

## International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693  
 ISSN Online: 2617-4707  
 IJABR 2024; 8(7): 1029-1032  
[www.biochemjournal.com](http://www.biochemjournal.com)  
 Received: 25-04-2024  
 Accepted: 28-05-2024

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## Morphological characterization of indigenous custard apple (*Annona squamosa* L.) genotypes at Dharsiwa block of Chhattisgarh

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DOI: <https://doi.org/10.33545/26174693.2024.v8.i7m.1656>

### Abstract

The present investigation to study the morphological characters of indigenous custard apple (*Annona squamosa* L.) genotypes evaluated from Dharsiwa block of Chhattisgarh, was carried out during the year 2022-23 and 2023-24. In this experiment, 60 genotypes of custard apple collected from various locations of Dharsiwa block at Raipur district (Chhattisgarh) were evaluated. The experiment was laid in Randomized Complete Block Design (RCBD) with four replications. The morphological characterization for tree characters, leaf characters and fruit characters were recorded for the observations of growth habit, leaf shape, leaf colour fruit shape and fruit colour. These *in-situ* genotypes under study were found growing in their wild forms in villages and farmer's fields and showed large variation in terms of these characters among them. The investigation was performed for the characterization of custard apple genotypes for morphological characteristics.

**Keywords:** Annona, characterization, genotype, morphological

### Introduction

Custard apple (*Annona squamosa* L.) commonly known as Sitaphal in South India & Sharifa in North India, is one of the major dryland fruit crops of India. It belongs to the family 'Annonaceae', having the chromosome number  $2n = 14$ . Annona fruits are found growing well throughout the plains of India at elevations not exceeding 4,000 ft. The fruit tree normally prefers tropical & sub-tropical climate for its successful cultivation and is believed to be native of Tropical America and its surrounding regions. *Annona* means year's harvest (Lizana and Reginato, 1990) [5] and *squamosa* means scaly referring to the scale like structure of the fruit surface. The fruit tree is widely distributed in Asia, Africa and the America (Nakasone and Paul, 1998) [7]. *Annona reticulata* (bullock's heart), *Annona muricata* (soursop), *Annona cherimola* (cherimoya), and *A. cherimola* x *A. squamosa* (atemoya) are other important species of Annonaceae that bears edible fruit.

It's a small deciduous tree of height 3-6 m tall, the early growth is highly pubescent, and the branches are spreading erratically (Caranga *et al.* 1961) [2]. According to Cabbab and Soliven (1938) [1], it produces fruits after two to four years of planting. When the skin between the segments changes from greenish-yellow to creamy-yellow, the fruit is said to be mature. Over the course of roughly three months, the fruits mature at irregular intervals. This fruit is having a very limited shelf life (2-5 days) and therefore highly perishable, when kept at room temperature. Climacteric behaviour is displayed by it (Prasanna *et al.* 2000) [9]. Fruit set occurs in India with the start of the rainy season (Thakur and Singh 1967) [11]. Similar to most other fruit crops, its root system is relatively shallow, and it thrives in slightly acidic soil that has a pH of 5.5 to 6.5 (Coronel 1983) [3] and able to thrive in moderate salinity (Pinto *et al.* 2005) [8]. Fruit is often consumed fresh and is a good source of proteins, vitamins, and carbohydrates. It is also used as ice cream flavouring. The green fruit and seed are used as astringents for diarrhoea and dysentery and have strong vermifugal and insecticidal qualities. Anonaine, an alkaloid, can be obtained from the unripe fruit, seeds, leaves, and harsh bark (Troup 1975) [12].

The local accessions or genotypes of custard apple is widely found unattended as wild plants in the parts of Madhya Pradesh, Rajasthan, Chhattisgarh, Gujarat, Odisha, Bihar etc. and hence, India has a rich genetic diversity of naturally occurring custard apples.

Custard apples can therefore be greatly improved genetically by choosing prominent genotypes from seedling progenies. With these perspectives in mind, an investigation was conducted with the goal of making efficient use of the genetic resources present in this area, assessing them for their quality attributes, and identifying superior germplasm based on qualitative characteristics from the germplasm found in nature.

### Material and methods

The experimental material consists of 60 genotypes of custard apple that were identified from different locations of the block under study. These genotypes were morphologically characterized for their tree, leaf and fruit parameters, which includes the observations of tree growth habit, leaf shape, leaf colour, fruit shape and fruit colour, as per the DUS guidelines of PPV & FRA descriptor for custard apple.

### Results and Discussions

**Growth Habit:** The genotypes were classified as erect and open type, erect and compact type and spreading type (as per PPV & FRA descriptor) for tree growth habit. Out of 60 genotypes evaluated, 44 genotypes were recorded with Erect and open type (DCA-02, DCA-03, DCA-04, DCA-05, DCA-06, DCA-07, DCA-10, DCA-12, DCA-13, DCA-15, DCA-16, DCA-18, DCA-20, DCA-22, DCA-23, DCA-24, DCA-25, DCA-27, DCA-28, DCA-29, DCA-30, DCA-31, DCA-33, DCA-34, DCA-35, DCA-36, DCA-38, DCA-39, DCA-40, DCA-41, DCA-42, DCA-43, DCA-45, DCA-46, DCA-49, DCA-50, DCA-51, DCA-52, DCA-53, DCA-54, DCA-55, DCA-58, DCA-59, DCA-60) while, remaining 16 genotypes were recorded with Erect and compact type of growth habit (DCA-01, DCA-08, DCA-09, DCA-11, DCA-14, DCA-17, DCA-19, DCA-21, DCA-26, DCA-32, DCA-37, DCA-44, DCA-47, DCA-48, DCA-56, DCA-57) and no genotypes were observed with spreading type of growth habit.

Similar results were found by Nag (2017) [6] observed that 41 genotypes were Erect and open while, 19 genotypes were noted with Erect and compact out of 60 genotypes studied at Bastar plateau of Chhattisgarh. Similar findings were obtained by Singh (2018) [10].

**Leaf Colour:** The genotypes were classified as green, light-green and dark-green colour for leaf colour. Out of 60 genotypes evaluated, 31 genotypes were observed with green colour (DCA-1, DCA-2, DCA-3, DCA-5, DCA-6, DCA-9, DCA-11, DCA-12, DCA-14, DCA-15, DCA-17, DCA-18, DCA-24, DCA-26, DCA-27, DCA-28, DCA-34, DCA-35, DCA-36, DCA-37, DCA-38, DCA-40, DCA-41, DCA-43, DCA-48, DCA-49, DCA-50, DCA-51, DCA-56, DCA-57, DCA-60) whereas, 09 genotypes were observed with light-green colour (DCA-10, DCA-16, DCA-20, DCA-21, DCA-42, DCA-44, DCA-45, DCA-58, DCA-59) and, 20 genotypes were recorded with dark-green colour (DCA-4, DCA-7, DCA-8, DCA-13, DCA-19, DCA-22, DCA-23, DCA-25, DCA-29, DCA-30, DCA-31, DCA-32, DCA-33, DCA-39, DCA-46, DCA-47, DCA-52, DCA-53, DCA-54, DCA-55).

Similar results were found by Nag (2017) [6] in his experiment that 5 genotypes were observed with light-green colour, 19 genotypes were observed with green colour and 6

genotypes were observed with deep-green colour among 30 genotypes evaluated.

**Leaf Shape:** The genotypes were classified as Ovate, Obovate and Elliptic and lanceolate shaped for leaf shape. Out of 60 genotypes evaluated, 32 genotypes were observed with Ovate shape (DCA-1, DCA-3, DCA-5, DCA-7, DCA-8, DCA-10, DCA-16, DCA-17, DCA-19, DCA-21, DCA-22, DCA-23, DCA-24, DCA-27, DCA-29, DCA-31, DCA-34, DCA-36, DCA-38, DCA-39, DCA-40, DCA-41, DCA-44, DCA-45, DCA-46, DCA-47, DCA-50, DCA-51, DCA-52, DCA-55, DCA-57, DCA-60) whereas, 14 genotypes were observed with Obovate shape (DCA-2, DCA-6, DCA-12, DCA-18, DCA-20, DCA-28, DCA-30, DCA-32, DCA-33, DCA-37, DCA-43, DCA-49, DCA-54, DCA-59) the rest 14 genotypes were observed with Elliptic shape (DCA-4, DCA-9, DCA-11, DCA-13, DCA-14, DCA-15, DCA-25, DCA-26, DCA-35, DCA-42, DCA-48, DCA-53, DCA-56, DCA-58) and no genotypes were observed with lanceolate type of leaf shape.

Similar results were found by, Husain (2023) [4] obtained in his experiment where 8 genotypes were ovate, 3 genotypes were obovate, 15 genotypes were elliptic and 4 genotypes were recorded with lanceolate leaf shape, out of 30 genotypes studied.

**Fruit Colour:** The genotypes were classified as green, light-green, dark-green for fruit colour. Out of 60 genotypes evaluated, 33 genotypes were observed with green colour (DCA-1, DCA-4, DCA-5, DCA-8, DCA-9, DCA-11, DCA-13, DCA-16, DCA-18, DCA-19, DCA-20, DCA-23, DCA-26, DCA-27, DCA-29, DCA-32, DCA-33, DCA-39, DCA-40, DCA-42, DCA-44, DCA-46, DCA-47, DCA-49, DCA-51, DCA-52, DCA-53, DCA-54, DCA-55, DCA-57, DCA-58, DCA-59, DCA-60) whereas, 10 genotypes were recorded with light-green colour (DCA-7, DCA-14, DCA-15, DCA-22, DCA-31, DCA-34, DCA-35, DCA-36, DCA-38, DCA-43) and the rest 17 genotypes were recorded with dark-green colour (DCA-2, DCA-3, DCA-6, DCA-10, DCA-12, DCA-17, DCA-21, DCA-24, DCA-25, DCA-28, DCA-30, DCA-37, DCA-41, DCA-45, DCA-48, DCA-50, DCA-56).

Similar results were found by, Husain (2023) [4] obtained in his experiment where 22 genotypes were green, 4 genotypes were light-green, and 4 genotypes were recorded with dark-green colour, out of 30 genotypes studied.

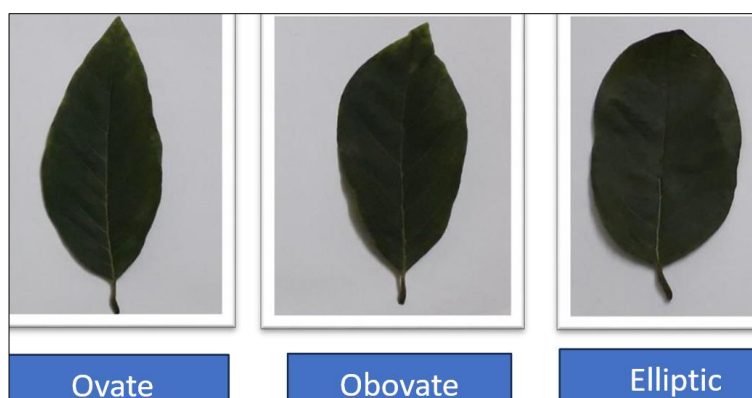
**Fruit shape:** The genotypes were classified as cordate, round and broadly cordate for fruit shape. Out of 60 genotypes evaluated, 27 genotypes were observed to be Cordate (DCA-1, DCA-4, DCA-6, DCA-9, DCA-11, DCA-14, DCA-18, DCA-20, DCA-23, DCA-26, DCA-28, DCA-29, DCA-31, DCA-32, DCA-36, DCA-39, DCA-40, DCA-41, DCA-43, DCA-44, DCA-49, DCA-51, DCA-54, DCA-55, DCA-56, DCA-59, DCA-60) whereas, 31 genotypes were Round (DCA-2, DCA-3, DCA-5, DCA-7, DCA-8, DCA-10, DCA-12, DCA-15, DCA-16, DCA-17, DCA-19, DCA-21, DCA-22, DCA-24, DCA-25, DCA-27, DCA-33, DCA-34, DCA-35, DCA-37, DCA-38, DCA-42, DCA-45, DCA-46, DCA-47, DCA-48, DCA-50, DCA-52, DCA-53, DCA-57, DCA-58) and the rest 2 genotypes were noted to be Broadly cordate (DCA-13 and DCA-30).

Similar results were found by, Husain (2023) <sup>[4]</sup> obtained in his experiment where 19 genotypes were round, 6 genotypes were observed cordate and 5

genotypes were noted with broadly cordate fruit shape out of 30 genotypes studied.



**Fig 1:** Fruit shape variation among some of custard apple genotypes at Dharsiwa block of Chhattisgarh



**Fig 2:** Leaf shape variation among some of custard apple genotypes at Dharsiwa block of Chhattisgarh

**Table 1:** Morphological characterization of Custard apple genotypes at Dharsiwa block of Chhattisgarh

S. N.	Genotypes	Growth Habit	Leaf Colour	Leaf Shape	Fruit Colour	Fruit Shape
1.	DCA-01	Upright and compact	Green	Ovate	Green	Cordate
2.	DCA-02	Upright and open	Green	Obovate	Dark green	Round
3.	DCA-03	Upright and open	Green	Ovate	Dark green	Round
4.	DCA-04	Upright and open	Dark Green	Elliptic	Green	Cordate
5.	DCA-05	Upright and open	Green	Ovate	Green	Round
6.	DCA-06	Upright and open	Green	Obovate	Dark green	Cordate
7.	DCA-07	Upright and open	Dark Green	Ovate	Light green	Round
8.	DCA-08	Upright and compact	Dark Green	Ovate	Green	Round
9.	DCA-09	Upright and compact	Green	Elliptic	Green	Cordate
10.	DCA-10	Upright and open	Light Green	Ovate	Dark green	Round
11.	DCA-11	Upright and compact	Green	Elliptic	Green	Cordate
12.	DCA-12	Upright and open	Green	Obovate	Dark green	Round
13.	DCA-13	Upright and open	Dark Green	Elliptic	Green	Broadly Cordate
14.	DCA-14	Upright and compact	Green	Elliptic	Light green	Cordate
15.	DCA-15	Upright and open	Green	Elliptic	Light green	Round
16.	DCA-16	Upright and open	Light Green	Ovate	Green	Round
17.	DCA-17	Upright and compact	Green	Ovate	Dark green	Round
18.	DCA-18	Upright and open	Green	Obovate	Green	Cordate
19.	DCA-19	Upright and compact	Dark Green	Ovate	Green	Round
20.	DCA-20	Upright and open	Light Green	Obovate	Green	Cordate
21.	DCA-21	Upright and compact	Light Green	Ovate	Dark green	Round
22.	DCA-22	Upright and open	Dark Green	Ovate	Light green	Round
23.	DCA-23	Upright and open	Dark Green	Ovate	Green	Cordate
24.	DCA-24	Upright and open	Green	Ovate	Dark green	Round
25.	DCA-25	Upright and open	Dark Green	Elliptic	Dark green	Round
26.	DCA-26	Upright and compact	Green	Elliptic	Green	Cordate
27.	DCA-27	Upright and open	Green	Ovate	Green	Round
28.	DCA-28	Upright and open	Green	Obovate	Dark green	Cordate
29.	DCA-29	Upright and open	Dark Green	Ovate	Green	Cordate
30.	DCA-30	Upright and open	Dark Green	Obovate	Dark green	Broadly Cordate
31.	DCA-31	Upright and open	Dark Green	Ovate	Light green	Cordate
32.	DCA-32	Upright and compact	Dark Green	Obovate	Green	Cordate

33.	DCA-33	Upright and open	Dark Green	Obovate	Green	Round
34.	DCA-34	Upright and open	Green	Ovate	Light green	Round
35.	DCA-35	Upright and open	Green	Elliptic	Light green	Round
36.	DCA-36	Upright and open	Green	Ovate	Light green	Cordate
37.	DCA-37	Upright and compact	Green	Obovate	Dark green	Round
38.	DCA-38	Upright and open	Green	Ovate	Light green	Round
39.	DCA-39	Upright and open	Dark Green	Ovate	Green	Cordate
40.	DCA-40	Upright and open	Green	Ovate	Green	Cordate
41.	DCA-41	Upright and open	Green	Ovate	Dark green	Cordate
42.	DCA-42	Upright and open	Light Green	Elliptic	Green	Round
43.	DCA-43	Upright and open	Green	Obovate	Light green	Cordate
44.	DCA-44	Upright and compact	Light Green	Ovate	Green	Cordate
45.	DCA-45	Upright and open	Light Green	Ovate	Dark green	Round
46.	DCA-46	Upright and open	Dark Green	Ovate	Green	Round
47.	DCA-47	Upright and Compact	Dark Green	Ovate	Green	Round
48.	DCA-48	Upright and compact	Green	Elliptic	Dark green	Round
49.	DCA-49	Upright and open	Green	Obovate	Green	Cordate
50.	DCA-50	Upright and open	Green	Ovate	Dark green	Round
51.	DCA-51	Upright and open	Green	Ovate	Green	Cordate
52.	DCA-52	Upright and open	Dark Green	Ovate	Green	Round
53.	DCA-53	Upright and open	Dark Green	Elliptic	Green	Round
54.	DCA-54	Upright and open	Dark Green	Obovate	Green	Cordate
55.	DCA-55	Upright and open	Dark Green	Ovate	Green	Cordate
56.	DCA-56	Upright and compact	Green	Elliptic	Dark green	Cordate
57.	DCA-57	Upright and compact	Green	Ovate	Green	Round
58.	DCA-58	Upright and open	Light Green	Elliptic	Green	Round
59.	DCA-59	Upright and open	Light Green	Obovate	Green	Cordate
60.	DCA-60	Upright and open	Green	Ovate	Green	Cordate

### Conclusion

The present investigation on morphological characterization reveals that there is a large variation in the custard apple genotypes observed from ten different villages at Dharsiwa block of Chhattisgarh in terms of growth habit, fruit shape, fruit colour, leaf shape and leaf colour. These variations in the morphological characteristics are attributed to a combination of factors, including soil conditions, management strategies (especially pruning and nutrient management), and also influenced by the climatic conditions of these respective villages. The fact that all of the plants used for the study were seedlings may be one of the causes of the diversity in the morphological traits of the custard apple fruits.

### Acknowledgement

The author takes the privilege to express his deep sense of gratitude and indebtedness to his Major Advisor Dr. G.D. Sahu, Associate Professor (Department of Fruit Science) for constant support during the conduct of research as well as Dr. Prabhakar Singh, Professor and Head (Department of Fruit Science) and Dr. S.K Verma, Assistant Professor (Department of Plant Biology and Biotechnology) for providing all possible facilities to carry out the research work. Also, the constant help of Dr. R.R. Saxena, Professor (Department of Agricultural Statistics) is truly commendable and the institutional support from Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) is acknowledged with gratitude.

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