

Phenotypic diversity of date-palm genotypes (*Phoenix dactylifera* L.) collected from Mundra of Kutch region

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Summary

A wide range of variability with regard to fruit and pulp characters and taste was observed in date groves in Kutch region of Gujarat (India), which have been developed naturally from seeds. An exploration was undertaken to identify better genotypes of date palm (*Phoenix dactylifera*) based on their fruit quality and yield-attributing characteristics. A total of 14 fruit samples were collected and data were analysed for fruit characters. Among the different genotypes MDR2 was identified and marked superior with respect to fruiting characteristics like fruit weight (29.86 g), fruit length (53.12 mm) and quality characteristics (TSS 35.17 °B). In India, the coastal strip of the Kutch region contains the only remaining natural date palm groves, which should be utilised and maintained to be used in future genetic improvement programmes.

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Introduction

Date palm, *Phoenix dactylifera* L., having the chromosome number $2n=36$, is a dioecious long-lived monocotyledonous plant belonging to the family Arecaceae. It is one of the oldest cultivated crops, is an excellent crop in arid and semiarid regions of the world to the west coast of India. Date palm is grown for its valuable fruit as well as for fuel, fibre, and as a cover for ground crops. The fruit is nutritionally rich; several products are made that generate employment and thus benefit the socioeconomic status of local people.¹ Moreover, this crop has great potential as a source of renewable energy due to the high carbohydrate content 44-88%, of date palm fruit.² Even though India ranks first in the date palm import, the information on the cultivation of this crop in the coastal belt of Kutch in western India needs to be included. However, there is about 17,658 ha area under palms with an annual production of 165,632 tonnes of fresh fruits.⁵ The Kutch region has the most suitable climate for date palm plantations which enjoys the monopoly of commercial cultivation of this crop in India. But available germplasm in the Kutch region needs more information about its genetic base. The date groves of Kutch are probably about 500 years old and are believed to be developed from the seeds thrown by the army camps and partly from the seeds and offshoot planted by settlers. The settlers used to visit Middle East countries for Hajj or for trade from where they brought a lot of plant material.^{8&9} It is also probable that the Arab gardeners working in the palaces of the former rulers of Kutch might also have contributed to importing date seeds and offshoots from Arab countries. There was also sea trade between Kutch

date fruits and date products. In due course of time, these initial plantations multiplied and developed into groves.⁴

In the Kutch region, there are no traditional orchards of the well-known cultivars of the date palm, and most of the groves have developed or multiplied by seeds, while the farmers identify the palms based on the colour, size, shape and taste of the fruits. Palms are generally grown on the farm boundaries and take a variety of intercrops. The fruits are harvested at khalal stage and consumed as fresh fruits due to climatic compulsion, etc. Hence, on the basis of unique socio-economic considerations, an elite palm should have sweetness at the khalal stage, brightly coloured, preferably red, early maturing, tolerance to rain, high yielding and giving a higher number of offshoots. Thus, the entire region exhibits great variability and diversity in many phenotypic visual traits; colour, size, shape, taste of the fruits and each palm is a separate identity or ecotype distinct from another owing to its origin through seeds. The genotypes raised in Kutch are extremely diverse. Hence, it is necessary to document these genotypes and find the best genotypes growing under Kutch conditions to increase or replace cultivars for a higher and better-quality yield.

Materials and Methods

An exploration was undertaken to identify better genotypes of date palm (*Phoenix dactylifera*) based on their fruit quality and yield-attributing characters in the areas of Mundra, Kutch during the fruiting season (June-July) of 2021. Kutch provides suitable factors like it spread over 45,652 sq. km lies between 22° 5' to 24° 4' N latitude and 68° 9' to 71° 5' E longitude, which is highly suitable for date palm cultivation. Kutch also provides suitable factors like a well-drained, deep, sandy soil type with adequate aeration (12%), a bulk density of 1-1.5 g/cm³, and a water-holding capacity of at least 15%. A total of 14 fruit samples were collected and data were

analysed for fruit characters. The following parameters were determined: fruit weight (using digital balance), fruit length, fruit width, fruit thickness, stone weight, stone length, stone width, stone thickness (using digimatic vernier calliper) and total soluble solids (TSS) value expressed in brix° using hand refractometer from five fruits each of 14 randomly selected palm.

Result and Discussion

The seedling populations are abundantly found in Kutch region of Gujarat showing variability with respect to berry shape, colour, weight, pulp content, fruit size, taste, bunch size and yield potential in date palm. The genotypes showed significant variation in morphological and physico-chemical characteristics of fruits. The various parameters among the studied 14 date palm genotypes showed significant differences in all studied characteristics of fruits. The data presented in Table 1 divulged that, the weight of the fruits varied from 9.18 g to 29.86g and fruit length also ranged from 33.64 mm to 53.12 mm. The genotype MDR2 exhibited the highest fruit weight (29.86g) and fruit length (53.12 mm) while, the MDR8 exhibited the lowest fruit weight and fruit length (9.18 g and 33.64 mm), respectively. Genotype MDR6 produced the highest fruit width (32.26 mm) and fruit thickness (30.68 mm) compared with all other genotypes. The maximum pulp thickness (16.08 mm) was found in MDR4 while, MDR8 produced the minimum

(22.46 mm) pulp thickness. The stone weight was ranged 1.02 to 1.71. The lowest stone weight was exhibited by MDR12 (1.02) whereas highest stone weight was exhibited by MDR14 (1.71). Stone length of various genotypes was ranged from 20.84 (MDR11) to 31.76 mm (MDR14). The maximum value of stone width (13.38mm) was shown by MDR11 whereas; it was observed lowest (8.34) in case of MDR14. The value of stone thickness ranged from 6.88 to 9.12. The highest stone thickness was exhibited by MDR11 (9.12 mm), whereas lowest stone thickness was exhibited by MDR14 (6.88 mm). Total soluble solids, is an important quality parameter for the fruits especially in date palm due to the fact that it is being harvested in khalal (*doka*) stage in Kutch region. The elite palms, which bear good quality, sweet fruits fetches good price in the market. TSS of different genotypes were exhibited between 21.23 to 35.17 and the highest value was found in MDR2 (35.17) and lowest in MDR13 (21.23) (Table 1). Fruit characters vary greatly depending on variety, environmental conditions and technical care given like fertilization, pollination, etc.⁷ These phenotypic characters were utilized for categorizing plants for meeting quality standards and increasing market value. The variation in fruit characteristics in different genotypes is also described by Muralidharan & Baidiyavadara³ and Singh et al.⁶

Table 1. Physio-chemical characteristics of different date palm genotypes collected from Kutch region

Collection	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Fruit thickness (mm)	Pulp thickness (mm)	Stone weight (g)	Stone length (mm)	Stone width (mm)	Stone thickness (mm)	TSS (°B)
MDR1	19.38	44.56	26.90	27.18	13.69	1.48	23.1	9.00	7.32	34.03
MDR2	29.86	53.12	31.12	29.76	14.77	1.58	24.92	10.66	8.22	35.17
MDR3	24.06	48.62	27.82	28.02	13.80	1.52	27.9	13.38	6.94	28.47
MDR4	22.56	40.98	32.34	32.20	16.08	1.22	21.96	9.54	8.12	28.83
MDR5	15.46	43.20	25.98	25.18	10.71	1.50	25.58	10.10	7.58	24.43
MDR6	22.98	40.98	32.26	30.68	14.85	1.11	23.76	8.46	7.82	21.67
MDR7	22.40	47.98	28.58	27.60	12.52	1.33	25.64	9.86	7.18	24.17
MDR8	9.18	33.64	22.74	22.46	10.00	1.07	21.76	8.56	7.24	21.43
MDR9	17.54	46.84	25.50	25.34	11.98	1.25	25.68	9.08	6.98	31.93
MDR10	15.44	41.20	25.42	25.32	12.64	1.40	25.46	8.90	8.30	26.27
MDR11	14.34	38.80	24.24	24.70	10.39	1.63	20.84	10.90	9.12	24.63
MDR12	13.48	42.90	22.34	22.78	11.53	1.02	20.96	8.78	6.98	33.00
MDR13	27.62	49.92	29.38	29.86	13.63	1.39	25.52	10.66	7.84	21.23
MDR14	15.16	47.84	22.60	22.62	11.00	1.71	31.76	8.34	6.88	28.17
SE.m±	0.98	1.09	0.71	0.66	0.77	0.10	1.10	1.06	0.29	0.52
CD at 5%	2.79	3.11	2.01	1.89	2.19	0.27	3.12	N/A	0.83	1.51

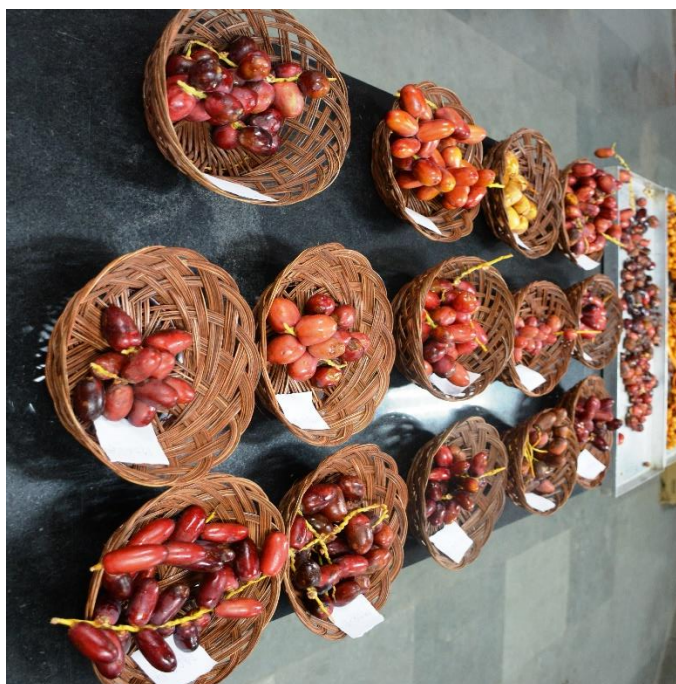


Figure1. Fruit variability in phenotypic characteristics

Conclusion

In India, coastal strip of the Kutch region contains the only remaining natural date palm groves, which should be utilised and maintained to be used in future genetic improvement programmes. The present populations of date palms are mostly grown from seed, offshoots and more recently from tissue culture. Study on qualitative and quantitative characters of date palm trees indicating a great diversity in the fruits. This diversity can be better exploited for selecting superior date palm cultivars for biotic and abiotic stresses and for preserving genetic material. But more systematic and concentrated investigations are required to identify genetic markers for the best cultivar identification and characterization of fruit qualities, such as shape, weight, taste and sweetness.

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Declaration of interests

The authors have no conflict of interest to declare.

Data sharing

All relevant data are within the manuscript.

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