

Morphometric study of Genus *Hibiscus* from family Malvaceae

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Abstract: The herbarium specimen of 8 different species of *Hibiscus* deposited at BSI, Western circle, Pune namely *Hibiscus mannihot*, *Hibiscus collinus*, *Hibiscus tillaceus*, *Hibiscus suratensis*, *Hibiscus hipidissimus*, *Hibiscus solondra*, *Hibiscus panduraeformis*, *Hibiscus trionus* were studied. The quantitative characters were recorded by using scale in cms. Parameters like Principal component analysis (PCA) and cluster analysis applied to the data. The results of both leads to delimitation and closed relation of the taxa. Correlation between all quantitative characters showed that internode is the delimiting factor and petiole length and leaf length are close to each other. Analysis refers to cluster analysis and dendrogram on the basis of farthest neighbour mean characters difference and constrained clustering strategy exhibits dissimilarities in between the species. Eigen value table showed that Internode is actually the main factor and leaf length can also delimit the taxa. Value of scree plot is above one. Internode and leaf length have eigen values above 1. In the morphometric studies it has been observed by the Most allied species are *Hibiscus mannihot* and *Hibiscus collinus* both are closely related and node 6 and node 4 species is the most diverse from the other group.

Keywords: Morphometric studies, 8 species of *Hibiscus*, PCA, Cluster analysis

Introduction

Genus *Hibiscus* belongs to the family Malvaceae. (Fryxell, 1997). Near about 200 species of *Hibiscus* have been recorded. All the species may be herb, shrub or trees. (Bailey, 1950; Bates, 1965, Beers and Howie, 1992; Sumia Fatima 2018). The medicinal uses of flowers, roots and buds are in burning sensation, skin disease and constipation. (Ivan, 1999; Kirtikar and Basu, 1999; Pullaiah, 2006). The extract of flower is very much effective in hair fall. (Burkill, 1995). stages of cancer development (Sharma and Sultana, 2004). Many taxonomist made their contribution on numerical taxonomy. Deshmukh, (2011), Deshmukh & et.al.(2012), Deshmukh & et.al. (2013), and Puhua and Ohashi, (2010), Puhua, et. al, (2010), Sonibare & et.al, (2004).

Material and Methods

Herbarium of 8 different species like *H. mannihot*, *H. collinus*, *H. tillaceus*, *H. suratensis*

H. hipidissimus, *H. solondra*, *H. panduraeformis*, *H. trionus* were selected for taking observations on the characters like length of internode, leaf length, breadth of leaf at three part of a leaf. (base, middle and apex) and petiole length. Measurements were taken for six characters quantitative characters. Mean values were calculated and processed for principal component analysis The principal component analysis (PCA) was performed following the method described by Sneath and Sokal (1973) and cluster analysis done. Similarity matrix and tolerance of Eigen values calculated by keeping standardized data. Eigen values and variance of the characters were calculated and scree plot graph plotted. (Kovach, 1999, Minakshi Mahajan and Sumia Fatima, 2014). The objectives of all the calculations was to determine the character that contributed strongly to the delimitation of the taxa and their close relationship on the basis of cluster analysis.

Result and Discussion

Morphometric studies of any taxa are based on Principal Component Analysis and cluster analysis. (Soladoye, et. al., 2010). The study was carried out for 8 species of *Hibiscus* for 6 characters.

Table 1. Voucher specimen of Herbarium

Fig 2. Dendrogram showing clusters

Table 3. Text Dendrogram

Fig 4. Scree plot on the basis of Eigen value percentage.

Table 5. Similarity matrix

Table 6 Eigen value percentage

Table 7. Variance in quantitative characters

Table 8 Euclidean distance

Table 1. Voucher specimen of Herbarium

Sr. No.	Species	Voucher no.
1	<i>H. mannihot</i>	-
2	<i>H. collinus</i>	2155
3	<i>H. tillaceus</i>	2175
4	<i>H. suratensis</i>	2173
5	<i>H. hipidissimus</i>	18014
6	<i>H. solondra</i>	74998
7	<i>H. panduraeformis</i>	2165
8	<i>H. trionum</i>	-

Fig 2. Dendrogram showing clusters

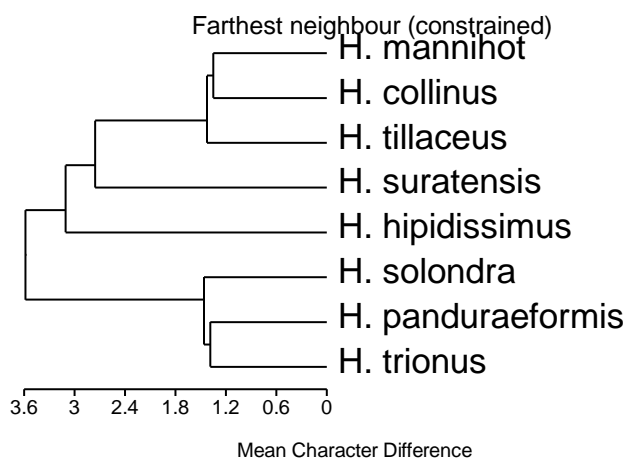


Table 3- Text dendrogram showing the relationship of 8 species of Hibiscus based on 6 morphological characters

CLUSTER ANALYSIS							
Imported data							
Analysis begun: Monday, April 02, 2018 7:44:55 PM							
Analysing 6 variables x 8 cases							
Farthest neighbour							
Mean Character Difference							
Constrained clustering strategy							
Distance matrix							
	H. mannihot	H. collinus	H. tillaceus	H. suratensis	H. hipidissimus	H. solondra	H. panduraeformis
H. mannihot	0						
H. collinus	1.35	0					
H. tillaceus	1.339	1.422	0				
H. suratensis	1.734	2.761	2.194	0			

Fig 4. Scree plot on the basis of Eigen value percentage.

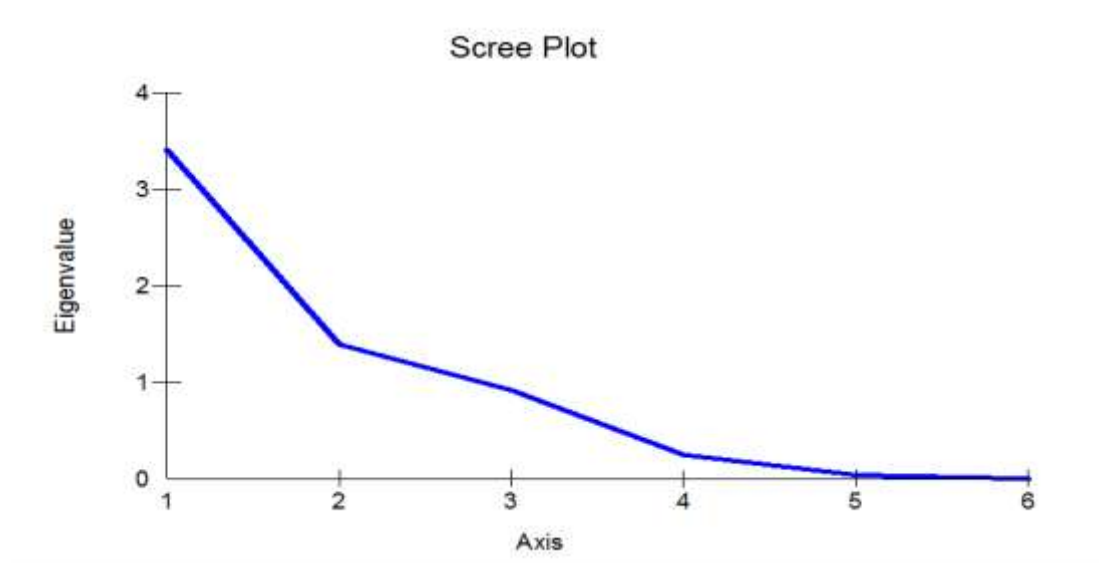


Table 5. Similarity matrix

Similarity matrix						
	Internode	Leaf L	Petiold L	Base	Middle	Apex
Internode	1					
Leaf L	0.449	1				
Petiole L	0.519	-0.186	1			
Base	-0.922	-0.531	-0.484	1		
Middle	-0.765	-0.471	-0.612	0.884	1	
Apex	-0.47	-0.364	-0.033	0.174	-0.086	1

Table 6. Eigen value percentage

	Internode	Leaf L	Petiole L	Base	Middle	Apex
Eigenvalues						
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Eigenvalues	3.408	1.391	0.916	0.248	0.037	0
Percentage	56.802	23.185	15.261	4.129	0.623	0
Cum. Percentage	56.802	79.986	95.248	99.377	100	100

Table 7. Variance in quantitative characters

PCA variable loadings						
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
A-Interno	0.514	-0.072	-0.201	-0.457	0.304	0.623
B-Leaf L	0.308	-0.548	0.457	0.52	-0.186	0.302
C-Petiold	0.318	0.536	-0.44	0.55	-0.277	0.196
D-Base	-0.521	-0.034	-0.142	0.409	0.635	0.37
E-Middle	-0.489	-0.242	-0.295	-0.187	-0.618	0.445
F-Apex	-0.171	0.589	0.671	-0.125	-0.102	0.383

Table 9. PCA case scores

PCA case scores						
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
A-H. mannihot	-0.267	0.565	-0.43	0.228	0.044	0
B-H. collinus	-0.362	-0.068	0.231	-0.002	-0.148	0
C-H. tillaceus	-0.937	-0.694	0.218	0.056	0.087	0
D-H. suratensis	0.56	-0.197	-0.363	-0.333	0.033	0
E-H. hipidissimus	-0.568	-0.021	-0.438	-0.029	-0.056	0
F-H. solondra	1.185	-0.394	0.007	0.165	-0.017	0
G-H. panduraeformis	-0.13	0.584	0.438	-0.201	0.03	0
H-H. trionus	0.519	0.225	0.339	0.116	0.027	0

Dendrogram exhibit 7 nodes.

Most allied species are *H. mannihot* and *H. collinus* Both are closely related and node 6 and node 4 species is the most diverse from the other group.

Node 1. – It is formed by 2 species namely *H. mannihot* and *H. collinus* both are closely related with each other. It shows least dissimilarities between both the species.

Node 2.- It is formed by 2 species namely *H. panduraeformis* , *H. trionus*

Node 3- It is formed by 3 species namely *H. mannihot*, *H. collinus*, *H. tillaceus*

Node 4. - It include 3 species namely *H. solondra*, *H. trionus* and *panduraeformis*

Node 5. -*H. mannihot*, *H. collinus*, *H. tillaceus*, *H. suratensis*

Node 6. Comprises of 5 species namely *H. mannihot*, *H. collinus*, *H. tillaceus*, *H. suratensis* and *H. hipidissius*

Node 7. - Comprises of 8 species namely *H. mannihot*, *H. collinus*, *H. tillaceus*, *H. suratensis*, *H. hipidissius*, *H. solondra*, *H. trionus* and *H. panduraeformis*

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