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Seed and Germination Attributes in *Sterculia urens* Roxb. Populations in South Gujarat

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ABSTRACT

Sterculia urens (Gum Karaya) is important NTFPs species distributed in the tropical deciduous forests. The species is very popular for its natural gum and having domestic and global demand for its purified gums by the pharmaceutical industries. A preliminary study was carried out to understand the seed traits and germination attributes of *S. urens* using 18 open pollinated trees distributed in the natural forest of South Gujarat. Result showed that, among seed lots from 18 trees (accessions), seed length varied from 7.97 to 13.29 mm, seed thickness varied from 4.75 to 7.90 mm and seed weight varied from 0.06 to 0.95 g. Considering germination, out of eighteen trees, seeds of only nine trees resulted in germination and remaining nine sources does not show germination, even up to 45 days from the date of sowing. Among nine sources, germination per cent varied significantly among these nine trees, which ranged from 15.92 to 66.13 per cent with an overall mean of 35.93 per cent. Other observations such as GRI, MDG, PV and GV also varied significantly among nine trees. These preliminary data recorded may be useful for understanding ecological aspects including regeneration of this species.

INTRODUCTION

Tropical moist deciduous forests are rich in forest resources including non-timber forest products (NTFP). This forest is composed of economically important species and many of them are under threat due to over exploitation and other reasons (MoEFCC 2017). *Sterculia urens* Roxb., popularly called as gum karaya, is one of the commercial NTFP species of deciduous forests. It is considered as threatened /near threatened species (Anon, 1976; GFD 2008). Purified gum karaya is used in foodstuffs as emulsifiers, stabilizers and thickeners (Orwa et al. 2009). A large part of the karaya is used in the pharmaceutical industries as a bulk laxative and as a denture adhesive (Rao 2015). There is a great demand for gum karaya in domestic and global market. India export gum karaya of 296,744 kg of worth USD 1,848,930 globally (www.zauba.com 2015). Mostly raw gum is procured from wild and is one of the major income sources to the tribe community.

Natural regeneration of this species is recorded to be poor (GFD 2008 and Bhuva 2016). Further, ecological studies play a vital role in addressing problems such as change in composition, irregular age-class distribution and poor natural regeneration. Hence, preliminary information on regeneration pattern of such species may be useful in conservation and management of species. Therefore, in the present study preliminary data base on seed traits and germination attributes of *S. urens* was documented in south Gujarat region.

MATERIALS AND METHODS

The preliminary study was carried out in the College of Forestry, Navsari Agricultural University, Navsari to assess the seed traits and germination attributes in *S. urens*. Trees were found on the sloppy-rocky area and few of them on the farmland as well as nearby stream. In present study, 18 open pollinated trees of *S. urens* were marked in Dharampur forest area, Valsad Forest Division, South Gujarat and germplasms were collected individual tree wise. Tree biometric parameters such as height, girth at breast height and crown diameter were recorded (Table 1). Tree height ranged from 7.0 to 24.0 m, tree girth ranged from 76.0 to 253.0 cm with crown of diameter of 4.05 to 17.25 m.

Fruits were collected from selected individuals during fruiting season *i.e.,* May-June. Seed traits such as seed weight, diameter and length were recorded for 40 randomly selected seeds. Germination trial was done following completely randomized design with 18 treatments replicated thrice. Seeds of each treatment were soaked in normal water for 24 hours prior to sowing in sand medium in germination tray. Regular watering was done as per requirement. Germination count was made up to 21 days from the date of sowing. Observations were recorded on germination per cent and other germination parameters such as GRI, MDG, PV and GV as per standard formula (Thakur et al. 2017).

Table 1. Biometric data of 18 selected open pollinated trees of *S. urens* in south Gujarat

Accessions*	Tree height (m)	GBH (cm)	Crown diameter (m)
DRM-01	12.00	135.00	10.75
DRM-02	13.00	175.00	10.20
DRM-03	14.00	199.00	11.00
DRM-04	17.00	193.00	11.90
DRM-05	17.00	167.00	12.90
DRM-06	12.00	136.00	6.85
DRM-07	12.00	76.00	4.05
DRM-08	21.00	209.00	10.75
DRM-09	17.00	156.00	12.95
DRM-10	24.00	253.00	17.25
DRM-11	15.00	165.00	7.70
DRM-12	12.00	129.00	7.70
DRM-13	17.00	113.00	8.25
DRM-14	15.00	119.00	7.70
DRM-15	16.00	150.00	8.05
DRM-16	16.00	170.00	9.35
DRM-17	11.00	98.00	5.65
DRM-18	7.00	111.00	9.15

*Open pollinated trees; GBH=Girth at breast height

RESULTS AND DISCUSSION

Study revealed that individual seed length, seed thickness and seed weight varied from 7.97 to 13.29 mm, 4.75 to 7.90 mm and 0.06 to 0.95 g, respectively (Table 2) among seed lots from all the 18 open pollinated trees. Considering intra population variation, individual tree variability for mean seed length varied from 9.24 (DRM-11) to 11.50 mm (DRM-06) with overall mean of 10.07 mm, whereas mean seed thickness ranged between 5.39 (DRM-08) to 7.13mm (DRM-09) with overall mean of 6.35 mm among eighteen open pollinated trees. Since seeds were minutes, the range of variation was quite low with 0.11 (DRM-08) to 0.26 g (DRM-04) with overall mean of 0.17 g among the selected trees. It means, total number of seeds per kg weight would be approximate 5900 seeds (range of 3800 to 9000).There was a strong positive association within seed traits, where seed length positively correlated with seed thickness (r=0.554) and seed weight (r=0.671). Similarly, seed weight also positively correlated with seed thickness (r=0.758).

Table 2. Seed traits of 18 selected open pollinated trees of *S. urens* in south Gujarat

Accessions*	Seed length (mm)			Seed thickness (mm)			Seed weight (g)		
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD
DRM-01	8.59	11.37	9.84±0.57	5.54	6.49	5.96±0.21	0.09	0.15	0.12±0.01
DRM-02	8.30	11.55	10.05±0.70	5.46	7.80	6.51±0.50	0.13	0.30	0.24±0.04
DRM-03	8.87	11.21	10.43±0.57	6.22	7.39	6.85±0.26	0.12	0.30	0.24±0.05
DRM-04	9.56	12.47	11.07±0.71	6.30	7.90	7.05±0.31	0.14	0.40	0.26±0.09
DRM-05	8.58	11.81	9.89±0.75	5.66	6.79	6.25±0.29	0.09	0.16	0.13±0.02
DRM-06	10.01	13.29	11.50±0.71	6.34	7.90	6.98±0.29	0.21	0.40	0.32±0.05
DRM-07	8.66	11.52	9.97±0.72	5.37	6.73	6.13±0.38	0.09	0.24	0.14±0.03
DRM-08	8.89	11.79	10.36±0.69	4.75	6.09	5.39±0.31	0.06	0.18	0.11±0.02
DRM-09	9.48	11.84	10.75±0.55	6.65	7.84	7.13±0.30	0.15	0.29	0.20±0.03
DRM-10	8.72	10.60	9.49±0.48	5.64	7.14	6.30±0.31	0.09	0.22	0.14±0.03
DRM-11	7.97	10.18	9.24±0.54	5.77	7.02	6.40±0.31	0.09	0.27	0.17±0.04
DRM-12	8.10	11.23	9.46±0.71	5.27	6.71	6.04±0.33	0.07	0.95	0.15±0.18
DRM-13	8.29	10.55	9.31±0.48	5.91	7.45	6.60±0.30	0.10	0.20	0.15±0.02
DRM-14	8.61	11.37	10.12±0.59	5.24	6.94	5.99±0.33	0.08	0.18	0.13±0.02
DRM-15	8.75	11.23	9.84±0.62	5.32	6.86	6.11±0.35	0.08	0.26	0.13±0.04
DRM-16	8.07	10.57	9.25±0.63	5.28	6.34	5.70±0.20	0.07	0.24	0.16±0.04
DRM-17	8.57	11.81	10.38±0.69	5.66	7.33	6.49±0.46	0.16	0.27	0.21±0.03
DRM-18	9.33	11.48	10.28±0.45	5.73	7.00	6.37±0.29	0.10	0.21	0.13±0.02
Overall	7.97	13.29	10.07 ±0.63	4.75	7.90	6.35 ±0.47	0.06	0.95	0.17 ±0.06

*Open pollinated trees

Out of eighteen trees, seeds of only nine selected trees resulted in germination; however, seeds of remaining nine trees did not germinate at all even up to 45 days from the date of sowing. Germination started from 4th day of sowing date and completed within 11 days. ANOVA showed that there was a great variation in germination and it ranged from 15.92 (DRM-11) to 66.13 per cent (DRM-16) with an overall mean of 35.93 per cent (Table 3). Seeds collected from accessions- DRM-16, DRM-02 and DRM-06 showed maximum germination (more than 45%)and few of them resulted less than 20 per cent germination.

Such significant variation was also recorded for various germination attributes *viz.*, germination rate index (GRI; 1.44 to 16.18), mean daily germination (MDG; 1.28 to 12.50), peak value of germination (PV; 0.74 to 9.0) and germination value (GV; 1.08 to 112.50). Among all the nine accessions, DRM-02, DRM-06 and DRM-16 showed better performance on the basis of seed germination attributes. Correlation analysis was carried out between seed traits and per cent germination. Result showed that seed traits does not significantly influence on seed germination.

Table 3. Variation in seed germination and its attributes among selected accessions of *S. urens* in south Gujarat

Accessions*	Germination (%)	GRI	MDG	PV	GV
DRM-02	62.76 ± 4.49 (78.33)	16.18 ± 1.16	12.50 ± 1.44	9.00 ± 1.00	112.50 ± 17.02
DRM-03	34.17 ± 2.09 (31.67)	5.75 ± 0.79	4.05 ± 0.66	3.00 ± 0.58	12.36 ± 3.82
DRM-06	47.89 ± 2.91 (55.00)	10.24 ± 0.77	7.96 ± 0.90	7.33 ± 0.33	58.47 ± 7.38
DRM-08	18.97 ± 4.01 (11.3)	1.84 ± 0.69	1.28 ± 0.48	0.75 ± 0.12	1.08 ± 0.57
DRM-09	18.04 ± 2.85 (10.00)	1.60 ± 0.55	1.34 ± 0.44	0.74 ± 0.13	1.09 ± 0.53
DRM-10	23.74 ± 5.89 (17.67)	3.03 ± 1.37	1.99 ± 0.78	2.21 ± 0.98	5.91 ± 3.86
DRM-11	15.92 ± 1.61 (7.67)	1.44 ± 0.24	1.33 ± 0.19	1.00 ± 0.00	1.33 ± 0.19
DRM-16	66.13 ± 13.07 (76.67)	12.33 ± 1.96	8.21 ± 1.48	4.79 ± 0.21	38.74 ± 5.15
DRM-17	36.22 ± 1.74 (35.00)	6.00 ± 0.68	5.00 ± 0.00	5.00 ± 0.00	25.00 ± 0.00
Overall Mean	35.93 (35.98)	6.49	4.85	3.76	28.50
SEm (±)	5.46	1.03	0.86	0.53	6.67
CD at 0.05	16.35	3.09	2.56	1.57	19.98
CV %	26.28	27.52	30.53	24.17	40.55

**Open pollinated trees; GRI = Germination rate index; MDG= Mean daily germination; PV= Peak value of germination; GV= Germination value*

Note: Germination data was subjected to arc-sine transformation and analyzed. Original values are given in the parenthesis

Tree to tree variation within a forest population for these seed traits was also noticed. Such inference of intra population variation for seed traits was recorded in some tropical forest species like *Mammea suriga* and *Dysoxylumbinec tariferum* (Gunaga and Vasudeva 2009; Gunaga et al. 2015). On other hand, seed germination capacity is one of the ecological important parameters, where forest regeneration is highly depends upon seed germination, viability and seed set. Ultimately, these ecological parameters shape the population structure of individual species. Bhuva (2016) recorded very poor natural regeneration in this species from Vansda National Park of Navsari, South Gujarat. However, similar observation was also noticed in Dharampur forest area, which is used in the study. Nursery experiment showed that there was a great variation between trees for germination (15.92 to 66.13 %); however, seeds collected from nine out of eighteen trees does not show germination, which may be due to dormancy problem. Such inference was also reported in *Mammea suriga*, where germination per cent ranged from 1 to 90 per cent among 24 open pollinated families (Gunaga and Vasudeva 2009). Intra population variation was also reported in other species such as *Garcinia talbotii* (Bansude et al. 2013) and *Nothapodytes nimmoniana* (Hareesh et al. 2008). Overall study showed that there is a need of detailed study of auto-ecology of this species to address the problem of dormancy and poor natural regeneration. The information generated for *S. urens* may be useful for further ecological and conservation studies in *S. urens*.

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