

# Qualitative Morphological Characteristics of Some Papilionoideae Fruits of Chandrapur District: A Comprehensive Analysis

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**Abstract:** *Papilionoideae* is a subfamily of *Fabaceae* or *Leguminosae*. The family is characterized by the fruit called a legume (a one-carpeled, beanlike, seed pod). The present investigation was carried out to study qualitative morphological characteristics of *Papilionoideae* fruit (legume). The qualitative characteristics of fruit analyzed include shape, color, exocarp hairiness, surface, apex, base, shattering, seeds/fruit, locules/fruit and fruit orientation. Fruits of different 24 species belonging to family *Papilionoideae* were used for the present investigation. Variations in the morphological characteristics of fruits were observed among studied taxa. The disparity in fruit morphological characteristics can be utilized as taxonomic tool to differentiate the taxa.

**Keywords:** papilionoideae, qualitative morphology, legume, fruit

## I. INTRODUCTION

The subfamily Papilionoideae belongs to the family Leguminosae. It is the largest and ecologically most diverse of the three subfamilies of Leguminosae. It consisting of about 475 genera and nearly 14,000 species grouped in 14 tribes (APG, 2012; Duane and Paul, 2012). It is an extremely important subfamily and has a broad range of usefulness (Datta and Mukherji, 1952; ILDIS, 2005). The subfamily is named after its butterfly-like (papilionoid) floral morphology (ILDIS, 2005; Cullen et al., 2011), which consists of bilaterally symmetrical flowers resembling those of the pea (*Pisum*). These flowers typically have two wing petals and a large standard petal. The members of the Papilionoideae subfamily are primarily herbaceous climbers or herbs; they may be erect or climbing shrubs, trees, or lianas (Watson and Dallwitz, 1999; Gurcharan, 2004; ILDIS, 2005).

Chandrapur district is the easternmost of the districts of Maharashtra state. It is situated between 18-4 to 20-5 (19.57') North Latitude and 78-5 to 80-6 (79.18') East Longitude with Altitude-189. The district covers a surface area of 26,128.7 km<sup>2</sup> (10,088.3 sq. miles) 8.53% of the surface area of the Maharashtra state. The district is rich in forest wealth and also known as the 'District of Forests'. A review of the literature shows that the information on fruit morphology of most species in the subfamily Papilionoideae, especially those found in India is scanty. Therefore this study aimed to document the morphological traits of taxonomic value in the species studied and allow relevant information for taxonomic and phylogenetic studies of the group.

## II. MATERIALS AND METHODS

During the study, various localities and villages of the Chandrapur district of Maharashtra were explored to collect fruits. For the present investigation fruit samples of the 24 plant species viz. *Abrus precatorius* Linn., *Aeschynomene americana* Linn., *Cajanus cajan* (L.) Millsp., *Canavalia gladiata* (Jacq.) DC., *Clitoria ternatea* Linn., *Clitoria ternatea* Linn. var. *pilosula*, *Crotalaria retusa* L., *Crotalaria verrucosa* L., *Dalbergia lanceolaria* Linn., *Dalbergia rubiginosa* Roxb., *Dalbergia sissoo* Roxb. ex DC., *Flemingia lineata* (Linn) Roxb., *Indigofera colutea* (Burm.f.) Merrill, *Lathyrus sativus* Linn., *Melilotus alba* Medicus., *Cullen corylifolia* (Linn.) Media., *Rhynchosia minima* (Linn.) DC, var. *laxiflora*, *Sesbania bispinosa* (Jacq.) Wight, *Sesbania grandiflora* (Linn.) Pers., *Tephrosia purpurea* (Linn.) Pers., *Tephrosia villosa* (Linn.) Pers., *Teramnus labialis* (Linn.f.) Spreng., *Trigonella foenum-graecum* L. and *Vigna radiata*

(Linn.) Wilczec belonging to the Papilionoideae family 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, color, exocarp hairiness, surface, apex, base, shattering, seeds/fruit, locules/fruit and fruit orientation.

### III. RESULTS AND DISCUSSION

Morphometric Qualitative characteristics of the fruits analyzed (Table-1) include shape, color, 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:

In the examined species of subfamily Papilionoideae, four different fruit shapes were recorded viz. linear- flat, linear-terete, round-terete and curved-flat (Fig.1). Linear-flat shaped fruits were observed in *A. precatarius*, *A. americana*, *C. gladiata*, *C. ternatea*, *C. ternatea* var. *pilosula*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo*, *L. sativus*, *T. purpurea*, *T. villosa* and *T. foenum-graecum*. In *C. cajan*, *C. retusa*, *C. verrucosa*, *R. minima*, *S. bispinosa* and *V. radiata* linear-terete shaped fruits were noted. Round-terete fruits were recorded in *F. lineata*, *I. colutea*, *M. alba*, *C. corylifolia* and *T. labialis*. *S. grandiflora* has curved -flat shaped fruit.

**Table 1:** 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>Abrusprecatarius</i>	Linear- flat	Light brown	Scabrous	Ribbed	Curved beak	Oblique	Present	4-5	5-6	Pendent
2	<i>Aeschynomene americana</i>	Linear- flat	Creamer	Glabrous	Ribbed	Acute	Cuneate	Absent	7-9	8-10	Pendent
3	<i>Cajanus cajan</i>	Linear-terete	Brown	Pubescent	Ribbed	Straight beak	Cuneate	Absent	3-5	3-5	Pendent
4	<i>Canavalia gladiata</i>	Linear- flat	Light brown	Scabrous	Not-ribbed	Curved beak	Cuneate	Present	9-12	10-12	Pendent
5	<i>Citriatarnatea</i>	Linear- flat	Creamer	Glabrous	Not-ribbed	Hooked	Cuneate	Present	7-10	9-11	Pendent
6	<i>Citriatarnatea</i> var. <i>pilosula</i>	Linear- flat	Creamer	Glabrous	Not-ribbed	Hooked	Cuneate	Present	6-7	8-9	Pendent
7	<i>Crotalaria retusa</i>	Linear-terete	Greyish brown	Glabrous	Not-ribbed	Hooked	Cuneate	Absent	11-15	1	Erect
8	<i>Crotalaria verrucosa</i>	Linear-terete	Creamer	Pubescent	Not-ribbed	Hooked	Rounded	Absent	11-15	1	Pendent
9	<i>Daibergeria lanceolaria</i>	Linear- flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Absent	2-3	2-3	Pendent
10	<i>Daibergeria rubiginosa</i>	Linear- flat	Creamer	Glabrous	Ribbed	Acute	Cuneate	Absent	1-2	1-3	Pendent
11	<i>Daibergeria sissoo</i>	Linear- flat	Dark brown	Glabrous	Ribbed	Acute	Cuneate	Absent	2-3	2-3	Pendent
12	<i>Flemingialineata</i>	Round- terete	Creamer	Pubescent	Not-ribbed	Cuspidate	Cuneate	Absent	1-2	1-2	Erect
13	<i>Indigofera colutea</i>	Round- terete	Brown	Pubescent	Ribbed	Straight beak	Obtuse	Absent	5-8	6-9	Pendent
14	<i>Lathyrus sativus</i>	Linear- flat	Creamer	Glabrous	Ribbed	Hooked	Cuneate	Absent	4-6	4-6	Pendent
15	<i>Melilotus alba</i>	Round- terete	Brown	Glabrous	Not-ribbed	Straight beak	Rounded	Absent	1	1	Pendent
16	<i>Cullen corylifolia</i>	Round- terete	Black	Scabrous	Not-ribbed	Rounded	Rounded	Absent	1	1	Erect
17	<i>Rhynchosia minima</i>	Linear-terete	Brown	Pubescent	Ribbed	Curved beak	Cuneate	Absent	2-3	2-3	Pendent
18	<i>Sesbania bispinosa</i>	Linear-terete	Light brown	Glabrous	Ribbed	Acuminate	Cuneate	Absent	27-30	29-32	Pendent
19	<i>Sesbania grandiflora</i>	Curved-flat	Creamer	Glabrous	Ribbed	Straight beak	Cuneate	Absent	35-49	35-50	Pendent
20	<i>Tephrosia purpurea</i>	Linear- flat	Creamer	Glabrous	Ribbed	Curved beak	Truncate	Present	4-6	5-7	Pendent
21	<i>Tephrosia villosa</i>	Linear- flat	Creamer	Pubescent	Ribbed	Curved beak	Truncate	Present	4-6	5-7	Pendent
22	<i>Teramnus labialis</i>	Round- terete	Black	Pubescent	Ribbed	Hooked	Rounded	Present	7-9	7-11	Pendent
23	<i>Trigonella foenum-graecum</i>	Linear- flat	Creamer	Pubescent	Ribbed	Straight beak	Cuneate	Absent	13-15	14-17	Pendent
24	<i>Vigna radiata</i>	Linear-terete	Black	Pubescent	Ribbed	Acute	Obtuse	Present	9-14	11-15	Pendent

#### b) Diversity in the fruit colour:

Vast diversity had been recorded in the fruit colour among the examined species (Fig.2). Creamer-coloured fruits were recorded in most of the species studied viz. *A. americana*, *C. ternatea*, *C. ternatea* var. *pilosula*, *C. verrucosa*, *D. rubiginosa*, *F. lineata*, *L. sativus*, *S. grandiflora*, *T. purpurea*, *T. villosa* and *T. foenum-graecum*. Light brown-coloured fruits were noted in *A. precatarius*, *C. gladiata* and *S. bispinosa*. In *C. cajan*, *I. colutea*, *M. alba* and *R. minima* the fruit was brown coloured. Two species namely *D. lanceolaria* and *D. sissoo* were found to possess dark brown coloured fruit. Black coloured fruits were noticed in three species *C. corylifolia*, *T. labialis* and *V. radiata*. *C. retusa* had greyish-brown coloured fruit.

**c) Diversity in the fruit exocarp hairiness:**

Variation in exocarp hairiness was seen among the examined species of Papilionoideae (Fig.3), scabrous fruits were found in *A. precatorius*, *C. gladiata* and *C. corylifolia*. while Glabrous fruits were seen in *A. americana*, *C. ternatea*, *C. ternatea* var. *pilosula*, *C. retusa*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo*, *L. sativus*, *S. bispinosa*, *S. grandiflora* and *T. purpurea*. In *C. cajan*, *C. verrucosa*, *F. lineata*, *I. colutea*, *R. minima*, *T. villosa*, *T. labialis*, *T. foenum-graecum* and *V. radiata* pubescent fruits were recorded.

**d) Diversity in the fruit surface:**

In examined species (Fig.4), ribbed fruits were recorded in *A. precatorius*, *A. americana*, *C. cajan*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo*, *I. colutea*, *L. sativus*, *R. minima*, *S. bispinosa*, *S. grandiflora*, *T. purpurea*, *T. villosa*, *T. labialis*, *T. foenum-graecum* and *V. radiata*. While fruits of *C. gladiata*, *C. ternatea*, *C. ternatea* var. *pilosula*, *C. retusa*, *C. verrucosa*, *F. lineata*, *M. alba* and *C. corylifolia* were seen as not-ribbed.

**e) Diversity in the fruit apex:**

Fruit apex in the studied species showed considerable disparity like hooked, curved beak, straight beak, acute, cuspidate, rounded and acuminate fruit apex were recorded (Fig.5). The hooked apex was recorded in *C. ternatea*, *C. ternatea* var. *pilosula*, *C. retusa*, *C. verrucosa*, *L. sativus* and *T. labialis*. The apex with a curved beak was observed in *A. precatorius*, *C. gladiata*, *R. minima*, *T. purpurea* and *T. villosa*. The straight-beaked apex was noted in *C. cajan*, *I. colutea*, *M. alba*, *S. grandiflora* and *T. foenum-graecum*. *A. americana*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo* and *V. radiata* were found to have acute apex. Cuspidate, rounded and acuminate fruit apex were seen in *F. lineata*, *C. corylifolia* and *S. bispinosa*.

**f) Diversity in the fruit base:**

Most diversified fruit bases were recorded in studied species (Fig.6). Among these, cuneate type of base was common. Cuneate type of fruit base was recorded in *A. americana*, *C. cajan*, *C. gladiata*, *C. ternatea*, *C. ternatea* var. *pilosula*, *C. retusa*, *L. sativus*, *R. minima*, *S. bispinosa*, *S. grandiflora*, *T. foenum-graecum*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo* and *F. lineata*. *C. verrucosa*, *M. alba*, *C. corylifolia* and *T. labialis* were found to possess rounded fruit base. Truncate fruit base was seen in *T. purpurea* and *T. villosa* while in *I. colutea* and *V. radiata* obtuse base was recorded. In *A. precatorius* oblique base was noted.

**g) Diversity in the fruit shattering:**

Fruit shattering was present in the following species (Fig.7) *A. precatorius*, *C. gladiata*, *C. ternatea*, *C. ternatea* var. *pilosula*, *T. purpurea*, *T. villosa*, *T. labialis* and *V. radiata*. While in *A. americana*, *C. cajan*, *C. retusa*, *C. verrucosa*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo*, *F. lineata*, *I. colutea*, *L. sativus*, *M. alba*, *C. corylifolia*, *R. minima*, *S. bispinosa*, *S. grandiflora* and *T. foenum-graecum* fruit shattering was absent.

**h) Diversity in the fruit seeds/fruit:**

The highest no of seeds per fruit was found in *S. grandiflora* (35-49), while the lowest no of seeds per fruit were found in *M. alba* and *C. corylifolia* having 1 seed per fruit.

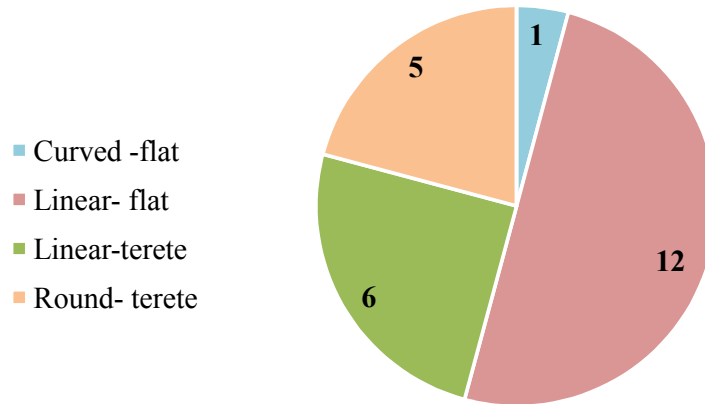
**i) Diversity in the fruit locules/fruit:**

The disparity in the locules per fruit was recorded in the examined species, the highest no of locules per fruit was found in *S. grandiflora* (35-50), while the lowest no of locules per fruit was found in *M. alba* and *C. corylifolia* having 1 locule per fruit.

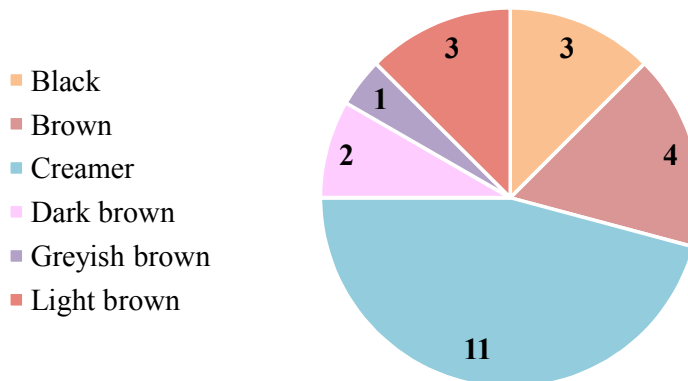
**j) Diversity in the fruit orientation**

Examined species showed two types of fruit orientation viz. pendent and erect (Fig.8). Following species showed the pendent type of fruit orientation *A. precatorius*, *A. americana*, *C. cajan*, *C. gladiata*, *C. ternatea*, *C. ternatea* var. *pilosula*, *C. verrucosa*, *D. lanceolaria*, *D. rubiginosa*, *D. sissoo*, *I. colutea*, *L. sativus*, *M. alba*, *R. minima*, *S. grandiflora* and *T. foenum-graecum*.

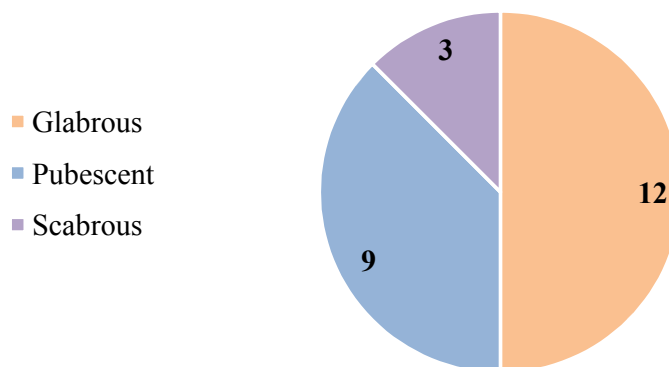
*bispinosa*, *S. grandiflora*, *T. purpurea*, *T. villosa*, *T. labialis*, *T. foenum-graecum* and *V. radiata*. While, *C. retusa*, *C. corylifolia* and *F. lineata* found to possess erect fruit orientation.



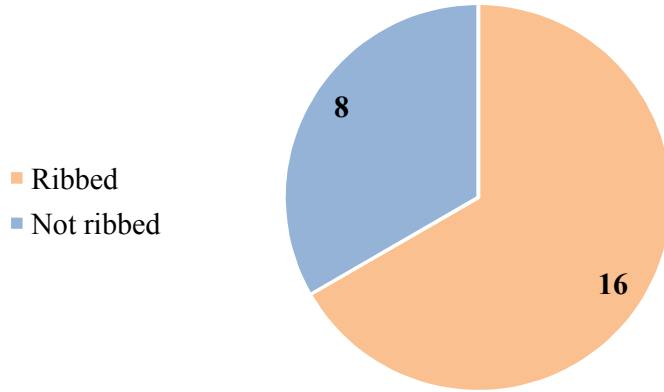
**Fig.1:** Diversity in fruit shape of Papilionoideae studied species.



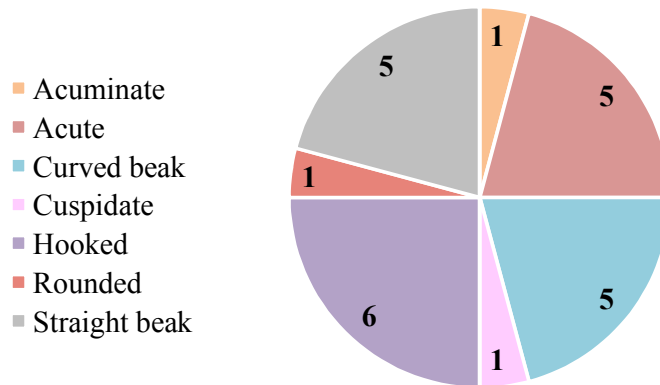
**Fig.2:** Diversity in fruit colour of Papilionoideae studied species.



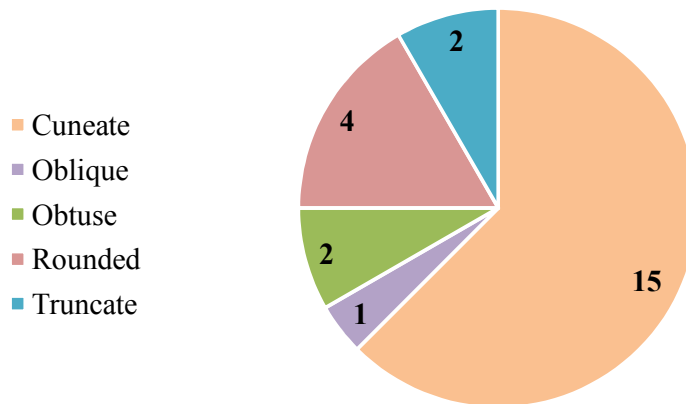
**Fig.3:** Diversity in fruit exocarp hairiness of Papilionoideae studied species.



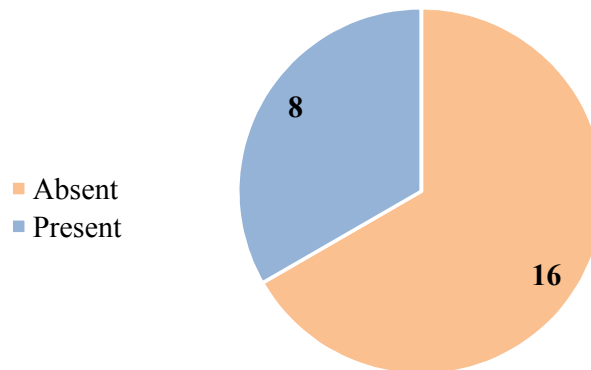
**Fig.4:** Diversity in fruit surface of Papilionoideae studied species.



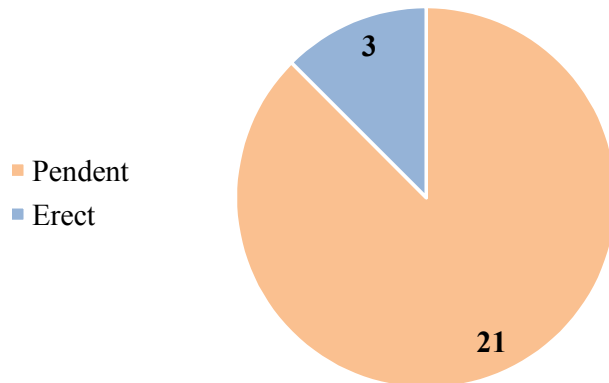
**Fig.5:** Diversity in fruit apex of Papilionoideae studied species.



**Fig.6:** Diversity in fruit base of Papilionoideae studied species.



**Fig.7:** Diversity in fruit shattering of Papilionoideae studied species.



**Fig.8:** Diversity in fruit orientation of Papilionoideae studied species.

Papilionoideae is a highly heterogeneous family in several aspects. It is a subfamily of Leguminosae the family refers to a type of fruit; its diversity is equally or even higher than other features. Thus, a detailed observation of the morphological qualitative characteristics of fruits in some cases is of great importance in the improvement of taxonomic knowledge. In this study, our observations of fruit features revealed the presence of considerable morphological variations among the studied species.

#### IV. CONCLUSION

The fruits of the studies species are variable in qualitative morphology. This study may have a potential source of characters for phylogenetic studies. So, we conclude that the this study can provide good diagnostic characters to distinguish among the different genera.

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