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Diversity in Fruit Morphology and Qualitative Features among Some Caesalpinioideae Species from Chandrapur District, Maharashtra.

Khirade P. D.* and Dudhe S. S.

Department of Botany, Guru Nanak College of Science Ballarpur Dist. Chandrapur.

* Email: pramodkhirade@gmail.com

ABSTRACT

This study aimed to examine the diversity of qualitative fruit traits in selected species of Caesalpinioideae from the Chandrapur district of Maharashtra, India. Fruit from 11 different species of the Caesalpinioideae subfamily were used for this investigation. The qualitative traits assessed included fruit shape, colour, exocarp hairiness, surface texture, apex and base features, shattering tendency, seed count per fruit, number of locules, and fruit orientation. The results showed that these characteristics varied significantly among the species under study. The research offers important contributions to understanding fruit morphology and taxonomy, which can aid in plant diversity assessments.

Keywords: Caesalpinioideae, fruit, qualitative characteristics, morphology.

Introduction

The Caesalpinioideae is predominantly composed of tropical and subtropical trees and shrubs, with an estimated 180 genera and 3,000 species. In India, approximately 23 genera and 85 species belong to this family (Rahman and Barman, 2017). The Caesalpinioideae is characterized by the presence of fruit type, a legume or indehiscent drupaceous and samaroid. Plants from the Caesalpinioideae family are economically valuable. They are valued for their medicinal properties or ornamental applications. Many species of the family are also used as sources of food and beverage, industrial, chutney, fodder, timber, fibre, fuel, etc. Plant Morphology explains the external structure and physical form of plants. It has always had an important role in the natural sciences.

Plant Morphology is very useful in the identification of plants visually, plant systematics and biodiversity. The study of the morphological diversity of living organisms is important for understanding the patterns and processes of the living world. Diversity in the phenotypes is the result of evolution. For an organism, phenotype plays a crucial role in the interaction between the surrounding environment and each other (Wagner, 2001a). Morphological differences in the fruit may add taxonomically valuable information. A literature review reveals that there is limited information available on the fruit morphology of most species within the Caesalpinioideae, particularly those native to India.

The present investigation was carried out in Chandrapur district, which is the easternmost district in Maharashtra, located between 18-4 to 20-5 (19.57') North Latitude and 78-5 to 80-6 (79.18') East Longitude, at an altitude of 189 meters. Covering an area of 26,128.7 km² (10,088.3 sq. miles), it accounts for 8.53% of Maharashtra's total area. The district is abundant in forest resources and is often referred to as the 'District of Forests.'

Chandrapur, as a biodiversity-rich area, growing Caesalpinioideae members can form the basis of fruit qualitative morphological investigation. Thus, this study seeks to record morphologically significant traits in the examined species, providing useful data for taxonomic and phylogenetic research on this group.

Materials and Methods

During the study, various localities and villages within the Chandrapur district of Maharashtra were explored to gather fruits. For the present investigation, fruit samples of the 11 plant species (Table No. 1) viz. *Caesalpinia bonduc* (Linn.) Roxb., *Ceasalpenia pulcherrima* (L.) Sw., *Cassia auriculata* Linn., *Cassia fistula* Linn., *Cassia occidentalis* Linn., *Cassia siamea* Lamk., *Cassia tora* Linn., *Cassia uniflora* Mill., *Parkinsonia aculeata* Linn., *Peltophorum pterocarpum* Baker. and *Senna alata* (L.) Roxb. belonging to the Caesalpinioideae were utilized. Morphological observations of fruit for the selected taxa were carried out and analyzed using distinctive qualitative characteristics. The qualitative characteristics of the fruit analyzed include shape, colour, exocarp hairiness, surface, apex, base, shattering, seeds/fruit, locules/fruit and fruit orientation.

Table 1: List of sampling sites of examined taxa.				
Sr. No.	Plant Species	Collection site	Latitude	Longitude
1	<i>Caesalpinia bonduc</i> (Linn.) Roxb.	Sasti, Chandrapur	19.814647°	79.334058°
2	<i>Ceasalpenia pulcherrima</i> (L.) Sw.	Mathara, Gadchandur Road	19.77085°	79.338591°
3	<i>Cassia auriculata</i> Linn.	Kothari, Chandrapur	19.790551°	79.486891°
4	<i>Cassia fistula</i> Linn.	Bhivkund, Chandrapur	19.88435°	79.346067°
5	<i>Cassia occidentalis</i> Linn.	Sasti, Chandrapur	19.805576°	79.341042°
6	<i>Cassia siamea</i> Lamk.	G. N. College, Ballarpur	19.840143°	79.368669°
7	<i>Cassia tora</i> Linn.	Ghot-Nimbala, Chandrapur	20.091494°	79.157173°
8	<i>Cassia uniflora</i> Mill.	Ballarpur, Chandrapur	19.831223°	79.377705°
9	<i>Parkinsonia aculeata</i> Linn.	Ballarpur, Chandrapur	19.83668°	79.337699°
10	<i>Peltophorum pterocarpum</i> Baker.	Sasti, Chandrapur	19.805576°	79.341042°
11	<i>Senna alata</i> (L.) Roxb.	Ballarpur, Chandrapur	19.825607°	79.378566°

Results and Discussion

Morphological qualitative characteristics of the fruits analyzed (Table-2) include shape, colour, exocarp hairiness, surface, apex, base, shattering, seeds/fruit, locules/fruit and fruit orientation. Fruits of examined species exhibit considerable variations among these characteristics.

a) Diversity in the fruit shape:

Four different types of fruit shapes were recorded among examined species viz. elliptic-terete, linear-flat, linear-terete and linear-quadrangular (Fig.1). Linear-flat types of fruit-shaped were found in *C. pulcherrima*, *C. occidentalis*, *C. siamea* and *P. pterocarpum*. In *C. auriculata*, *C. fistula*, *C. tora*, *C. uniflora* and *P. aculeata* linear-terete shaped fruits were observed. Elliptic-terete and linear-quadrangular fruit shapes were recorded in *C. bonduc* and *S. alata* respectively.

b) Diversity in the fruit colour:

In the studied species (Fig.2) dark brown coloured fruits were recorded in *C. bonduc*, *C. fistula*, *P. pterocarpum* and *S. alata*. *C. pulcherrima*, *C. auriculata* and *C. siamea* were found to have brown-coloured fruit. The fruits of *C. occidentalis*, *C. tora* and *C. uniflora* were light brown coloured. *P. aculeata* was observed with creamer coloured fruit.

c) Diversity in the fruit exocarp hairiness:

Most of the examined species (Fig.3) were found to have glabrous fruits including *C. pulcherrima*, *C. auriculata*, *C. fistula*, *C. occidentalis*, *C. siamea*, *C. tora*, *P. aculeata*, *P. pterocarpum* and *C. alata*. Scabrous and hispid fruits were seen in *C. uniflora* and *C. bonduc* respectively.

d) Diversity in the fruit surface:

C. pulcherrima, *C. auriculata*, *C. occidentalis*, *C. siamea*, *C. tora*, *C. uniflora*, *P. aculeata*, *P. pterocarpum* and *S. alata* were found to have ribbed fruits, while *C. bonduc* and *C. fistula* had non-ribbed fruits (Fig.4).

e) Diversity in the fruit apex:

Among the species examined acute, cuspidate, straight beak, curved-beak and caudate fruit apex were observed (Fig.5). Fruits with acute apex include *C. pulcherrima*, *C. tora*, *P. aculeata* and *P. pterocarpum*. Fruits with Cuspidate apex were *C. auriculata*, *C. occidentalis* and *C. uniflora*. The fruit apex in *C. bonduc* and *C. siamea* were recorded as straight beak. Curved-beak and caudate fruit apex were noted in *S. alata* *C. fistula* respectively.

f) Diversity in the fruit base:

All investigated species were found to possess cuneate fruit base except *C. bonduc*. In *C. bonduc* obtuse base was observed (Fig.6).

g) Diversity in the fruit shattering:

Among examined species, fruit shattering was present in *C. bonduc*, *C. pulcherrima*, *C. occidentalis*, *C. siamea*, *C. tora* and *S. alata*. Fruit shattering was absent in *C. auriculata*, *C. fistula*, *C. uniflora*, *P. aculeata* and *P. pterocarpum* (Fig.7).

h) Diversity in the fruit seeds/fruit:

In examined species, the highest no of seeds per fruit was found *C. fistula* (30-80) while the lowest no of seeds per fruit was found in *C. bonduc* having 1-2 seeds per fruit.

i) Diversity in the fruit locules/fruit:

Among the studied species, the highest no of locules per fruit was found *C. fistula* (35-85) while the lowest no of locules per fruit was found in *C. bonduc* having 1-2 seeds per fruit.

j) Diversity in the fruit orientation

C. bonduc, *C. occidentalis*, *C. uniflora*, *P. pterocarpum* and *S. alata*. were recorded with erect fruit orientation while Pendent fruit orientation was recorded in *C. pulcherrima*, *C. auriculata*, *C. fistula*, *C. siamea*, *C. tora* and *P. aculeata* (Fig.8).

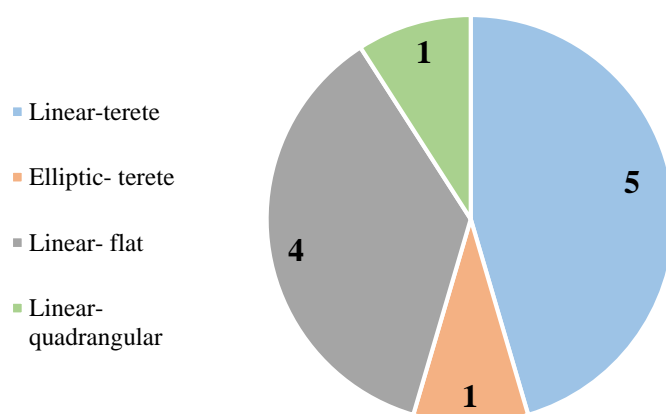


Fig.1: Diversity in fruit shape of Caesalpinioideae studied species.

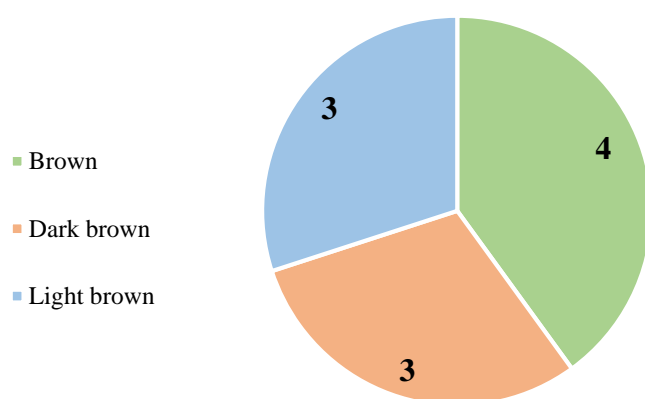


Fig.2: Diversity in fruit colour of Caesalpinioideae studied species.

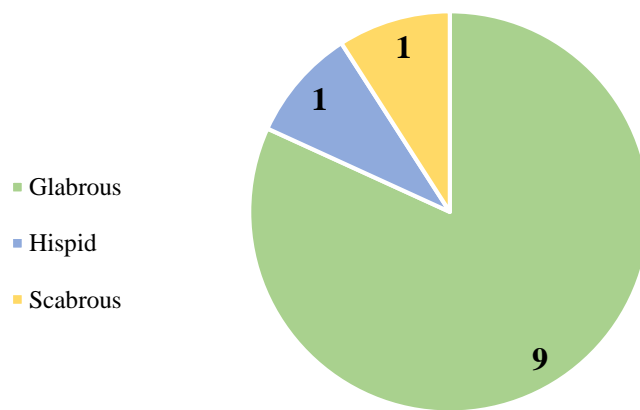


Fig.3: Diversity in fruit exocarp hairiness of Caesalpinioideae studied species.

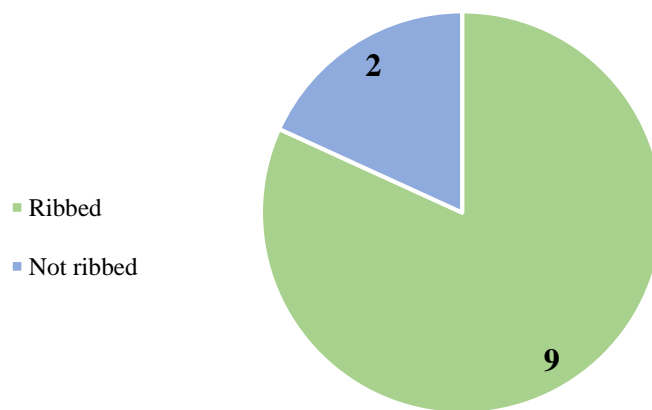


Fig.4: Diversity in fruit surface of Caesalpinioideae studied species.

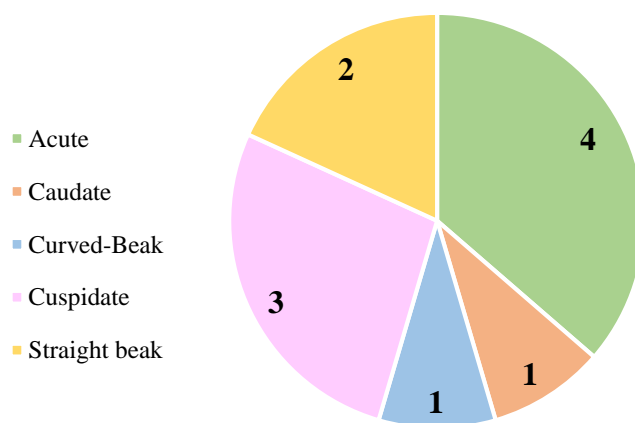


Fig.5: Diversity in fruit apex of Caesalpinioideae studied species.

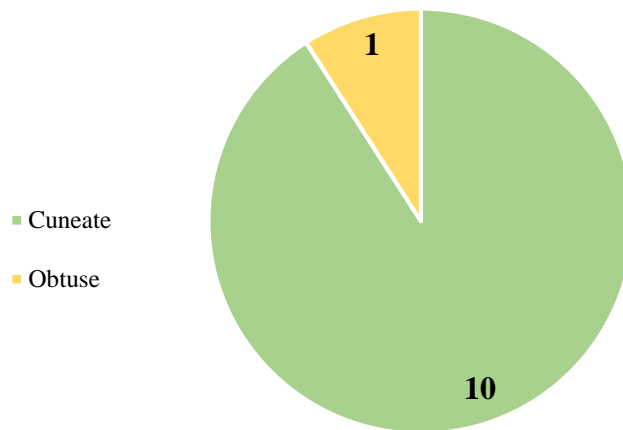


Fig.6: Diversity in fruit base of Caesalpinioideae studied species.

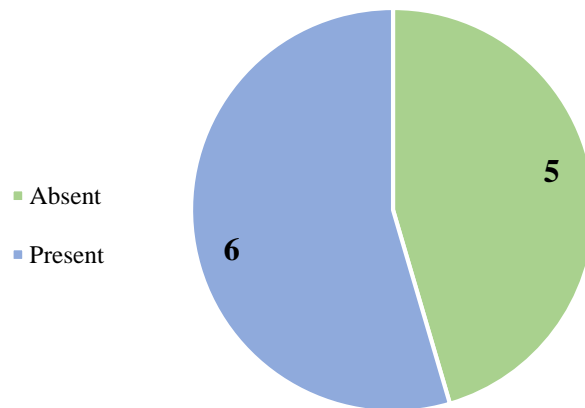


Fig.7: Diversity in fruit shattering of Caesalpinioideae studied species..

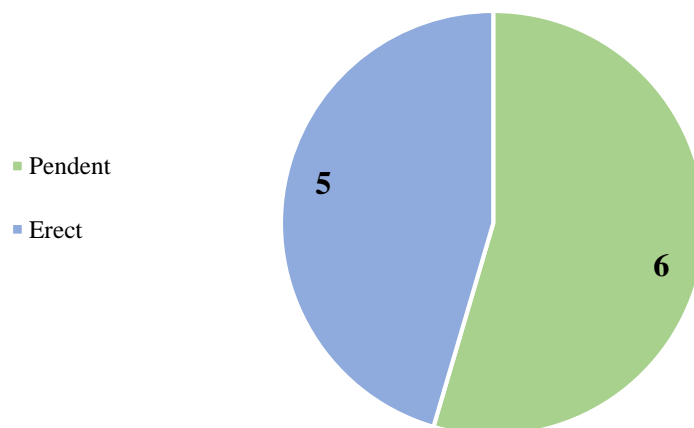


Fig.8: Diversity in fruit orientation of Caesalpinioideae studied species.

Table 2: Fruit qualitative characteristics of examined species.

Sr. No.	Character Species	Shape	Colour	Exocarp hairiness	Surface	Apex	Base	Shattering	Seeds/fruit	Locules/fruit	Fruit orientation
1	<i>Caesalpinia bonduc</i>	Elliptic- terete	Dark brown	Hispid	Not-ribbed	Straight beak	Obtuse	Present	1-2	1-2	Erect
2	<i>Cesalpenia pulcherrima</i>	Linear- flat	Brown	Glabrous	Ribbed	Acute	Cuneate	Present	8-10	8-12	Pendent
3	<i>Cassia auriculata</i>	Linear-terete	Brown	Glabrous	Ribbed	Cuspidate	Cuneate	Absent	13-16	14-17	Pendent
4	<i>Cassia fistula</i>	Linear-terete	Dark brown	Glabrous	Not-ribbed	Caudate	Cuneate	Absent	30-80	35-85	Pendent
5	<i>Cassia occidentalis</i>	Linear- flat	Light brown	Glabrous	Ribbed	Cuspidate	Cuneate	Present	32-38	35-40	Erect
6	<i>Cassia siamea</i>	Linear- flat	Brown	Glabrous	Ribbed	Straight beak	Cuneate	Present	27-33	23-35	Pendent
7	<i>Cassia tora</i>	Linear-terete	Light brown	Glabrous	Ribbed	Acute	Cuneate	Present	29-36	30-38	Pendent
8	<i>Cassia uniflora</i>	Linear-terete	Light brown	Scabrous	Ribbed	Cuspidate	Cuneate	Absent	7-10	7-10	Erect
9	<i>Parkinsonia aculeata</i>	Linear-terete	Creamer	Glabrous	Ribbed	Acute	Cuneate	Absent	6-10	7-12	Pendent
10	<i>Peltophorum pterocarpum</i>	Linear- flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Absent	1-3	1-3	Erect
11	<i>Senna alata</i>	Linear- quadrangular	Brown	Glabrous	Ribbed	Curved-Beak	Cuneate	Present	45-47	47-50	Erect

The present investigation finds diversified fruit qualitative characteristics. Based on the morphological characteristics, one can distinguish different plants from one another (Maftuna et al. 2020). Feitoza et al. (2014) studied the morphology of fruits, seeds, seedlings, and saplings of *Macrolobium acaciifolium*, *Macrolobium bifolium* and *Macrolobium pendu* belonging to Leguminosae-Caesalpinioideae in the Brazilian Amazon floodplain. They observed differences in the morphological traits of fruits and seeds among the species studied. According to them, these morphological traits can help to distinguish among the species studied. Among the three species studied, *Macrolobium bifolium* and *M. pendulum* differed in only a few morphological characteristics. These morphological characters have taxonomic value and can help in species identification.

Conclusion

The diversity of fruit morphology indicates adaptations for different methods of seed dispersal, such as passive release, elastic or explosive dehiscence mechanisms, and transport by water, wind, large animals, ants, and birds.

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