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Assessment of fruit qualitative traits of selected Mimosoideae species in Chandrapur district

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Abstract
Mimosoideae, an important group within the family Fabaceae, comprises several ecologically and economically valuable taxa characterized by diverse pod morphology. The present study was undertaken to assess fruit qualitative traits of 13 selected Mimosoideae species occurring in Chandrapur District and to evaluate their taxonomic significance. Mature fruits were examined for characters such as shape, colour, exocarp hairiness, surface texture, apex, base, shattering behaviour, number of seeds per fruit, locules per fruit, and fruit orientation. The results revealed substantial interspecific variation in pod morphology. Linear-flat pods were predominant, while curved-flat, round-terete, and curved-terete forms were restricted to specific taxa. Fruit colour ranged from light brown and dark brown to grey, cream, and light green. Ribbed surfaces were common, whereas non-ribbed fruits occurred only in a few species. Apex morphology showed marked diversity including acute, rounded, cuspidate, curved beak, and straight beak types. Seed number ranged from 2–4 in *Calliandra haematocephala* to 29–33 in *Desmanthus virgatus*, while locules varied from 2–4 to 30–35. Most fruits were pendent, with erect orientation confined to *Acacia farnesiana* and *Calliandra haematocephala*. Uniform glabrous exocarp and cuneate base were less diagnostic. The study confirms that fruit qualitative traits provide reliable supplementary characters for species identification, delimitation, and systematic evaluation of Mimosoideae species, and contribute useful baseline data for biodiversity documentation and future taxonomic studies in the region.

Keywords: Mimosoideae, fruit qualitative traits, pod morphology, taxonomy, chandrapur district, species identification

Introduction

Mimosoideae represents an important assemblage within the family Fabaceae and includes numerous economically, ecologically, and taxonomically significant taxa distributed in tropical and subtropical regions worldwide (Cronquist, 1981; Lewis *et al*., 2005; Legume Phylogeny Working Group, 2017) [3, 5, 6]. The group comprises trees, shrubs, and herbs such as *Acacia*, *Albizia*, *Leucaena*, *Mimosa*, *Prosopis*, and *Samanea*, many of which are widely utilized for timber, fuelwood, fodder, soil reclamation, ornamentation, and traditional medicine (Orchard & Maslin, 2003; Banik & Nema, 2014) [1, 7]. Members are characterized by bipinnate leaves, compact inflorescences arranged in heads or spikes, numerous stamens, and pod-like fruits exhibiting remarkable variation in size, form, and dehiscence (Judd *et al*., 2016; Singh, 2019) [4, 11].

Taxonomic studies in angiosperms frequently rely on reproductive structures because such characters are often more stable and evolutionarily informative than vegetative features (Radford *et al*., 1974; Soltis *et al*., 2018) [9, 12]. In legumes, fruit morphology has proven highly useful in classification, species delimitation, and phylogenetic interpretation (Polhill & Raven, 1981; Bruneau *et al*., 2001) [2, 8]. Pod shape, curvature, surface ornamentation, colour, apex type, septation, and seed arrangement provide dependable diagnostic characters for distinguishing related taxa (Lewis *et al*., 2005; Willis, 2017) [6, 13].

Chandrapur District is floristically rich due to its tropical climate, dry deciduous forests, roadside plantations, and agricultural landscapes that support several native and introduced Mimosoideae species. Despite the abundance of these taxa, detailed comparative studies on fruit qualitative traits in the district are lacking. Therefore, the present investigation was undertaken to assess fruit qualitative traits of selected Mimosoideae species in Chandrapur District and to evaluate the taxonomic significance of pod morphology.

Materials and Methods

Field explorations were conducted in various localities of Chandrapur District including Ballarpur, Mathara, Arvi, Gadchandur Road, Palasgaon-Gondpipari Road, Palsagaon-Kothari Road, and Ghot-Nimbala. Thirteen species were selected for study: *Acacia auriculiformis*, *Acacia farnesiana*, *Acacia leucophloea*, *Acacia nilotica* var. *indica*, *Acacia longifolia*, *Albizia lebbeck*, *Calliandra haematocephala*, *Desmanthus virgatus*, *Leucaena leucocephala*, *Mimosa hamata*, *Pithecellobium dulce*, *Prosopis juliflora*, and *Samanea saman* (Table 1)

Mature fruits were collected from healthy individuals during the fruiting season. Morphological observations were made following standard taxonomic methods used in comparative plant systematics (Radford *et al*., 1974; Judd *et al*., 2016; Singh, 2019) [4, 9, 11]. Characters analyzed included fruit shape, colour, exocarp hairiness, surface texture, apex, base, shattering behaviour, number of seeds per fruit, number of locules per fruit, and fruit orientation

Table 1: List of sampling sites of examined taxa

1	***Acacia auriculiformis* A. Cunn. ex. Benth.**	**Mathara, Gadchandur Road**	**19.770047º**	**79.337032º**
2	*Acacia farnesiana* (Linn.) Willd.	Palasgaon-Gondpipari Road	19.796123º	79.477228º
3	*Acacia leucophloea* (Roxb.) Willd.	Ballarpur, Chandrapur	19.855557º	79.372905º
4	*Acacia nilotica* var.*indica* (Benth.) Hill.	Ghot- Nimbala, Chandrapur	20.081625º	79.183907º

5	*Acacia longifolia* (Andr.)Willd.	Palasgaon-Gondpipari Road	19.814271°	79.453992°
6	*Albizia lebbeck* (L.) Willd.	Ballarpur, Chandrapur	19.877999°	79.34293°
7	*Calliandra haematocephala* Hassk.	Ballarpur, Chandrapur	19.844084°	79.360708°
8	*Desmanthus virgatus* (Linn.) Willd.	Palsagaon-Kothari, Road	19.795342°	79.480298°
9	*Leucaena leucocephala* (Lamk.) De Wit.	Arvi, Gadchandur Road	19.767432°	79.33622°
10	*Mimosa hamata* Willd.	Mathara, Gadchandur Road	19.767825°	79.336171°
11	*Pithecellobium dulce* (Roxb.) Benth.	Ballarpur, Chandrapur	19.875026°	79.329826°
12	*Prosopis juliflora* (Sw) DC.	Ballarpur, Chandrapur	19.854948°	79.37296°
13	*Samanea saman* (Jacq.) Merrill	Ballarpur, Chandrapur	19° 50'31.4592"	79° 21'54.5724"

Observations

All examined taxa (Table-2 and Fig. 1-8) possessed glabrous fruits, suggesting uniformity in exocarp indumentum. Pod shape varied markedly and included linear-flat, curved-flat, round-terete, and curved-terete types. Linear-flat pods predominated in *Acacia leucophloea*, *A. nilotica* var. *indica*, *A. longifolia*, *Albizia lebbeck*, *Calliandra haematocephala*, *Desmanthus virgatus*, *Prosopis juliflora*, and *Samanea saman*. Curved-flat pods were recorded in *Acacia auriculiformis*, *Leucaena leucocephala*, and *Mimosa hamata*, while terete pods occurred in *Acacia farnesiana* and *Pithecellobium dulce*.

Fruit colour ranged from light brown, dark brown, grey, cream, and light green. Ribbed surfaces were common, while non-ribbed fruits were confined to *Acacia farnesiana* and *Calliandra haematocephala*. Apex morphology showed substantial variation, including acute, rounded, cuspidate, curved beak, and straight beak forms. All species exhibited cuneate bases.

Shattering pods were observed in *Acacia auriculiformis*, *A. longifolia*, *Calliandra haematocephala*, *Desmanthus virgatus*, *Leucaena leucocephala*, and *Pithecellobium dulce*. Seeds per fruit ranged from 2–4 in *Calliandra haematocephala* to 29–33 in *Desmanthus virgatus*. Locules per fruit varied from 2–4 to 30–35. Most fruits were pendent, whereas erect orientation occurred only in *Acacia farnesiana* and *Calliandra haematocephala*

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	*Acacia auriculiformis*	Curved -flat	Light brown	Glabrous	Ribbed	Acute	Cuneate	Present	6-10	7-11	Pendent
2	*Acacia farnesiana*	Round-terete	Dark brown	Glabrous	Not ribbed	Curved beak	Cuneate	Absent	9-14	10-15	Erect
3	*Acacia leucophloea*	Linear- flat	Light brown	Glabrous	Ribbed	Rounded	Cuneate	Absent	8-14	9-15	Pendent
4	*Acacia nilotica* var. *indica*	Linear- flat	Gray	Glabrous	Ribbed	Cuspidate	Cuneate	Absent	8-15	9-17	Pendent
5	*Acacia longifolia*	Linear- flat	Creamer	Glabrous	Ribbed	Acute	Cuneate	Present	8-10	9-11	Pendent
6	*Albizia lebbeck*	Linear- flat	Creamer	Glabrous	Ribbed	Curved beak	Cuneate	Absent	7-11	7-12	Pendent
7	*Calliandra haematocephala*	Linear- flat	Creamer	Glabrous	Not ribbed	Straight beak	Cuneate	Present	2-4	2-4	Erect
8	*Desmanthus virgatus*	Linear- flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Present	29-33	30-35	Pendent
9	*Leucaena leucocephala*	Curved -flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Present	17-22	18-24	Pendent
10	*Mimosa hamata*	Curved -flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Absent	7-9	8-11	Pendent
11	*Pithecellobium dulce*	Curved-terete	Light green	Glabrous	Ribbed	Acute	Cuneate	Present	7-12	8-14	Pendent
12	*Prosopis juliflora*	Linear- flat	Creamer	Glabrous	Ribbed	Acute	Cuneate	Absent	26-30	27-31	Pendent
13	*Samanea saman*	Linear- flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Absent	12-22	13-25	Pendent

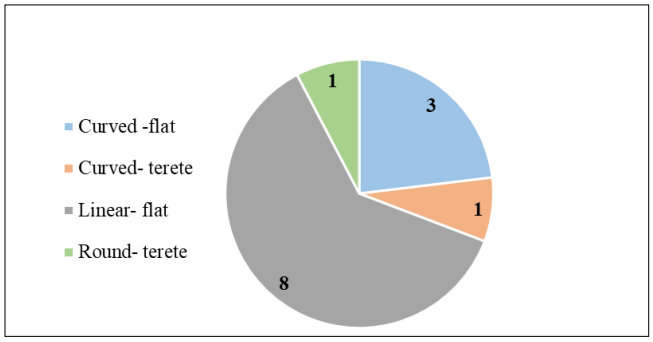

Fig 1: Variation in Fruit shape among the Studied Mimosoideae Species

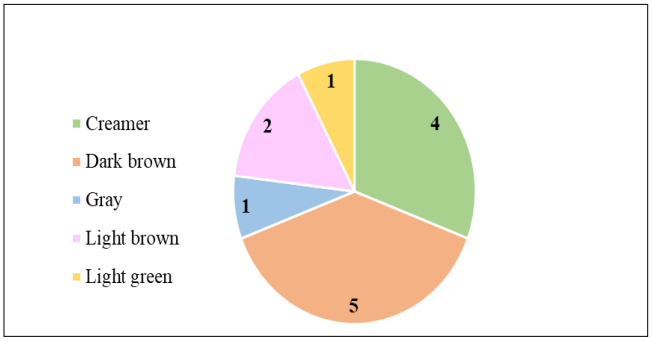

Fig 2: Variation in fruit colour among the Studied Mimosoideae Species

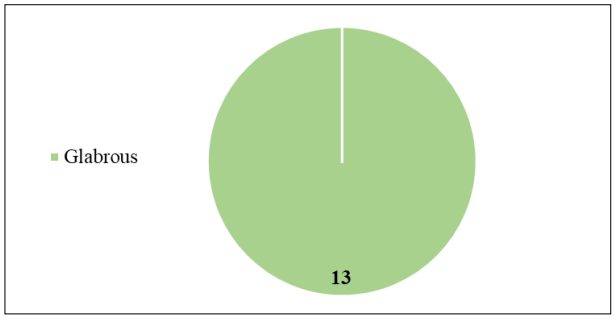

Fig 3: Variation in fruit exocarp hairiness among the Studied Mimosoideae Species

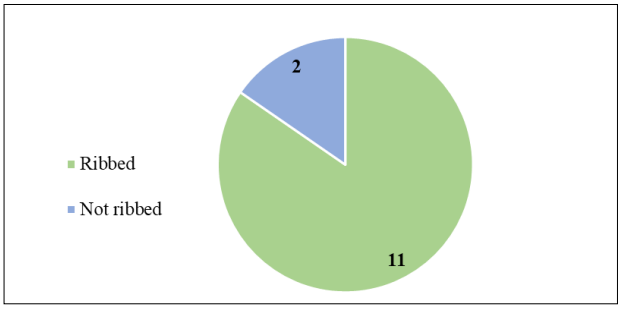

Fig 4: Variation in fruit surface among the Studied Mimosoideae Species

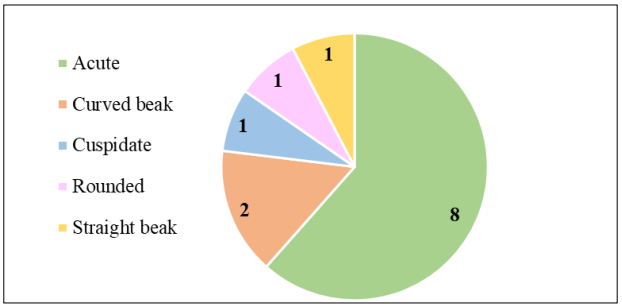

Fig 5: Variation in fruit apex among the Studied Mimosoideae Species

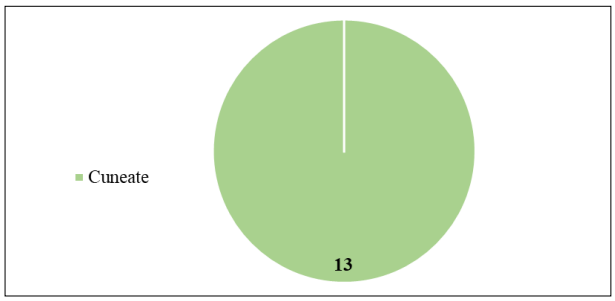

Fig 6: Variation in fruit base among the Studied Mimosoideae Species

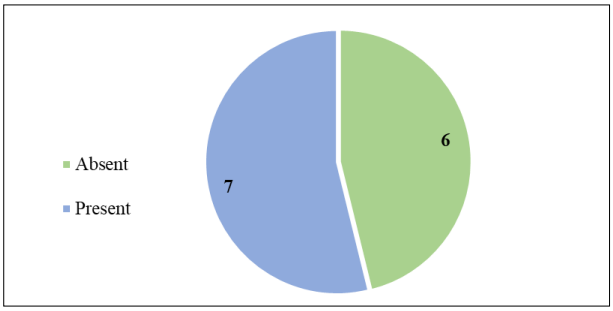

Fig 7: Variation in fruit shattering among the Studied Mimosoideae Species

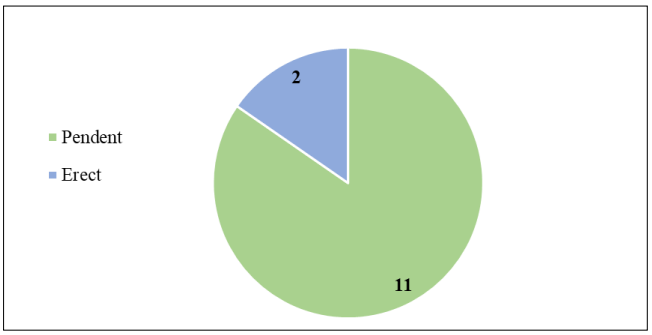

Fig 8: Variation in fruit orientation among the Studied Mimosoideae Species

Result and Discussion

The present study demonstrates that fruit qualitative characters provide significant taxonomic evidence for distinguishing selected Mimosoideae species. The predominance of linear-flat pods suggests a common structural pattern within many mimosoid taxa, whereas curved-flat and terete fruits provide useful species-level distinctions (Polhill & Raven, 1981; Lewis *et al*., 2005) [6, 8]. Similar emphasis on pod morphology in legume systematics has been reported by Bruneau *et al*. (2001) [2] and Legume Phylogeny Working Group (2017) [5].

The universal occurrence of glabrous exocarp and cuneate base among examined taxa indicates these traits possess comparatively lower diagnostic value. In contrast, surface ribbing and apex structure are highly informative. Ribbed pods may contribute to fruit rigidity and controlled dehiscence, whereas smooth pods may indicate specialized adaptations (Cronquist, 1981; Judd *et al*., 2016) [3, 4]. Curved beak apex in *Acacia farnesiana* and *Albizia lebbeck*, rounded apex in *Acacia leucophloea*, cuspidate apex in *A. nilotica* var. *indica*, and straight beak in *Calliandra haematocephala* are important field characters useful for identification (Singh, 2019; Willis, 2017) [11, 13].

Variation in shattering behaviour suggests different seed dispersal strategies among species. Dehiscent pods facilitate rapid seed release, while indehiscent fruits may delay dispersal or support transport by animals and water (Radford *et al*., 1974; Soltis *et al*., 2018) [9, 12]. Higher seed and locule numbers in *Desmanthus virgatus* and *Prosopis juliflora* indicate greater reproductive potential and colonizing ability. This may partly explain the successful spread of some species in disturbed habitats, as also noted for invasive trees and shrubs by Richardson and Rejmánek (2011) [10].

Low seed number in *Calliandra haematocephala* may represent a contrasting reproductive allocation strategy emphasizing seed quality over quantity. Predominantly pendent fruits in most taxa may reduce branch strain and aid gradual seed dispersal, whereas erect fruits in *Acacia farnesiana* and *Calliandra haematocephala* are distinctive morphological traits. In addition to taxonomic value, several Mimosoideae species also possess ethnobotanical importance, highlighting the need for their accurate identification and conservation (Banik & Nema, 2014; Orchard & Maslin, 2003) [1, 7].

Overall, the findings confirm that fruit qualitative traits remain reliable supplementary evidence for taxonomy, species delimitation, biodiversity surveys, and floristic documentation of Mimosoideae species in the region.

Conclusions

Comparative evaluation of fruit qualitative traits in 13 selected Mimosoideae species from Chandrapur District revealed substantial interspecific variation in pod morphology. Characters such as pod shape, colour, surface texture, apex type, shattering behaviour, seed number, locule number, and orientation were taxonomically informative, whereas glabrous exocarp and cuneate base were relatively constant. The study confirms that fruit morphology provides dependable supplementary evidence for species identification, delimitation, and systematic studies. These observations also contribute to biodiversity assessment and future phylogenetic studies of regional Mimosoideae taxa.

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