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Study of Genetic Variability of Palmyapalm on the Basis of Tree Morphology and Yield Parameters in Bihar

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A B S T R A C T

Palmyra palm (*Borassus flabellifer*L) or commonly called Taad or Tarh is a palm tree of the Sugar palm group. It is an important multipurpose tree of great utility. There is a rich genetic diversity of palmyrah in Bihar, but no database is available regarding Palmyra. Thus a study was undertaken to study the variability in Palmyra for their plant morphological traits and yield parameters. Sample was collected during fruiting season and plants with diverse in nature for tree characteristics and fruit yield. Among 22 genotypes selected in the area surveyed, the great variability was noted with respect to plant height (dwarf and Tall) and yield parameters. The average height of the palms was 15.22m with a variation from 7.10m in PC-7 to 22.50m in PC-12.Trunk girth varied from 137cm (PC-11) to 180 cm (PC-6) and . Bunch number ranged from 7 bunch/tree to 34 bunches/tree in with yield variation from 84 fruit /palm to480 fruits. Grfeat variations in leaf parameters were also observed.

Introduction

Palmyra Palm (*Borassus spp.*) belongs to family Arecaceae and order Arecales. It is also called fan palm due to its typical palm shaped leaves. The genus *Borassus* constituted of five species. These species have different centre of origin. The species are *Borassus aethiopum*, *Borassus akcassii*. *Borassus flabellifer*, *Borassus heineansus* and *B. madagascariensis*.

Among all these species *Borassus flabellifer* L. or Asian palm is of most important which has great economic use. The word *"Borassus*" is derived from a Greek word means "leathery

covering of fruits" and *"flabellifer*" means "fan bearing" (Small, 2012)It is also known Tarh ,Taad, Toddy Palm, Sugar Palm and its fruit is known as Tari in Hindi, Munjal in Urdu, Taadfali in Gujarati and Sometimes known as Ice-apple in British English especially by the immigrants living in India Archeological and historical evidence indicated the presence this species in S.E. Asia at least 1500 years ago.

In India the wealth of Palmyra palm is very rich with a population nearly 122 million palms (Vengaiah, *et al.,* 2012)and half of them are in Tamil Nadu. More than 50% of palms are concentrated in the southern district of Thoothukudi (AICRP, Palms, 2015). The state of Bihar has very rich diversity ofpalmyra with more than 92 lakh palmyra population in the state. Districts like Gaya, Jahanabad, Nalanda, Banka and Bhagalpur are the leading districts of Bihar with large palmyra population. It is easily grown without much care and can be spotted growing in wild, in agricultural fields and sporadically even on wastelands as stray plantation.

Palmyra palm is a versatile tree of immense use to mankind of which no part is wasted. Palmyra is a dioecious palm with the great majority of its economic products such as immature endosperm, mesocarp pulp, fibre from the fruits and tuberous seedlings are obtained only from female palms.

Palmyra is means of livelihood of many people in the state especially who comes from economically and socially weaker section. Thus it is essential to exploit the availability of large palmyra population in the state. Unfortunately no data base regarding their variability is available till date. Thus attempts were made to study the variability in palmyra on the basis of their plant morphology and yield potential.

Materials and Methods

To study the variability in palmyra a survey of Palmyra palm plants was conducted during fruiting season in Bhagalpur district and its adjoining area in Bihar. Survey was conducted in five blocks of the district i.e Sabour, Kahalgaon, Nathnagar, Jagdishpur, Goradih .The sample was collected during survey on the basis of tree height, fruit size and yield potential by visual observation of palm during maturity period in the month of August, 2017 to study the variability. Observations were taken on tree characteristics and yield potential. Altogether 22 genotypes of palmyra were selected from the area surveyed and given number such as PC-1 (Palmyra collection -1) to PC- 22 (Palmyra collection 22). Observations on tree morphology such as tree height, girth, number of leaf scarce, leaf characteristics and yield parameters were taken to study the variability.

Tree height of different genotypes of palm was measured by using measuring tape from the crown to the base of the palm and expressed in meter. Trunk circumference was measured at 1 m height from the base of the palm and expressed in centimeter by using measuring tape. Number of leaf scars was counted in 50 cm length on trunk above 1m of the base of the trunk. Approximate age of palm was measure in years with the help of owner of that particular palm.

Total number of fruits at maturity period of selected palm was counted in all the bunch and average was calculated by dividing total number of fruits by number of bunch in that tree.

During the survey numbers of total bunch were counted in selected palm. Number of fruits/palm was taken by adding all the fruits in all the bunch of that tree. Among leaf parameters total number of leaves/tree,

number of leaflets /leaf was counted in the entire selected palm during survey. The length of the leaves was measured with the help of measuring tape and expressed in centimeters from the portion of leaflet bearing area.. The length of petiole was taken from the base of leaf to the leaflet bearing portion. Among yield parameters number of bunch per palm and number of fruits per bunch was counted and yield per plant was calculated in terms of no of fruit per palm.

Results and Discussion

The characteristics feature of Palmyra tree such as age of the palm, plant height, trunk girth at 1m height and number of leaf scarce in 50 cm of trunk length was studied in different germplasm of Palmyra and data is presented in Table 1. Significant variation was observed with respect to these parameters among the germplasm collected. The age of the palms varied from 30 years in PC-1 to 45 years in PC-18 with mean age of 36.35years. Similar type of variation n plant height and age of the flowering palm has been reported by Sankarangam *et al.,* (1999). It has been reported that slow growing Palmyra commences flowering only after 12-15 years of maturity (Ponnuswami, 2010) and sometimes it takes about 20 years to mature as reported by Pipatchartlearnwong *et al.,* (2017). Palmyra is robust and long lived palm that can survive up to 100years (Sankaralingam *et al.,* 1999). The average height of the palms under study was 15.22m with a variation from 7.10m in PC-7 to 22.50m in PC-12.Variation in plant height of Palmyra from 15 to 20 m has been enunciated by Bhaskar (2017) in Nellore district of Andhra Pradeshhas reported a Height up to 30 m of single stem robust Palmyra has also been reported (Kovoor, 1983).

Very high variation in trunk girth and in number of scars in 50 cm trunk length above 1 m plant height of trunk among the collected genotypes was noticed. Trunk girth varied from 137cm (PC-11) to 180 cm (PC-6) having mean value of 159.09 cm. Variation in number of scarce was from 12(PC-1) – 20(PC-18).Variation in trunk circumferences of 1.5m to 3.0 m at the base has been reported by Bhaskar(2017) in Nellore district of Andhra Pradesh and 1.7 m and trunk diameter of 60-90 cm (Sankaralingam *et al.,* 1999).

The data on different parameters of Palmyra leaf such as number of leaves/plant, number of leaflets/leaf, petiole length, petiole girth and leaf length was recorded in all the germplasm and analyzed data has been depicted in Table 2. The close perusal of data showed high variation in all these parameters among the genotypes of Palmyra. The findings of present investigation showed variation in leaf characters such as length of leaf and petiole, number of leaflets and number of leaves per palm among the genotype studied.

Total number of leaflets/leaf was found highly variable, which is varied from 82(PC-20) to 107(PC-21). The mean value of leaflets/leaf was noted 92.68. Higher number of leaflets/leaf was noted in PC-19, PC-18, PC-22, PC-10 and PC-2 genotypes with 105,103, 98, 98 and 97 number of leaflets/leaf and less no of leaflets/leaf was noted in PC-11, PC-17, PC-4, PC-12 genotypes with leaflet number of 85, 86, 87 and 87, respectively. The variation in leaf length varied from 111cm (PC5) to 145 cm (PC3) having mean value 125.27 cm. The genotypes having higher leaf length of 143cm, 142 cm, 141cm and 140 cm was observed in PC-12, PC-8, PC-15 and PC-19 respectively. Variation in leaf number from 20-30 per palm has been reported (Sankaralingam *et al.,* 1999; Kovoor, 1983) and 25-40 leaves (Morton, 1988) in palmyra earlier. .Leaf length of 0.60 m to 1.2m has also been

enunciated in past (Bhaskar, 2017) 2-4 ft(Morton, 1988) and 1.0 to 1.5 m by Sankaralingam *et al.*, (1999). Whereas 1-2 m leaf length in palmyra has been found by Bhaskar (2017). Variation in number of leaf lets and petiole length has been enunciated by earlier workers from different place of India and abroad (AICRP, Palms, 2015; Morton, 1988].

Yield parameters

Yield parameters like number of fruiting bunch and number of fruits/bunch was recorded in each of the genotypes collected and yield/palm. The data collected were analysed statistically and depicted in Table 3. Diversity with respect to yield parameters like number of bunch/ palm, number of fruits / bunch consequently fruit yield / palm was found during the present investigation. Variation with respect to number of bunch/ tree among different genotypes of Palmyra was recorded. The variation was from 7 bunch/tree in PC-6 to 34 bunches/tree in PC-14. The mean value of bunch number/tree was recorded 18.73.

Table.1 Tree characteristics of different genotypes of Palmyra palm

Genotypes	Age of tree (yrs)	Plant height (m)	No of scars /50cm of trunk length	Trunk girth (cm)
PC1	30	15	12	150
PC2	32	12.2	16	142
PC3	35	15.54	18	160
PC4	40	9.24	20	162
PC5	37	11.1	18	165
PC6	31	12.1	15	180
PC7	36	7.1	15	172
PC8	41	13.08	17	145
PC9	38	16.87	15	152
PC10	32	13.55	13	157
PC11	38	14.2	17	137
PC12	43	20.2	14	149
PC13	40	22.5	13	162
PC14	36	18.25	13	172
PC15	32	18.75	16	177
PC16	43	14	16	167
PC17	41	16.75	19	143
PC18	45	13.45	20	148
PC19	36	18.5	18	145
PC20	32	18.25	17	164
PC21	37	19.75	15	178
PC22	38	14.55	17	173
Mean	**36.95**	**15.22**	**16.09**	**159.09**
Range	**30-45**	**7.10-22.50**	**12-20**	**137-180**
SEm(±)	**2.25**	**0.80**	**0.48**	**2.78**
CV(%)	**7.30**	**24.66**	**14.08**	**8.20**

Table.2 Leaf characteristics of different genotypes of Palmyra palm

Genotypes	No of leaves/tree	No of leaflets/leaf	Leaf length (cm)	Petiole length (cm)	Girth of petiole (cm)
PC1	9	92	140	120	21
PC2	12	97	132	140	25
PC3	34	95	145	118	18
PC4	22	87	123	106	23
PC5	21	89	111	144	25
PC6	24	93	133	109	19
PC7	29	90	127	152	21
PC8	26	89	142	155	21
PC9	35	88	125	145	20
PC10	20	98	134	123	18
PC11	21	85	136	122	25
PC12	25	87	143	124	17
PC13	18	97	126	116	21
PC14	32	92	117	128	23
PC15	22	90	141	132	21
PC16	19	89	133	138	20
PC17	23	86	125	155	19
PC18	18	103	131	145	16
PC19	15	105	140	108	23
PC20	17	82	123	115	22
PC21	23	107	134	125	21
PC22	21	98	135	142	21
Mean	**22.09**	**92.68**	**125.27**	**130.09**	**20.90**
Range	**9-35**	**82-107**	**111-145**	**106-155**	**16-25**
SEm(±)	**1.38**	**1.41**	**3.12**	**3.30**	**2.20**
CV(%)	**29.37**	**7.15**	**11.30**	**11.90**	**8.35**

Table.3 Yield parameters of different genotypes of Palmyra palm

Genotypes	No of bunch/tree	No of fruits/bunch	No of fruits/palm
PC1	9	12	108
PC2	15	16	240
PC3	32	11	352
PC4	9	13	117
PC5	12	9	108
PC6	7	14	98
PC7	7	12	84
PC8	23	11	253
PC9	21	7	147
PC10	24	8	192
PC11	30	16	480
PC12	34	11	374
PC13	11	9	99
PC14	15	15	225
PC15	23	13	299
PC16	17	11	187
PC17	8	12	96
PC18	14	9	126
PC19	30	13	390
PC20	28	13	364
PC21	25	9	225
PC22	18	14	252
Mean	**18.73**	**11.73**	**159.09**
Range	**7-34**	**7-16**	**84 - 480**
SEm(±)	**1.86**	**0.53**	**2.78**
CV(%)	**46.50**	**21.40**	**8.20**

The genotypes with higher number of bunch were PC-3, PC-19, PC-20 and PC-21 having 32, 30, 28 and 25 bunches/tree, respectively. The less number of bunches/tree of 8, 9, 11 bunches were noted in PC-7, PC-9 and PC-17. Variation in number of fruits/bunch was from 7(PC9) to 16 (PC-11). Diversity in yield parameters of palmyra has also been reported by Morton (1988). The next genotype having higher no of fruits/bunch was recorded in PC-14(15), PC-22(14), PC-4, and PC-15 (13).An average crop of *B. flabellifer* in Ceylon had 350 fruits (Kovoor, 1983). Usually a single tree produced anywhere between 50 to 300 fruits in Nellore district of Andhra Pradesh (Bhaskar, 2017).

Thus great variation in tree morphology and yield potential was observed in palmyra in the area surveyed under Bhagalpur district and its adjoining part. A strong data base is needed to be collected for palmyra in orser to exploit this crop at commercial scale.

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