was found to be 36.7%. The average fresh weight for the *Ipomoea* sp. seeds was 24.3 g (100 seeds), average dry weight of 8.7 g (100 seeds) and the seeds were having an average moisture content of 23.8%. *Canavalia* sp. seeds were having average length of 14.42 mm, average height of 26.95 mm and average breadth of 8.35 mm. Average volumes of *Canavalia* sp. seeds from the south east coast of India is 33.1mm^3. *Ipomoea sp* seeds were having average length of 6.95 mm, average height of 6.81mm and average breadth of 5.63mm. Average volumes of *Ipomoea sp* seeds from the south east coast of India is 19.4 mm^3. *Canavalia sp.* seeds are relatively faster in germination which usually germinates in 2 days where as *Ipomoea* seeds germinate in 12 days. Direct sowing was found to be best for germination of *Ipomoea* seeds while water soaking for 24 is found essential for the germination of *Canavalia* sp.

Key words: Coastal sand dunes, *Canavalia sp, Ipomoe sp,* Morphometrics and Seed germination.

In comparison with inland habitats the coastal dunes are characterized by hard, salt-loaded wind and by supply and movement of sand (Weeda, 2010). Coastal sand dune (CSD) ecosystem is an important ecological niche between terrestrial and marine realms. Many natural and anthropogenic activities cause a considerable loss of habitat and dependent flora and fauna in the CSD. Consequently, CSD flora has gained global attention for their protection, conservation and rehabilitation. Therefore, adequate information (extent, biotic and abiotic constituents, climate, coastal dynamics, sediment type) pertaining to such habitats forms the basis for developing effective strategies for management (Rodrigues *et al*., 2011). Although the importance of coastal sand

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dune for a diversity of characteristic and often rare organisms from a variety of taxa has been addressed, many of the broader ecosystem services that these habitats provide to society have been overlooked. This suggests that coastal sand dune systems are neglected ecosystems of significant and often under-appreciated societal value (Everard *et al*., 2010).

There have been very few studies concentrated on the coastal sand dunes of India which is having a coast line of more than 7000 Km. The floristic composition and distribution from CSDs of India has been analysed and found that a total 338 species of CSD flora, of which 92 species are found to be common to the west and east coasts. The west coast showed a greater diversity than the east coast, accounting for 267 and 163 species respectively (Rodrigues *et al*., 2011). The coastal dunes of tropics, especially the East Coast of India has received scanty attention. A detailed vegetation survey along the coastal area in Pudhuchery (Pondicherry) was done during 2008. A total of 41 species belonging to 35 genera and 20 families were identified at different distances from the shoreline towards inland where various edaphic factors decline facilitating more floral colonization (Padmavathy *et al*., 2010). A study of sand dune flora along coastal sand dune areas of Tirunelveli District, Tamil Nadu, India was done from June 2011 to December 2012. 55 species belonging to 46 genera and 26 families were identified at different distances from the shoreline (Ramarajan and Murugesan, 2014). CSD vegetation in South East coast of India was sampled by belt transect and quadrate method at three gradients of disturbance highly disturbed, moderately disturbed and slightly disturbed. Three clear zones could be identified such as fore dune (comprising plants such as *Cyperus* sp., *Ipomea pescapre, Spinifix litoreus*), mid zone (comprising plants such as *Ginisekia pharmacoeides, Glinus oppositifolius*) and back dune (comprising plants such as *Bulbostylis barbata*).

Studies on coastal sand dune plants largely concentrated on its taxonomy and distribution (Rodrigues *et al*., 2011), microbiology and bioprospecting (Jayaprakashvel *et al*., 2010). In this context, we found that the morphometric characteristics and germination biology of seeds from coastal sand dune plants has not been given due attention. The morphometric characteristics and nutrional properties of *Canavalia* spp. seeds from the west coast sand dunes of India were studied (Arun *et al*., 2003). Seena *et al*. (2005) have studied the biochemical and biological evaluation of an unconventional legume *Canavalia maritima* of coastal sand dunes of India. Similarly, the nutritional and microbiological features of little known legumes, *Canavalia cathartica* Thouars and *Canavalia maritima*Thouars of the southwest coast of India were also studied (Seena and Sridhar, 2006). However, the coastal sand dune plants from the East Coast of India has not been shown due attention earlier. Hence, we have taken up this study to analyze the morphometric features and germination potency of two important coastal sand dune plants (*Canavalia* sp. and *Ipomoea* sp.) from the South East Coast of India.

MATERIALS AND METHODS

Collection of Seed Samples

Two seed bearing coastal sand dune plants i.e., *Canavalia rosea* and *Ipomoea pescaprae* were selected in the present study. Both fresh and dried pods of Kernels *Canavalia rosea* and *Ipomoea pescaprae* were collected from eight different locations around the South East Coast of India. For the analysis of fresh weight of the seeds, fresh seeds were used immediately. Otherwise for other parameters, seeds were separated from pods and sun dried for 3 days. Immature, malformed, insect infected and wrinkled seeds were eliminated. The seeds were stored in air tight plastic containers in room temperature until use.

Sampling Locations

The eight sampling locations are Besant Nagar (12.989370, 80.270045), Palavakkam (12.959519, 80.263515), Injammpakkam (12.923497, 80.257403), Uthandi (12.863219, 80.249539), Kanathur (12.843741, 80.248173), Vada Nemmeli (12.743290, 80.241998), Tiger Caves (12.655305, 80.210216) and Mamallpuram (12.603108, 80.193459) along the South East Coast of Tamil Nadu, India.

Biometrics of the collected coastal sand dune plant seeds

A total of 100 seeds per location per plant were considered for the measurement of physical parameters of the seeds (*Canavalia rosea* and *Ipomoea* sp.) such as height, breadth and total

volume. Calculations of seed fresh weight, dry weight and moisture content were based on weights determined before and after oven drying seed samples at 80°C for 24 h. Moisture content represents the percentage of water in seed, and was determined through direct method involving the removal of water from seed by heating in an oven, and the lost weight measured (Nedeva and and Nikolova, 1999). The length, breadth and total volume were calculated using Vernier scale.

Germination of coastal sand dune plants at different salinity

Scarification was not done in this experiment. The seeds surface was sterilized by using following steps.

1) Wash in sterile water - 60 seconds
2) Wash in 50% ethonol - 30 seconds
3) Wash in sterile water - 30 seconds (2 times)
4) Wash in 2% sodium hypochlorite - 60 seconds
5) Wash in sterile water - 60 seconds (3 times)

Then the seeds were air dried in sterile blotting paper in Laminar Air Flow (LAF) chamber. These seeds were then soaked for 24 h in sterile distilled water/seawater or mixture of both (50% v/v) and allowed to germinate on the moist sand bed. Distilled water/seawater or mixtures of both were sprinkled on sand bed until germination of seeds was observed. Number of seeds germinated was recorded from which, the germination percentage was calculated by the following formula.

$$\text{Germination Percentage} = \frac{\text{Number of seeds germinated}}{\text{Total Number of Seeds}} \times 100$$

RESULTS AND DISCUSSIONS

Temperate CSDs comprise of mainly the members of Poaceae, while tropics with Asteraceae, Cyperaceae and Fabaceae and Poaceae. Over a decade, efforts were made to unravel the importance of the coastal germplasm of *Canavalia* spp. in the west coast of India with a view to exploit their potential for nutritional and agricultural needs (Seena and Sridhar, 2006). In east coast of India, very few studies only have made on the diversity and bioprospecting of coastal sand dune plants. The Department of Marine Biotechnology, AMET University has concentrating on the microbiological aspects of three coastal sand dune plants such as *Ipomoea* , *Canavalia* and *Spinifex* in the South East Coast of India (Jayaprakashvel *et al*., 2010; Sangeetha *et al*., 2011; Muthezhilan *et al*., 2014). These coastal sand dune plants are being considered as important biota in the Integrated coastal zone management. The legumes of coastal sand dunes in west coast of India are adequately studied for their microbiological, nutritional and bioprosepcting aspects (Arun *et al*, 2003; Seena and Sridhar, 2006; Seena *et al*., 2006). However, attempts on the study of morphometrics in the important coastal sand dune plants such as *Ipomoea* sp. and *Canavalia* sp. are very scanty in the south east coast of India. Hence, we have studied the morphometrics and germination of seeds of these coastal sand dune plants.

The fresh weight of the *Canavalia* sp. seeds from different locations exhibited little temporal variations. The fresh weight ranged from

Table 1. Moisture and seed weight of *Canavalia* sp. from the south east coast of India

S. No.	Sampling Location	Fresh weight (g)		Dry Weight (g)		Moisture (%)
		100 seeds	1 seed	100 seeds	1 seed	
1	Besant Nagar	96.5 ± 49.83	0.96 ± 0.005	47.90 ± 0.07	0.48 ± 0.01	50.65
2	Palavakkam	99.5 ± 51.38	0.83 ± 0.258	52.66 ± 0.51	0.55 ± 0.02	48
3	Injampakkam	98 ± 0.89	0.97 ± 0.008	56 ± 0.89	0.58 ± 0.02	43.29
4	Uthandi	107.26 ± 0.98	1.08 ± 0.008	60.37 ± 0.48	0.63 ± 0.05	44.29
5	Kanakthur	98.33 ± 0.51	0.97 ± 0.013	54.7 ± 0.17	0.57 ± 0.02	44.38
6	Nemmeli	114.03 ± 0.89	1.44 ± 0.253	64.73 ± 0.22	0.64 ± 0.01	43.47
7	Tiger caves	114.27 ± 0.56	1.14 ± 0.008	55.85 ± 0.11	0.56 ± 0.01	51.02
8	Mahabalipuram	104 ± 0.89	1.05 ± 0.017	61 ± 0.88	0.76 ± 0.13	41.73

Values are mean of triplicates with standard deviation

96.5 to 114.27 g. Similarly the fresh weight of single seed ranged from 0.83 to 1.44 between the stations. However, the average fresh weight of the *Canavalia* sp. in the Chennai coastal sand dunes was 0.84 g. The dry weight of *Canavalia* sp. was in the range of 47.90 – 64.73 g (100 seeds weight) and 0.48-0.64 g (for a single seed). The moisture content of these seeds was in the range of 43.29 – 51.02. Average moisture content of *Canavalia* sp. seeds was found to be 36.7% (Table 1). The fresh weight of *Ipomoea* sp. seeds ranged from 31.05 to 32.83 g. Similarly the fresh weight of single seed ranged from 0.2 to 0.4 between the stations. However, the average fresh weight of the *Ipomoea* sp. in the Chennai coastal sand dunes was 0.3 g. The dry weight of *Ipomoea* sp. was in the range of 9.86 – 12.32 g (100 seeds weight) and 0.11-0.25 g (for a single seed) with an average of 0.2g. The moisture content of these seeds was in the range of 24.03 – 35.32. The average moisture content of the *Ipomoea* sp. seeds was 23.8% (Table 2).

Table 2. Moisture and seed weight of *Ipomoea* sp. from the south east coast of India

S. No.	Sampling Location	Fresh weight (g)		Dry Weight (g)		Moisture (%)
		100 seeds	1 seed	100 seeds	1 seed	
1	Besant Nagar	31.05 ± 0.82	0.4 ± 0.08	9.86 ± 0.11	0.11 ±0.09	35.32
2	Palavakkam	30.30 ± 0.23	0.2 ±0.05	10.34 ± 0.5	0.23 ±0.13	33.25
3	Injampakkam	29.41 ± 0.06	0.2 ±0.01	11 ± 0.89	0.3±0.17	31.85
4	Uthandi	28 ± 0.89	0.3 ±0.01	10.46 ± 0.41	0.25±0.16	30
5	Kanathur	30 ± 0.89	0.3 ±0.02	10.7 ± 0.23	0.20±0.15	27.58
6	Nemmeli	32.06 ± 0.82	0.3 ±0.01	12.32 ± 0.52	0.17±0.09	25.15
7	Tiger caves	32.83 ± 0.68	0.3 ±0.02	11.38 ± 0.47	0.25±0.19	30.78
8	Mahabalipuram	29.24 ± 0.28	0.3 ±0.03	11.34 ± 0.50	0.25±0.18	24.03

Values are mean of triplicates with standard deviation

Table 3. Morphometrics of *Canavalia* sp. seeds

S. No.	Name of the Coastal Stations	Length(mm)	Height(mm)	Breadth(mm)	Volume (mm^3)
1	Besant Nagar	14.6±0.16	9.9±0.13	10±0.09	34.5
2	Palavakkam	14 ± 0.04	10±0.07	7.7±0.07	31.7
3	Injampakkam	14.2±0.12	9.7±0.08	8.1±0.05	32.0
4	Uthandi	14.8±0.12	11.8±0.13	8.2±0.03	33.8
5	Kanakthur	14.7±0.04	10.1±0.05	7.8±0.13	32.6
6	Nemmeli	15±0.04	10.9±0.08	8.4±0.03	34.7
7	Tiger caves	13.9±0.07	13.9±0.07	8.4±0.06	33.5
8	Mahabalipuram	14.2±0.08	14.2±1.12	8.2±0.04	32.0

The morphometric characteristics such as length, height, breadth and volume of dry seeds were mesasured for both the seeds. *Canavalia* sp. seeds were having average length of 14.42 mm, average height of 26.95 mm and average breadth of 8.35 mm. Average volume of *Ipomoea* sp seeds from the south east coast of India is 33.1 mm^3 (Table 3). *Ipomoea* seeds were having average length of 6.95 mm, average height of 11.25 mm and average breadth of 5.63 mm. Average volume of *Ipomoea* sp seeds from the south east coast of India is 19.4 mm^3 (Table 4).

The germination of *Ipomoea* seeds are always a hurdle. The *Canavalia* seeds are relatively easier to get germinated. Studies were already done on the germination of *Canavalia* using a pretreatment. These two plants are coastal sand dune plants. So, their germination may get affected by moisture and salinity. Hence, in the present study experimentation was made to find the effect of salinity and soaking was studied. It has been found that the *Canavalia* sp. seeds germinate well even in soaking condition itself.

Table 4. Morphometrics of *Ipomoea* sp seeds

S. No.	Name of the Coastal Stations	Length(mm)	Height(mm)	Breadth(mm)	Volume (mm^3)
1	Besant Nagar	6.7 ± 0.09	6.9 ± 0.02	5.6 ± 0.01	19.2
2	Palavakkam	7.4 ± 0.05	6.7 ± 0.05	6.1 ± 0.07	20.2
3	Injampakkam	6.8 ± 0.06	6.5 ± 0.03	5.5 ± 0.05	18.8
4	Uthandi	6.9 ± 0.06	7.1 ± 0.03	6 ± 0.08	20.0
5	Kanakthur	6.4 ± 0.04	6.7 ± 0.02	5.3 ± 0.04	18.4
6	Nemmeli	7.3 + 0.02	7.2 ± 0.04	6 ± 0.04	20.5
7	Tiger caves	7.1 + 0.09	6.8 ± 0.05	5.7 ± 0.04	19.6
8	Mahabalipuram	7 + 0.04	6.6 ± 0.07	4.9 ± 0.05	18.5

Table 5. Effect of salinity on the germination of coastal sand dune plant seeds

Treatment	Germination Percentage		Time taken for germination (days)	
	Canavalia sp.	*Ipomoea* sp.	*Canavalia* sp.	*Ipomoea* sp.
Distilled Water	60	30	2	15
Sea Water	50	20	2	15
Mixture of Both (50% v/v)	70	40	2	15
Direct Sowing	40	55	4	12

When they sown on sand bed and watered, they germinated in 48 h. However, the *Ipomoea* sp. seeds usually germinate after 10 days only. The direct sowing of *Ipomoea* sp. in the sand bed increases the germination percentage of the seeds. *Canavalia* sp. seeds are relatively faster in germination which usually germinates in 2 days where as *Ipomoea* seeds germinate in 12 days. Similarly, *Canavalia* sp. seeds have more germination percentage of 70% in the seawater and distilled water mixture where as the maximum germination percentage of *Ipomoea* seeds was

Fig. 1. *Canavalia* sp. in the south east coast of India and its seeds

Fig. 2. *Ipomoea* sp. in the south east coast of India and its seeds

observed when seeds are sown directly without any soaking (Table 5).

CONCLUSION

The morphometric characteristics and germination biology of coastal sand dune plant seeds are finding importance in developing suitable conservation technologies. Hence this study find much significance as a base work for future research on biology and bioprospecting of coastal sand dune plants in East Coast of India.

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REFERENCES

1. Arun, A.B., Sridhar, K.R., Raviraja, N.S., Schmidt, E., Jung, K., Nutritional and anti-nutritional components of *Canavalia spp*. seeds from the west coast sand dunes of India. *Plant Foods for Human Nutrition.,* 2003; **58:** 1-13.
2. Everard, M., Jones, L., Watts, B., Have we neglected the societal importance of sand dunes? An ecosystem services perspective. *Aquatic Conservation: Marine and Freshwater Ecosystems*., 2010; **20:** 476–487.
3. Muthezhilan R, Vinoth S, Gopi K and Jaffar Hussain A, Dye Degrading Potential of Immobilized Laccase from Endophytic Fungi of Coastal Sand Dune Plants. International *Journal of ChemTech Research*, 2014; **6**(9): 4154-4160.
4. Nedeva, D., Nikolova, A., Fresh and dry weight changes and germination capacity of natural or premature desiccated developing wheat seeds. *Bulg. J. Plant Physiol.*, 1999; **25**: 3-15.
5. Padmavathy, V., Poyyamoli, G., Balachandran, N., Coastal Dune Flora, Nallavadu Village, Puducherry, India. *Check List*., 2010; **6:** 198-2000.
6. Ramarajan, S., Murugesan, A.G., Plant diversity on coastal sand dune flora, Tirunelveli, District, Tamil Nadu. *Indian Journal of Plant Sciences*., 2014; **3:** 42-48.
7. Rodrigues, R.S., Mascarenhas, A., Jagtap, T.G. An evaluation of flora from coastal sand dunes of India: Rationale for conservation and management. *Ocean & Coastal Management*., 2011; **54:** 181-188.
8. Seena, S., Sridhar, K.R., Nutritional and microbiological features of little known legumes, *Canavalia cathartica* Thouars and *Canavalia maritime* Thouars of the southwest coast of India. *Current Science*., 2006; **90:** 1638-1650.
9. Seena, S., Sridhar, K.R., Bhagya. B. , Biochemical and Biological evaluation of an unconventional legume *Canavalia maritima* of coastal sand dunes of India. *Tropical and subtropical Agroecosystems* 2005; **5:** 1-14.
10. Sridhar, K.R., Bhagya, B., Coastal sand dune vegetation: a potential source of food, fodder and pharmaceuticals. *Livestock Research for Rural Development.*, 2007; **19**.
11. Weeda, E.J., The role of archaeophytes and neophytes in the Dutch coastal dunes. *J Coast Conserv*., 2010; **14:** 75–79.
12. Jayaprakashvel M, Muthezhilan R, Srinivasan R, Jaffar Hussain A, Gobalakrishnan S., Hydrogen cyanide mediated biocontrol potential of *Pseudomonas* sp. AMET1055 isolated from the rhizosphere of coastal sand dune vegetation. *Advanced Biotech.*, 2010; **9:** 39-42
13. Sangeetha, S., Balram, J., Muthezhilan, R., Jaffar Hussain, A., Jayaprakashvel, M., Influence of salinity on the antifungal activity of marine associated rhizobacteria against Rhizoctonia solani. *Journal of Advanced Biotechnology.*, 2011; **11:** 07-11.