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## Bio-diversity of custard apple genotypes in bastar District of Chhattisgarh

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### Abstract

Custard apple is one of the most favorite's dry land of Chhattisgarh fruit crop, because it is hardy in nature and drought tolerant. The lack of acceptable and improved cultivars is a significant barrier to increasing area productivity. On the basis of observation 2022-23, the highest tree height BCA-5 (7.20 m) and lowest tree height Madhur (check) (3.40 m), trunk girth (cm) maximum (60.10 cm) and minimum trunk girth Madhur (check) (31.5 cm), canopy-spread (m) "North-South Spread" BCA-14 had the minimum plant spread (3.0 m) and maximum BCA-15 (4.7 m) and "East-West Spread" BCA-8 showed the maximum canopy spread (5.0 m) where as the minimum canopy spread BCA-2 and BCA-3 showed similar result (3.40 m), data regarding of showed maximum number of fruit per tree Madhur (check) (88), minimum number of fruits per plant found in the genotype BCA-3 (46), the highest yield (kg/plant) was reported in the genotype Madhur (check) (24.37 kg/plant) followed by BCA-8 (22.27 kg/plant), BCA-4 (18.96 kg/plant), BCA-7 (18.62 kg/plant) and BCA-5 (18.17 kg/plant) whereas, lowest yield (kg/plant) was found in the genotype BCA-2 (8.56 kg/plant), maximum length of leaf was recorded in genotype BCA-3 (13.6 cm), the minimum length of leaf was recorded in genotype Madhur (check Cv.) (11.20 cm), maximum breadth of leaf was recorded in genotype BCA-15 (5.6 cm), whereas the minimum breadth of leaf was recorded in genotype BCA-2 (3.5 cm), maximum fruit length was recorded in genotype Madhur (check) (8.90 cm per fruit), whereas minimum fruit length was recorded in BCA-1 (4.30 cm/fruit), maximum breadth of fruit observed in Madhur (check) (8.46 cm/fruit), whereas minimum breadth of fruit was recorded in BCA-2 (4.67 cm/fruit).

Among 16 custard apple genotypes collected from Bastar District, were Madhur (check) is a cultivated variety and its production is more, but BCA-8, BCA-7, BCA-5 and BCA-4 are natural genotypes of custard apple but their production competes with Madhur (check) and we can increase production by adopting modified agronomical and horticultural practices.

BCA-8, BCA-7, BCA-5 and BCA-4 are the four superior custard apple genotypes, which we can use for future breeding program to created new varieties.

**Keywords:** Custard apple, genotypes, growth, yield and variability

### 1. Introduction

Custard apple is one of the most delicious tropical and sub-tropical fruit crop, a member of the Annonaceae family are mainly grown in Asia, Africa, and the Americas (Nakasone, 1998) [16]. In India the custard apple is also known as sugar apple, sitaphal, sweet sop and Sharifa (Ghawade *et al.*, 2018) [18].

The area and production of custard apple in India is about 48.26 thousand hectares and 411.22 metric tones, respectively. In India, Maharashtra is the leading producer state of custard apple, followed by Madhya Pradesh, Gujarat, Chhattisgarh, Telangana, Karnataka, Andhra Pradesh, Rajasthan, Kerala and Tamil Nadu (Anonymous, 2021-22) [11]. The Chhattisgarh state of India is also leading producer of custard apple with the area about 9.59 thousand hectares and production 53.45 metric tonnes (Anonymous, 2022) [12].

Custard apple is an excellent source of minerals, energy, protein, fiber and little fat. These fruit are becoming a growing trend with consumers, as well as being highly profitable for farmers.

This natural Bio-diversity available within the species is often exploited to identify superior custard apple genotype in Chhattisgarh Plateau has availability of lines of custard apple and exists in the form of land races, hence there exists to a lot of opportunities to identify best one custard apple genotypes amongst wild strains available in absolutely. Now day no systematic study of custard apple cultivars or genotypes has been carried out in Chhattisgarh Plateau. The selection, characterization and assessment of highly-yielding custard apple genotypes that might be successfully farmed on a commercial basis in Chhattisgarh are thus urgently required.

## 2. Materials and Methods

Growth and yield characters observations of *in-situ* custard apple genotypes plants were recorded in the selected locations of the Bastar District of Chhattisgarh. Where the plants were found in the homestead garden of the people at two block Tokapal and Lohandiguda for present investigation selected 16 custard apple genotypes BCA-1, BCA-2, BCA-3, BCA-4, BCA-5, BCA-6, BCA-7, BCA-8, BCA-9, BCA-10, BCA-11, BCA-12, BCA-13, BCA-14, BCA-15 and Madhur (check). Growth and yield parameters of *in-situ* custard apple genotypes, tree height, trunk girth, canopy spread (m), using a measuring tape, leaf length, breadth of leaf, length of fruit (cm per fruit) and breadth of fruit (cm per fruit) using a measuring tape, number of fruit per plant fruits were harvested after full maturity from each tree and the total number was recorded and fruit yield per plant (kg) are measured in kg use in electrical balance machine.

## 3. Results and Discussion

The observations were recorded on five samples for each custard apple genotype in three replications growth and yield, physical parameters of *in-situ* custard apple genotypes traits were evaluated on the basis of their mean performance presented in table 1 and 2 respectively.

### 3.1 Tree height (m)

The data on the custard apple tree's height (m) that ranges between genotypes is reported in table 1 the height of the tree, measured in metres ranged from 3.40 to 7.20, with a mean of 5.27. The analysis of the data showed that BCA-5 had the tallest tree (7.20 m), whereas Madhur (check) had the lowest tree height (3.40 m). The significant variation in plant height across genotypes may be caused by how effectively each genotype grows under certain climatic and edaphic environments. Since different germplasm exhibit genetic heterogeneity in various geographical areas, the genotype BCA-5 displayed strong development that led to the greatest plant height. Similar outcomes were attained by Rao and Subramanyam (2010) [19], Pandey *et al.* (2016) [17] and Chandel (2017) [6] in custard apple.

### 3.2 Trunk girth (cm)

The data presented in table 1 showed trunk girth variation among different genotypes. The minimum trunk girth (31.5 cm) was recorded in Madhur (check), whereas the maximum trunk girth (60.1 cm) was recorded in BCA-7 followed by BCA-5 (55.5 cm) and BCA-12 (55.3 cm), respectively. Maximum trunk girth in genotypes BCA-7 and BCA-5 might be due to higher tree height. Variation in trunk girth in different genotypes is a genetic character of each genotype similar results were also reported by Rao and Subramanyam (2010) [19], Chandel (2017) [6] and Tanaji (2018) [22] in custard apple.

### 3.3 Canopy spread (m) North-South Spread and East-West Spread

Table 1 reveals that the North-South spread range from 3.0 to 4.7 metres, BCA-14 show the minimum plant spread in the North-South canopy direction (3.0 m), whereas genotype BCA-15 had the most plant spread (4.7 m). The population means East-West spread (Table 1) ranged from 3.4 to 5.0 m. The genotype BCA-8 showed the maximum East-West canopy spread (5.0 m), whereas the custard apple genotypes BCA-2 and BCA-14 the (3.4 m) canopy spread showed the

minimum canopy spread. A more desirable quality that increases fruit production is higher plant spread. Such a variance in canopy spread may result from different genetic properties of germplasm found in different agro-climatic areas. These results are in agreement with the findings of Mathakar (2005) [13], Nag (2017) [14] and Chandel (2017) [6] in custard apple.

### 3.4 Number of fruits per tree

Number of fruits per plant data regarding number of fruits per tree given in table 2 showed the variation in total number of fruits per plant in different custard apple genotypes. The higher number of fruits per plant was observed in the genotype Madhur (check) (88) at par by BCA-8 (87), BCA-4 (81), BCA-7 (79), whereas lower number of fruits per plant found in the genotype BCA-3 (46).

The variation in number of fruits per tree might be due to genetic diversity amongst number of shoot, shoot length and number of flowers per shoot of different genotypes as well as due to climatic conditions, as also reported by Jadhav (2008) [11], Nag (2017) [14], Chandel (2017) [6] and Idate *et al.* (2019) [10] in custard apple.

### 3.5 Fruit yield per plant (kg)

Data related to fruit yield presented in table 2 showed significant variation in fruit yield among different custard apple genotypes. The highest yield per plant was reported in the genotype Madhur (check) (24.37 kg/plant) followed by BCA-8 (22.27 kg/plant), BCA-4 (18.96 kg/plant), BCA-7 (18.62 kg/plant) and BCA-5 (18.17 kg/plant) whereas, lowest yield per plant was found in the genotype BCA-2 (8.56 kg/plant).

The significant variation in yield per tree might be due to number of fruits retained per shoot, fruit retention percentage and average fruit weight. The finding implies that the selection for more number of fruits will automatically lead to higher yield as also reported by Shete *et al.* (1991) [21], Selvarajan *et al.* (2008) [20], Dikshit *et al.* (2008) [7], Nag (2017) [14], Chandel (2017) [6] and Idate *et al.* (2019) [10] in custard apple.

### 3.6 Length of leaf (cm)

The length of leaf (cm) table 2 show maximum length of leaf was recorded in genotype BCA-3 (13.6 cm) at par BCA-15 (13.5 cm), BCA-8 (13.3 cm), BCA-10 (13.1 cm), BCA-9, BCA-14 show (13.0 cm) whereas the minimum length of leaf was recorded in genotype Madhur (Check) (11.20 cm). Maximum length of leaf is an important character for obtaining optimum yield as higher length of leaf provides more leaf area and contributed in increased photosynthetic efficiency, which might be influenced the growth and yield of the plant to a greater extent. Similar results were also obtained by Mathakar (2005) [13], Jadhav (2008) [11], Nag (2017) [14] and Chandel (2017) [6] in custard apple, which validated the present findings.

### 3.7 Breadth of leaf (cm)

The maximum breadth of leaf was (table 2) recorded in genotype BCA-15 (5.6 cm) at par BCA-4 and BCA-7 (5.1 cm) show similar result, BCA-8 (5.0 cm), BCA-6 and BCA-12 (4.9 cm) show similar result whereas the minimum breadth of leaf was recorded in genotype BCA-2 (3.5 cm). Similar to maximum leaf length and higher leaf breadth is also an important character for obtaining optimum yield as maximum

breadth of leaf provides more space for photosynthetic produced during photosynthesis, which transfer to the growing plant parts and increased the yield of the plant to a greater extent. The present findings are reported by, Mathakar (2005)<sup>[13]</sup> and Jadhav (2008)<sup>[11]</sup> in custard apple.

### 3.8 Length of fruit (cm per fruit)

The observation regarding fruit length in different genotypes of custard apple (Table 2) indicated that the fruit length ranged from 4.30 to 8.90 cm and maximum fruit length was recorded in genotype Madhur (check) (8.90 cm), followed by BCA-10 (7.57 cm) and BCA-9 (7.34 cm), whereas minimum fruit length was recorded in BCA-1 (4.30 cm), respectively. The quantity of fruits on the tree, the production of the best photosynthates, the soil's moisture level, and the soil's fertility all had an impact on the difference in fruit size. These elements might be important in the production of fruit that is the ideal size and the maintenance of its quality. Similar result was also reported by Beerh *et al.* (1983)<sup>[5]</sup> for Balanagar and

Red Sitaphal, Mathakar (2005)<sup>[13]</sup>, Bakane *et al.* (2015)<sup>[4]</sup>, Nag (2017)<sup>[14]</sup>, Tanaji (2018)<sup>[22]</sup> and Poyam *et al.* (2022)<sup>[18]</sup> in custard apple.

### 3.9. Breadth of fruit (cm per fruit)

Table 2 presents the information on fruit width for the various genotypes of custard apple. The fruit width ranged from 4.67 cm to 8.46 cm minimum and maximum breadth of fruit observed in Madhur (check) (8.46 cm) which was at par with BCA-7 (8.16 cm), BCA-10 (8.14 cm), BCA-5 and BCA-6 (7.33 cm), whereas minimum breadth of fruit was recorded in BCA-2 (4.67 cm), respectively

The fruit's size and quality were regulated by the climatic and edaphic-conditions. The greatest collection of seeds in the fruit's horizontal plain may also be the cause of the largest fruit these findings are in agreement with the work of Mathakar (2005)<sup>[13]</sup>, Bakane *et al.* (2015)<sup>[4]</sup>, Nag *et al.* (2018)<sup>[15]</sup> and Handique *et al.* (2022)<sup>[9]</sup> in custard apple.

**Table 1:** Growth and yield parameters of *in-situ* custard apple genotypes Tree height (m) Trunk girth (cm), Canopy spread E-W (m) Canopy spread N-S (m)

Treatments	Genotypes	Tree height (m)	Trunk girth (cm)	Canopy spread	
				E-W (m)	N-S (m)
T <sub>1</sub>	BCA-1	5.23	54.5	4.7	4.5
T <sub>2</sub>	BCA-2	3.70	52.4	3.4	3.1
T <sub>3</sub>	BCA-3	4.50	45.0	3.9	3.2
T <sub>4</sub>	BCA-4	5.10	35.6	3.8	3.5
T <sub>5</sub>	BCA-5	7.20	55.4	4.8	3.9
T <sub>6</sub>	BCA-6	6.00	34.6	4.1	3.8
T <sub>7</sub>	BCA-7	4.80	60.1	3.9	4.0
T <sub>8</sub>	BCA-8	6.40	43.3	5.0	4.2
T <sub>9</sub>	BCA-9	5.70	46.1	4.7	4.0
T <sub>10</sub>	BCA-10	6.70	32.4	4.1	3.7
T <sub>11</sub>	BCA-11	5.30	30.2	3.9	4.2
T <sub>12</sub>	BCA-12	4.60	55.3	4.2	4.0
T <sub>13</sub>	BCA-13	5.10	43.6	4.0	3.4
T <sub>14</sub>	BCA-14	4.50	27.3	3.4	3.0
T <sub>15</sub>	BCA-15	6.10	38.3	4.9	4.7
T <sub>16</sub>	Madhur (Check)	3.40	31.5	3.7	3.5
	Range	3.40-7.20	27.3-60.1	3.4-5.0	3.0-4.7
	Mean	5.27	42.85	4.1	3.7

**Table 2:** Growth and yield parameters of *in-situ* custard apple genotypes, Number of fruit per fruit, Fruit yield per plant (kg), Leaf length (cm), Breadth of leaves (cm), Length of fruit (cm / fruit) and Breadth of fruit (cm / fruit)

Treatments	Genotypes	Number of fruits per plant	Fruit yield per plant (kg)	Leaf length (cm)	Breadth of leaves (cm)	Length of fruit (cm/ fruit)	Breadth of fruit (cm/ fruit)
T <sub>1</sub>	BCA-1	63	8.56	12.4	4.1	4.30	5.67
T <sub>2</sub>	BCA-2	69	13.33	12.2	3.5	5.03	4.67
T <sub>3</sub>	BCA-3	46	10.11	13.6	4.1	5.67	5.33
T <sub>4</sub>	BCA-4	81	18.96	11.8	5.1	6.37	6.35
T <sub>5</sub>	BCA-5	71	18.17	11.4	4.7	7.34	7.73
T <sub>6</sub>	BCA-6	67	15.51	11.5	4.9	7.05	7.73
T <sub>7</sub>	BCA-7	79	18.62	11.3	5.1	6.87	8.16
T <sub>8</sub>	BCA-8	87	22.27	13.3	5.0	6.44	6.39
T <sub>9</sub>	BCA-9	61	13.19	13.0	4.8	7.17	7.51
T <sub>10</sub>	BCA-10	52	12.23	13.1	3.9	7.57	8.14
T <sub>11</sub>	BCA-11	69	13.31	11.5	4.2	6.61	6.98
T <sub>12</sub>	BCA-12	53	10.00	12.3	4.9	6.35	6.06
T <sub>13</sub>	BCA-13	75	13.52	11.2	3.9	6.09	6.29
T <sub>14</sub>	BCA-14	56	12.08	13.0	4.0	6.88	6.94
T <sub>15</sub>	BCA-15	76	10.53	13.5	5.6	5.34	5.56
T <sub>16</sub>	Madhur (Check)	88	24.37	11.2	4.0	8.90	8.46
	S.E.M±	3.90	1.23	0.574	0.307	0.276	0.328
	CD at 5%	11.32	3.56	1.665	0.89	0.8	0.952
	CV (%)	9.89	14.46	8.174	11.834	7.345	8.417

#### 4. Conclusions

On the basis of present investigated, it can be concluded show the all custard apple genotypes wide variation within genotypes. BCA-8, BCA-5, BCA-7 followed by BCA-4 were superior among all the custard apple genotypes therefore genotypes may be exploited for future breeding programme.

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