

PEDUNCLE, PEDICEL, AND CAPSULE EPIDERMAL CHARACTERS OF CERTAIN ORCHID SPECIES FROM NORTHEAST INDIA

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Abstract

Epidermal characters of peduncle, pedicel, and capsule of five orchid species of NorthEast India were studied. The epidermal data/characters (both qualitative and quantitative) obtained were found useful in deciphering the individual species. On the basis of useful taxonomic characters, an artificial taxonomic key was prepared.

Introduction

OUT OF a total of about 1,150 orchid species known to exist in India, as many as 825 species are known to occur in NorthEast India (Hegde, 2000). Anatomical characters can be used to distinguish species in vegetative phase (Metcalf, 1961). Earlier many authors hinted that vegetative anatomical characters can be used as a tool to identify the orchid species (Kaushik, 1982, 1983; Mahan Ram and Khasim, 1987; Stern and Judd, 1999). It is often found difficult to identify the orchid members at their vegetative stage. If there are no flowers, it may not be possible to determine their nomenclatural types accurately. Hence, their vegetative external characteristics cannot always be taken as a basis for accurate classification and anatomical characters like epidermal, is much desirable to bring out differences at species level (Baruah and Sonowal, 2010; Sonowal and Baruah, 2010; Stern and Judd, 1999). Very little has been known about the epidermal characters of peduncle, pedicel, and capsule of orchid species. In the present investigation, an attempt has been made to evaluate the epidermal characters of peduncle, pedicel, and capsule of five orchid species, as an aid for taxonomic determination from NorthEast India.

Materials and Methods

Materials undertaken in the present investigation consists of five orchid species *i.e.* *Aerides multiflora* Roxb., *Cymbidium pendulum* (Roxb.) Sw., *Dendrobium moschatum* (Buch.-Ham.) Sw., *Phaius tankervilleae* (L'Herit.) Bl. and *Rhynchostylis retusa* (L.) Bl. Identifications of the studied orchid species were confirmed by consulting the relevant literature (Barua, 2001; Chowdhery, 1998; Hegde, 2000; Hynniewta *et al.*, 2000). Small fragments of peduncle, pedicel, and capsule of sizes 2-5 × 3-8 mm, taken from the middle

regions, were boiled in 5% KOH solution at 80-100°C for 15-25 min. The epidermal peels were stripped-off gently with the help of forceps and brush. Epidermal peels were washed in distilled water, stained with aqueous safranin and mounted in 50% glycerine; the margins of the cover-slips were sealed with Dibutyl phthalate xylol. The slides were examined under light microscope and drawings were made with the help of camera lucida. The quantitative data were based on the average of six readings. Both qualitative and quantitative data recorded for the species were presented in Table 1 and Table 2, respectively.

Results

Stomata

The stomata were anomocytic and present on the surface of peduncles (*Aerides multiflora*, *Dendrobium moschatum*, *Phaius tankervilleae* and *Rhynchostylis retusa*), pedicels (*Cymbidium pendulum*, *D. moschatum* and *P. tankervilleae*) and capsules (*C. pendulum*, *D. moschatum*, *P. tankervilleae* and *R. retusa*) (Fig. 1 A-O).

The number of stomata/mm² in peduncle ranged from 6-27, in pedicel 6-43 and in capsule 6-27. In peduncle, the lowest number of stomata (6) was found in *R. retusa*, while the highest (27) in *P. tankervilleae*. In pedicel, the lowest number of stomata (6) was found in *C. pendulum* and *D. moschatum*, while the highest (43) in *P. tankervilleae*. In capsule, the lowest number of stomata (6) was found in *C. pendulum*, while the highest (27) in *P. tankervilleae*.

The smallest size of stomata was recorded in the capsules of *R. retusa* (13.53 × 14.52 μm) and largest in the pedicel of *D. moschatum* (121.04 × 199.36 μm). The stomatal index in peduncle ranged from 0.05-3.81, in pedicel 0.18-6.18 and in capsule 0.13-3.27. In peduncle, the lowest numbers of stomatal index (0.05)

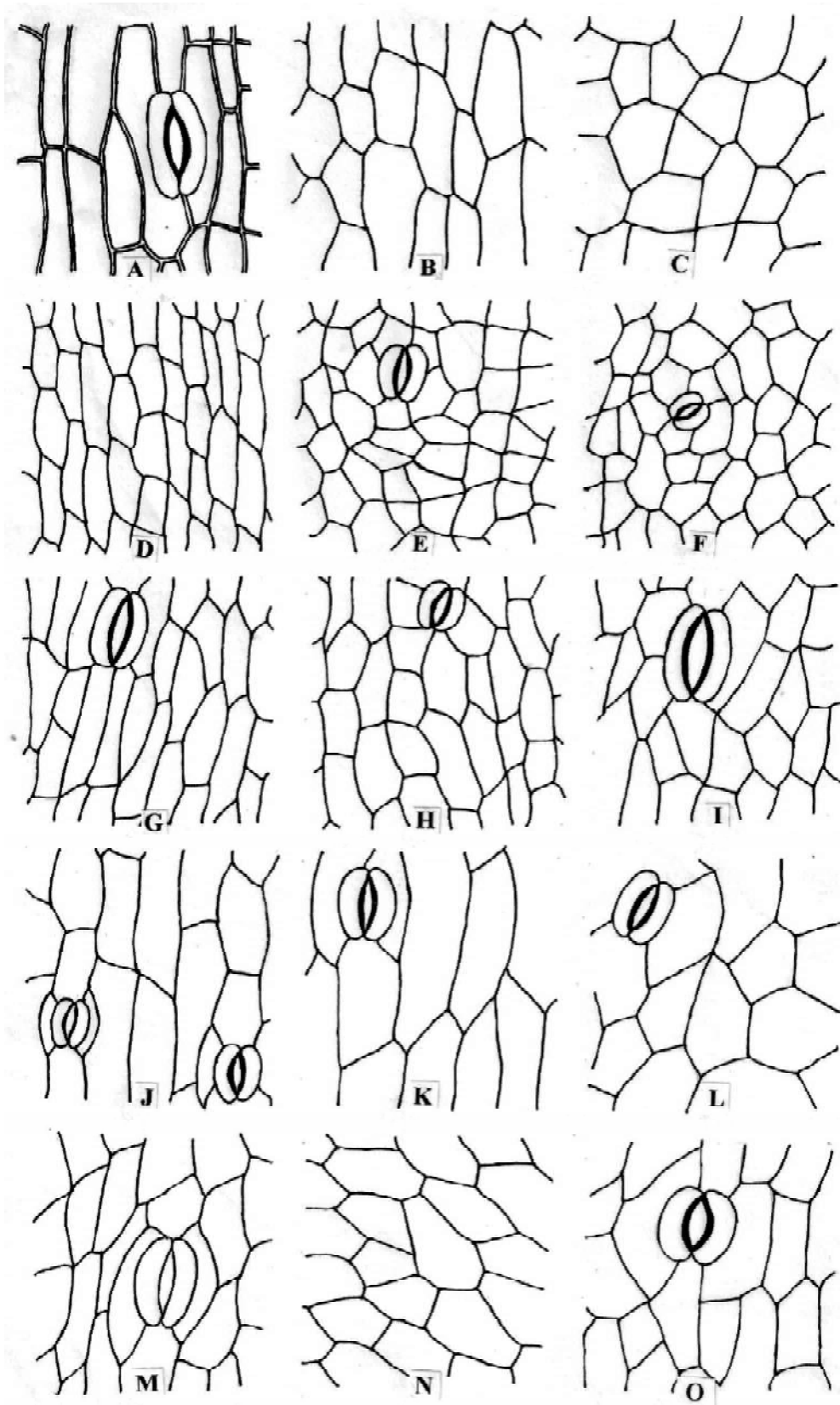


Fig.1. A-O. Epidermal structures of peduncle, pedicel, and capsule of five orchid species from NorthEast India: A-C, *Aerialis multiflora*; D-F, *Cymbidium pendulum*; G-I, *Dendrobium moschatum*; J-L, *Phaius tankervilleae*; M-O, *Rhynchosstylis retusa*.

Table 1. Qualitative characters of peduncle, pedicel, and capsule epidermis of five orchid species from NorthEast India.

Species	Epidermal cell								
	Shape			Wall nature			Type of Stomata		
	Peduncle	Pedicel	Capsule	Peduncle	Pedicel	Capsule	Peduncle	Pedicel	Capsule
<i>Aerides multiflora</i>	Tetragonal	Tetragonal to polygonal	Tetragonal to polygonal	Almost straight	Almost straight	Almost straight	Anomocytic	-	-
<i>Cymbidium pendulum</i>	Tetragonal to polygonal	Tetragonal to polygonal	Polygonal	Almost straight	Almost straight	Almost straight	-	Anomocytic	-
<i>Dendrobium moschatum</i>	Tetragonal to polygonal	Tetragonal to polygonal	Tetragonal to polygonal	Almost straight	Almost straight	Almost straight	Anomocytic	Anomocytic	Anomocytic
<i>Phaius tankervilleae</i>	Pentagonal to polygonal	Pentagonal to polygonal	Pentagonal to polygonal	Almost straight	Almost straight	Almost straight	Anomocytic	Anomocytic	Anomocytic
<i>Rhynchostylis retusa</i>	Tetragonal to polygonal	Polygonal	Tetragonal to polygonal	Curvy	Almost straight	Curvy	Anomocytic	-	Anomocytic

were recorded in *D. moschatum*, while the highest (3.81) in *P. tankervilleae*. In pedicel, the lowest number of stomatal index (0.18) was found in *C. pendulum*, while the highest (6.18) in *P. tankervilleae*. In capsule, the lowest number of stomatal index (0.13) was found in *C. pendulum*, while the highest (3.27) in *P. tankervilleae*.

Epidermis

The epidermal cells were tetragonal to polygonal, in all the investigated species, except in the peduncles of *A. multiflora*, where these were tetragonal and polygonal in the pedicels of *R. retusa* and in the capsules of *C. pendulum*, while pentagonal to polygonal in the peduncle, pedicel, and capsules of *Phaius tankervilleae* (Table 1). The epidermal cell walls were almost straight in all the investigated plant parts (peduncle, pedicel, and capsule) of the species except in *D. moschatum* and *R. retusa* where these were curvy to straight, and curvy, respectively (Table 1). The number of epidermal cells/mm² in peduncles ranged from 681-2631. The lowest number of epidermal cells (681) were recorded in *P. tankervilleae* and highest (2631) in *D. moschatum*. The number of epidermal cell/mm² in pedicels ranged from 652-3176. The lowest number of epidermal cells (652) was recorded in *P. tankervilleae* and highest (3176) in *C. pendulum*. The number of epidermal cells/mm² in capsules ranged from 825-4710. The lowest number of epidermal cells (825) was recorded in *P. tankervilleae* and highest (4710) in *C. pendulum*.

In peduncle, the smallest size of epidermal cells was recorded in *C. pendulum* (12.81 × 59.80-54.59 × 218.34 μm) and largest in *P. tankervilleae* (99.68 × 172.66-89.00 × 357.78 μm). In pedicel, the smallest size of epidermal cells was recorded in *C. pendulum* (31.33 × 35.6-45.09 × 68.83 μm) and largest in *P. tankervilleae* (99.68 × 249.20-04.42 × 427.20 μm). In capsule, the smallest size of epidermal cells was recorded in *C. pendulum*

(29.90 × 34.18-39.16 × 60.52 μm) and largest in *R. retusa* (90.78 × 137.06-98.26 × 192.80 μm).

Discussion

Very little has been known about the peduncle anatomy of orchid species. Apart from the recent report of Sonowal and Baruah (2010) on the foliar epidermal characters of 20 orchid species from NorthEast India, few other earlier works (Baruah, 1998, 2001; Baruah and Saikia, 2002; Baruah and Sonowal, 2010; Handique, 1991; Handique and Handique, 1996; Sonowal and Baruah, 2010, 2012; Vij *et al.*, 1991) on the anatomical aspects have been reported from the East Himalayan region.

Sonowal and Baruah (2010) reported anomocytic stomata in the leaves of *Aerides multiflora*, *Dendrobium moschatum*, *Phaius tankervilleae* and *Rhynchostylis retusa*, where the leaves were hypostomatic except in *Rhynchostylis retusa* where these were amphistomatic. In the present investigation, the same type of stomata *i.e.* anomocytic were observed in the peduncle of *Aerides multiflora*, *Dendrobium moschatum*, *Phaius tankervilleae* and *Rhynchostylis retusa*; in the pedicel of *Cymbidium pendulum* and *Dendrobium moschatum*; and in the capsules of *Cymbidium pendulum*, *Dendrobium moschatum*, *Phaius tankervilleae* and *Rhynchostylis retusa*. Interestingly, the pedicels of *Phaius tankervilleae* were found to have paracytic stomata.

A dichotomous artificial key, formulated on the basis of evaluated epidermal characters of peduncle, pedicel and capsule, is presented below:

1a. Stomata absent in the epidermal surface of capsule; epidermal cell of peduncle tetragonal; Stomata present in the epidermal surface of peduncle; Number of epidermal cells/mm² in peduncle, pedicel and capsule

Table 2. Quantitative data of peduncle, pedicel, and capsule epidermis of five orchid species from NorthEast India.

Species	Epidermal cell						Peduncle			Stomata			Capsule			
	Size (μm)		Number/ mm^2		Cap- sule	Pedun- cle	Size	Number/ mm^2	Index	Size	Number/ mm^2	Index	Size	Number/ mm^2	Index	
	Pedun- cle	Pedicel	Pedun- cle	Pedicel												Peduncle
<i>Aerides multiflora</i>	53.40 X	71.12 X	81.88 X	1605	1391	1294	106.8X	6	0.37	-	-	-	-	-	-	
	168.45 -	161.98 -	106.80 -				234.96									
	74.76 X	96.12 X	115.54 X													
	387.82	270.56	175.15													
<i>Cymbidium pendulum</i>	12.81 X	31.33 X	29.90 X	2600	3176	4710	-	-	-	-	35.6 X	6	0.18	42.72 X	6	.013
	59.80 -	35.6 -	34.18 -								49.84			49.84		
	54.59 X	45.09 X	39.16 X													
	218.34	68.83	60.52													
<i>Dendrobium moschatum</i>	50.62 X	69.42 X	62.30 X	2631	1657	1328	56.96 X	13	0.05	121.04 X	6	0.36	85.44 X	13	0.41	
	150.45 -	105.02 -	96.12 -				137.65 -			199.36			103.24			
	79.74 X	95.40 X	74.04 X				92.56X									
	200.78	169.45	145.24				172.66									
<i>Phaius tankervilleae</i>	99.68 X	99.68 X	99.54 X	681	652	825	85.44 X	27	3.81	113.92 X	43	6.18	99.68 X	27	3.27	
	172.66 -	249.20 -	165.54 -				103.24			178.00			142			
	89.00 X	104.42 X	161.38 X													
	357.78	427.20	377.36													
<i>Rhynchosyris retusa</i>	74.76 X	68.35 X	90.78 X	1734	1176	1039	106.80 X	6	0.34	-	-	-	13.53 X	17	1.60	
	97.90 -	135.28 -	137.06 -				192.24						14.52			
	71.20 X	128.16 X	98.26 X													
	252.04	219.29	192.80													

1605, 1391 and 1294 respectively
..... *Aerides multiflora*

1b. Stomata present in the epidermal surface of capsule;
epidermal cell of peduncle tetra pentagonal to polygonal
..... 2

2a. Stomata present in the epidermal surface of
peduncle 3

3a. Stomata present in the epidermal surface of pedicel
..... 4

4a. Epidermal cell tetragonal to polygonal; Number of
epidermal cells/mm² in peduncle, pedicel and capsule
2631, 1657 and 1328 respectively; Number of stomata/
mm² in peduncle, pedicel and capsule 13, 6 and 13
respectively; Stomatal index in peduncle, pedicel and
capsule 0.05, 0.36 and 0.41 respectively
.....*Dendrobium moschatum*

4b. Epidermal cell pentagonal to polygonal; Number
of epidermal cell/mm² in peduncle, pedicel and capsule
681, 652 and 825 respectively; Number of stomata/
mm² in peduncle, pedicel and capsule 27, 43 and 27
respectively; Stomatal index in peduncle, pedicel and
capsule 3.81, 6.18 and 3.27 respectively
..... *Phaius tankervilleae*

3b. Stomata absent in the epidermal surface of pedicel;
Epidermal cell tetragonal to polygonal in peduncle and
capsule, epidermal cell wall curvy to almost straight;
Number of epidermal cells/mm² in peduncle, pedicel
and capsule 1734, 1176 and 1039 respectively
..... *Rhynchostylis retusa*

2b. Stomata absent in the epidermal surface of
peduncle; epidermal cell tetragonal to polygonal and
its wall almost straight; Number of epidermal cell/mm²
in peduncle, pedicel and capsule 2600, 3176 and 4710
respectively *Cymbidium pendulum*

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