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Chemosystematics of *Tabebuia*

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ABSTRACT

The infrageneric chemotaxonomy of 9 species of *Tabebuia* (Bignoniaceae) expressed in terms of synthetic numerical indices, indicate that they are closely related. The dendrogram of cluster analysis is suggestive of splitting of species studied, into 4 clusters.

INTRODUCTION

There are some published reports on the chemotaxonomy of a few bignanaceous taxa in general (Padhye *et al.*, 1985; Satyavathi *et al.*, 1984, 1987) and at tribal and supratribal levels in particular (Harborne, 1967; Gibbs,1974; Padhye and Sabnis,1987; Satyavathi, 1988; Satyavathi *et al.*, 1989 a,b). The present paper on the infrageneric chemotaxomomy of *Tabebuia* deals with the extent of inter-relationships among the species and the desirability of splitting the gemus.

MATERIALS AND METHODS

The 9 cultivated species of *Tabebuia* Viz. *T. argentea* (Burm. and Schum.) Britt., *T. avallandae* Lorentz. ex Griseb., *T. donnell-smithii* Rose., *T. heptaphylla* (Vell) Toledo., *T. pallida* Miers., *T. pentaphylla* (L) Hemsl., *T. rosea* (Bertol) DC., *T. Spectabilis* Nichols and *T. triphylla* L. were collected from the Indian Botanic Garden, Howrah, Lalbagh Garden, Bangalore or Public Garden, Hyderabad (India). The aerial parts of the above taxa were screened for different classes of secondary metabolites (including the phenolic compounds) and free amino acids by standard phytochemical methods (Gibbs, 1974; Harborne, 1984; Satyavathi, 1988). The unidentified chromatographic spots on different chromatogram with identical Rf values and colour reactions under UV light and with the visualising agents, were assigned codes and designated by the same.

RESULTS

The distribution pattern of various chemical constituents is presented in the Table 1, from which it is evident that there is uniform presence of syringyl radicals and positive activity of the polyphenolase and absence of alkaloids (quinolizidine type), anthraquinones, aurones, cyanogenic glycosides a saponins and triterpenoids/steroids, while there is restricted distribution of aucubin, chalcones flavonols, flavanones, indole type of alkaloids, iridoids (other than aucubin) syringin and tannins (both catechol and hydrolysable types). From among the phenolic constituents there is wide spread incidence of gentisic, p-OH benzoic p-coumaric, caffeic and vanillie acids besides, the unidentified ones. The gallic acid (a precursor of ellagic acid) is observed in *T. argentea* and *T. triphylla*. The distribution pattern of the free protein amino acids in general and their absence in particular is ignored because of their nebulous taxonomic potential. The distribution of unusual and uncommon free and amino acids is recorded as codes a-g.

DISCUSSION

The distribution of different secondary chemical constituents (including the phynolic compounds) and uncommon free amino acids is quantified following Ellison *et al.* (1962) and presented in the Table 2. The paired affinity indices (affinity among pairs of species)

Table 1. Distribution pattern of different chemical constituents

Name of the chemical constituent	1	2	3	4	5	6	7	8	9
ALKALOIDS									
Quinolizidine type									
Indole type			+		+	+	+		
FLAVONOIDS									
Aurones									
Chalcones	+		+					+	
Flavones									
Flavonols		+				+	+		
Flavanones				+	+				+
Proanthocyanidins									
QUINONES									
Anthraquinones									
Napthaquinones (Juglone)			+			+			
TONNINS									
Catechol tannins	+								
Hydrolysible tannis						+			
Ellagic acid	+	+	+		+	+	+		
TERPENOIDS									
Aucubin		+	+			+	+		
Iridoids (other than aucubins)		+	+	+		+	+	+	
Sapoinins									
Triterpenoids/ Steroids									
OTHERS									
Cyanogenic Glycosides									
Polyphenolase a activity	+	+	+	+	+	+	+	+	+
Syringin									
Syringyl radicals	+	+	+	+	+	+	+	+	+
PHENOLIC CONSTITUENTS									
P.OH Benzoic acid		+	+	+	+	+	+	+	+
Caffeic acid	+	+	+	+	+	+	+	+	+
p-coumaric acid	+	+	+	+	+	+	+	+	+
Gallic acid	+								
Gentisic acid	+	+	+	+	+	+	+	+	+
Salicylic acie			+				+		
Vanilic acid	+	+	+	+	+	+	+	+	+
A-27/26		+	+	+	+	+	+	+	+
B-36/75		+							
C-40/30	+	+	+	+		+		+	+
D-48/9	+		+						
E-52/12			+			+	+		
F-61/64			+						
G-62/50		+	+			+	+		
H-66/82	+	+	+		+	+	+	+	
I-68/59	+	+	+	+			+	+	
UNCOMMON AMINOACIDS									
a-4				+					
b-6		+	+						+
c-10	+								
d-28					+				
e-42		+				+			+
f-55	+				+		+	+	
g-75							+		+

Name of the taxon*: *1 = *Tabebuia argentea*, 2 = *T. avallandae*, 3 = *T. donnell-smithii*, 4 = *T. heptaphylla*, 5 = *T. pallida*, 6 = *T. pentaphylla*, 7 = *T. rosea*, 8 = *T. spectabilis*, 9 = *T. triphylla*

Table 2. Synthetic numerical indices

Name of the taxon*	Paired affinity and indices Name of the taxon* 1	2	3	4	5	6	7	8	9	Group affinity indices	Isolation values
1	100	59	63	57	55	51	59	76	50	570	2.7
2		100	76	69	61	82	79	73	65	664	2.7
3			100	61	59	79	76	70	58	642	0
4				100	67	87	63	81	71	656	2.7
5					100	65	67	71	76	621	2.7
6						100	72	59	57	652	2.7
7							100	73	53	642	0
8								100	62	665	0
9									100	592	2.7

*Same as in Table 1

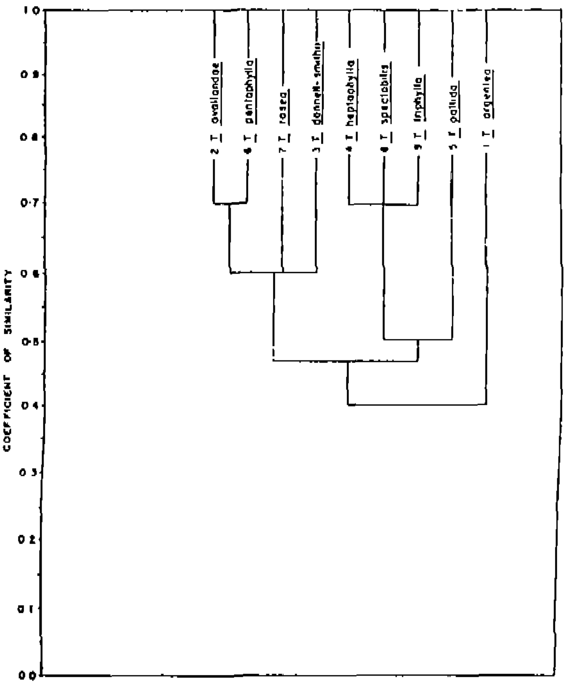

Fig. 1. Dendrogram of cluster analysis based on the coefficients of similarity by weighted pair group method-*Tabebuia*.

range from 55 to 87 and the group affinity indices (affinity of one taxon with all others in question) from 570 to 665. The isolation values (indicative of uniqueness) are very poor. These synthetic numerical indices speak of close ties among the species studied.

The dendrogram (Fig. 1) or cluster analysis (Sneath and Sokal, 1973), based on the Weighted Pair Group

Table 3. Jaccard Coefficient of Similarity

Name of the taxon*	Name of the taxon* 1	2	3	4	5	6	7	8	9
1	1.0	0.4	0.4	0.4	0.4	0.3	0.4	0.6	0.4
2		1.0	0.6	0.5	0.4	0.7	0.6	0.5	0.6
3			1.0	0.5	0.4	0.6	0.6	0.5	0.4
4				1.0	0.5	0.4	0.5	0.7	0.7
5					1.0	0.5	0.6	0.5	0.5
6						1.0	0.6	0.5	0.5
7							1.0	0.5	0.5
8								1.0	0.5
9									1.0

*Same as in Table 1.

Method Average (WPGMA) of chemical features, derived from Jaccard Coefficient of Similarity ($S_J = nJK/nJK + U$, where nJK stands for the number of positive matches between taxa J and K and U for the mismatches) which ranges from 0.3 to 0.7 (Table 3) is suggestive of splitting of the species studied, into 4 clusters at the 50% phenon line. While *T. argentea* and *T. pallida* exhibit their identity, in some chemical features, and stand out as independent clusters, the rest of the species, however, show a marked similarity to be grouped under two clusters.

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