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ALKANES OF FOLIAR EPICUTICULAR WAXES OF VELLOZIACEAE

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Abstract—One hundred and ten species of Velloziaceae were surveyed for the distribution of the alkanes in their foliar epicuticular waxes. Longer chains were found in waxes of representatives of subfamily Barbacenioideae, the main homologues being mostly n-C_{33} or n-C_{35}, except most members of *Pleurostima*, which had n-C_{31} or n-C_{33} as the main alkane. In Vellozioideae, the main alkane was chiefly n-C_{29}. The results support proposals for the establishment of *Burlemarxia* and the re-establishment of *Pleurostima*, but does not lend support to the recognition of Brazilian *Xerophyta* as distinct from *Vellozia* and of *Aylthonia* as distinct from *Barbacenia*. In some cases very small or no differences were noted among the alkane profiles of different specimens of the same species, but in other cases substantial differences were detected.

INTRODUCTION

The Velloziaceae constitute a relatively small family of tropical monocotyledons with most of their species ocurring in Brazil. A large proportion grow in 'campos rupestres', a characteristic ecosystem with rocky or sandy soils and open vegetation on mountain areas of Central and Eastern Brazil [1] Most Velloziaceae grow under conditions of high solar irradiation and low availability of water, especially on sandy soils or with their roots penetrating in crevices of rocks, at altitudes ranging between 900 and 2000 m [2]

In the last 15 years the family has been considered as comprising two subfamilies, the Barbacenioideae Menezes and the Vellozioideae Menezes [3], but there has been much disagreement about the recognition and delimitation of genera and even of subfamilies. For example, while Smith and Ayensu [4] recognize four genera in Barbacenioideae (*Barbacenia* Vand , *Barbaceniopsis* L. B Smith, *Talbotia* Balf, now *Talbotiopsis* L B Smith [5] and *Xerophyta* Juss.) and two in Vellozioideae (*Nanuza* L B. Smith and Ayensu and *Vellozia* Vand.), Menezes splits *Barbacenia* into four genera through segregation of some species to the new genera *Aylthonia* Menezes [3], *Burlemarxia* Menezes and Semir [2], re-establishment of *Pleurostima* Raf [6] and maintenance of the remaining species in *Barbacenia*. In addition, the latter investigator does not recognize the genus *Nanuza*, splits *Vellozia* into two genera by means of segregation of some species to *Xerophyta*, and sinks *Talbotia* (now *Talbotiopsis*), *Nanuza* and *Barbaceniopsis* into synonymy of *Xerophyta* In short, Menezes treatment divides Barbacenioideae into *Aylthonia*, *Barbacenia*, *Burlemarxia* and *Pleurostima*, and Vellozioideae into *Vellozia* and *Xerophyta*; thus there is no agreement as to the delimitation of the subfamilies.

The present paper reports the distribution of foliar epicuticular alkanes of 142 specimens of Velloziaceae, covering 110 species, with the aim of ascertaining their bearing on the taxonomy of the family. The binomials employed are based on the classification of Menezes [2, 3, 6].

RESULTS AND DISCUSSION

The specimens investigated and their taxonomic status are given in Table 1 This table also gives the distribution of the alkanes of their foliar epicuticular waxes Chain lengths range from 18 to 37 carbon atoms, branched-chain homologues being rare and found more commonly in the range of shorter lengths between 18 to 25 carbon atoms Homologues with odd numbers of carbon atoms predominate, as is normally the rule in leaves of angiosperms. However, a remarkable feature of the alkane profile of many Velloziaceae is a high incidence of n-homologues with more than 33 carbon atoms In fact, many species have n-C_{33} or n-C_{35} as the main alkane, a feature quite unusual in angiosperms, which normally present n-C_{29} or n-C_{31} as chief foliar alkanes. Results similar to the ones here presented have been reported only for representatives of a few xerophytic angiosperm families, such as Crassulaceae [9], Euphorbiaceae [10] and Portulacaceae [11]

Many other species of Velloziaceae bear common profiles characterized by n-C_{29} or n-C_{31} as the main alkanes. Taken into consideration the main homologues, either C_{29}–C_{31} or C_{33}–C_{35}, it is possible to recognize two groups of genera, *Aylthonia–Barbacenia–Burlemarxia* with longer chains (90% of the species of the set bearing C_{33} or C_{35} as main alkanes), and *Pleurostima–Vellozia–Xerophyta* (only 30% of the species with C_{33} as main homologue, C_{35} hardly ever found as the predominant alkane). Except for a misplacement of *Pleurostima*, these groups coincide with the generic composition of the two subfamilies of Velloziaceae *sensu* Menezes [2, 3]. Since the morphological and anatomical characteristics of the species of *Pleurostima* leave no doubt as to its proper place among the Barbacenioideae, the alkane chemistry represents support to the re-establishment of the genus [6], especially if it is taken into account that *Pleurostima* can be discerned from other genera by the common possession of either C_{31} or C_{33} as the main alkane In relation to this the species of *Pleurostima* hold an intermediate position between Vellozioi-

Table 1 Distribution of the homologues in the alkane fraction of the foliar epicuticular wax of species of Velloziaceae (figures are given as per cent concentrations, data in parenthesis represent the proportion of branched-chain homologues)

Species	Voucher specimen*	Location	Chain lengths†																		
			18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Aylthonia blackii (L B Smith) N Menezes	Menezes 189	S do Cipó (Minas Gerais)					—	—	—	—	—	—	—	3	t	9	t	42	5	40	1	
A blanchetii (Goet & Henr) N Menezes comb nov ined	Menezes 1011	M do Chapéu (Bahia)				-	-	-					-	5	—	22	2	55	2	13	t	1
A coronata (P F Rav ex L B Smith & Ayensu) N Menezes comb nov ined	Menezes 911	Itambé (Minas Gerais)				2 (2)	8 (5)	5 (3)	3 (2)	1 (4)	1 (2)	1 (1)	t (1)	1	2	23	1	26	2	4	—	—
A gentianoides (Goet & Henr) N Menezes	Giulietti CFCR 1783	Diamantina (Minas Gerais)		t	t	1	1	2	2	4	1	2	1	8	1	11	3	24	4	32	2	1
A gentianoides (Goet & Henr) N Menezes	Menezes 434	S de Cipó (Minas Gerais)					-	-	- -	5	2	6	t	5	t	4	t	35	3	40		
A graminifolia (L B Smith) N Menezes comb nov ined	Menezes CFSC 8231	S do Cipó (Minas Gerais)	-			t	t (t)	t (t)	t (t)	t (t)		1	- -	1	—	2	t	89	1	6	—	- -
A longiflora (Mart) N Menezes comb nov ined	Mello-Silva CFCR 8593	Diamantina (Minas Gerais)	--	-	-	--	-							t	2	3	2	13	8	56	12	4
A luzulifolia (Mart ex Schultes f) N Menezes	Mello-Silva CFCR 9735	S da Piedade (Minas Gerais)						—	—	—	—	—	—	1	t	32	4	58	2	3	- -	
A macrantha (Lemaire) N Menezes	Menezes 491	S do Cipó (Minas Gerais)		-												23	2	74	1	—	—	—
A magalhaesii (L B Smith) N Menezes	Menezes 77	S do Cipó (Minas Gerais)		—	- -	6 (5)	6 (5)	4	3 (2)	3	t	16	t	20	t	9	t	12	t	9		
A pulverulenta (L B Smith & Ayensu) N Menezes comb nov ined	Menezes 1198	S do Cipó (Minas Gerais)										- -	—	—	—	1	1	48	2	46	1	1
A salmonea (L B Smith & Ayensu) N Menezes comb nov ined	Menezes 423	S do Cipó (Minas Gerais)		1 (t)	4 (1)	6 (2)	7 (4)	4 (7)	6 (5)	6 (3)	3 (3)	3	3	5	8	8	2	6	t	3	t	
A tricolor (Mart) N Menezes	Menezes 114	S Tomé Letras (Minas Gerais)							t	t	t	1	t	3	t	6	t	36	3	48	1	2
A tricolor (Mart) N Menezes	Menezes 115	S Tome Letras (Minas Gerais)							2	1	t	1	-	4		13	t	45	1	33		
A umbrosa (L B Smith & Ayensu) N Menezes comb nov ined	Mello-Silva CFCR 8360	Grão-Mogol (Minas Gerais)							-	—	—	1	t	6	1	12	5	26	15	28	3	3
A umbrosa (L B Smith & Ayensu) N Menezes comb nov ined	Mello-Silva CFCR 8368	Grão-Mogol (Minas Gerais)						1	1	t		t		6	t	17	1	29	9	33	3	
Barbacenia conicostigma Goet & Henr	Menezes 306	S. do Cipó (Minas Gerais)		1 (t)	5 (1)	7	6 (4)	3 (3)	4 (3)	4	3	8	3	3	1	6	1	13	2	19	t	
B aff *conicostigma* Goet & Henr	Mello-Silva CFCR 8657	Diamantina (Minas Gerais)		3 (t)	3 (3)	2	t (t)	t (t)	t (t)	t	t	1	2	10	1	10	1	29	4	30	1	t

B aff *curviflora* Goet & Henr	Mello-Silva CFCR 8605	Diamantina (Minas Gerais)	—	1	1 (t)	t (t)	t	2	—	8	t	15	4	11	—	7	t	23	2	26	—	—
B flava Mart ex Schultes f var *flava*	Menezes 44	S. do Cipó (Minas Gerais)	6	22	8	8	4	5	4	20	t	5	1	t	—	t	—	14	—	3	—	—
B flava Mart ex Schultes f. var. *minor* L B Smith	Menezes 866	S. do Cipó (Minas Gerais)	—	t	2	3	7	6	7 (6)	7	3 (3)	4 (1)	3	6 (t)	1	6	1	18	5	10	1	—
B globata Goet & Henr	Mello-Silva CFCR 8201	S. do Cabral (Minas Gerais)	—	—	—	—	—	—	—	1	t	2	1	17	2	23	2	18	4	27	1	2
B ignea Mart ex Schultes f	Mello-Silva CFCR 8648	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	1	—	4	1	7	—	24	1	39	2	21	—	—
B. involucrata L B Smith	Menezes 65	S do Cipó (Minas Gerais)	—	—	2	6 (1)	9 (2)	4 (3)	4 (4)	6 (3)	4	4 (1)	2 (t)	10	1	6	1	25	1	1	—	—
B itabirensis Goet & Henr.	Mello-Silva CFCR 7903	Diamantina (Minas Gerais)	—	6	4 (t)	t (1)	2	t	t	t	t	3	1 (t)	23	t	7	1	43	1	8	—	—
B markgrafii Schulze-Menz ex Markgraf	Mello-Silva CFCR 8338	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	1	—	t	—	4	t	13	1	28	4	46	1	2
B reflexa L B Smith & Ayensu	Mello-Silva CFCR 9654	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	t	—	1	—	4	1	49	4	41	—	—
B aff *reflexa* L B Smith & Ayensu	Mello-Silva CFCR 7838	Pedra Menina (Minas Gerais)	—	t	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	— (t)	t (t)	2	t	23	10	39	6	20	t	—
B rubro-virens Mart	Mello-Silva CFCR 7971	Diamantina (Minas Gerais)	—	2	8 (1)	5	3	2 (3)	1	1 (1)	1 (t)	4 (t)	t	2	t	5	1	41	2	17	t	—
B schwackei Goet & Henr.	Giulietti CFSC 7433	S. do Cipó (Minas Gerais)	—	—	—	—	—	—	—	—	t	9	t	11		13	t	35	2	30	t	—
B. sellowii Goet. & Henr	Braga s n (BHCB 7084)	S. da Piedade (Minas Gerais)	—	t	t	t (t)	t (t)	t (t)	t	—	—	1	13	1	t	4	t	33	4	44	t	—
Burlemarxia pungens N. Menezes & Semir sp nov ined	Menezes CFCR 8833	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	36	1	52	t	10
Bu rodriguesii N. Menezes & Semir sp. nov ined.	Menezes 1089	Gouveia (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100	—	—	—	—
Bu. spiralis (L. B. Smith & Ayensu) N Menezes & Semir comb. nov ined	Menezes 1043	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	31	1	56	2	7
Genus *Pleurostima* sect *Pleurostima*																						
P caricina (Goet & Henr.) N. Menezes	Orsich s n. (SPF 33978)	Terezópolis (R Janeiro)	—	—	—	—	—	2	1	3	1	6	7	29	10	30	3	8	—	—	—	—
P cylindrica (L B Smith & Ayensu) N. Menezes	Silva 479	C Veadeiros (Goiás)	—	—	1	7 (3)	9	8	3	2 (2)	1	t	27	8	2	14	—	13	—	—	—	—
P. delicatula (L. B. Smith & Ayensu) N Menezes	Menezes 795	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	—	—	15	t	77	t	8	—	—
P. gounellaena (Beauverd) N Menezes	Menezes 401	Itatiaia (R Janeiro)	—	1	1 (7)	1 (t)	t	1	t	2 (t)	2	6	10	28	5	31	—	5	—	—	—	—
P minima (L. B. Smith & Ayensu) N. Menezes comb. nov. ined	Menezes 613	S do Cabral (Minas Gerais)	—	t	t	—	t (t)	t (t)	t (t)	t (t)	1 (1)	5	4	59	1	12	t	15	—	3	—	—

Table 1 *Continued*

Species	Voucher specimen*	Location	Chain lengths†																		
			18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
P pabstiana (L B Smith & Ayensu) N. Menezes	Brade 19774	Castelo (Esp Santo)			1	1	2	4	2 (2)	2	t	t	–	24	1	45	1	15	– –		–	—
P spectabilis (L B Smith & Ayensu) N Menezes	Menezes 722	Piúma (Exp. Santo)	–	t	1 (t)	2 (1)	2 (2)	4 (1)	2 (1)	8	6	31	5	15	5	11	1	2	—		—	
P riparia Menezes & Mello-Silva	Mello-Silva CFCR 8400	Grão-Mogol (Minas Gerais)	—	–	—		–	—	t	t (t)	t (t)	t (t)	t (t)	11	4	51	t	34		– –		–
Pleurostima sp nov	Mello-Silva CFCR 9667	Grão-Mogol (Minas Gerais)	–		–				–		–		–	t		36	1	60	t	3		
Genus *Pleurostima* sect *Graziela*																						
P inclinata (Goet & Henr) N Menezes	Menezes 1071	Diamantina (Minas Gerais)		–	t	t	t	2	1	1 (t)	t (t)	t (t)	1	46	3	36	1	9	–		–	
P longiscapa (Goet & Henr) N Menezes	Menezes 564	Diamantina (Minas Gerais)	—	–	–		—	t (t)	t	t (t)	–	t	–	27	t	45		28	–	t	–	
P longiscapa (Goet & Henr) N Menezes	Menezes CFCR 8816	Trinta Réis (Minas Gerais)	–		–		—	–	—	t	t (t)	2	2	74	2	19	t	1	–	–		—
P nuda (L B Smith & Ayensu) N Menezes comb nov ined	—	S do Cipó (Minas Gerais)	– –	–		—		1	t	2	–	1	11	30	6	31	3	15	—	–	–	
P plantaginea (L B Smith & Ayensu) N Menezes comb nov ined	Menezes 635	Garden specim (R Janeiro)	–		t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	6	4 (2)	19 (1)	5 (1)	36	4	22		—		
P plantaginea (L B Smith & Ayensu) N Menezes comb nov ined	Menezes 1203	S do Cipó (Minas Gerais)	—	–		t		t		1		1	t	19	2	40	3	34	–		–	–
P stenophylla (Goet & Henr) N Menezes	Menezes 610	Cristalina (Goiás)			–	t (t)	t (t)	t (t)	t (t)	9	2 (1)	1 (1)	1 (t)	6	t	29	1	49			–	–
Genus *Vellozia* sect *Vellozia*																						
V alata L B Smith	Menezes 68	S do Cipó (Minas Gerais)	–	7 (1)	8 (4)	10 (6)	6 (7)	7 (6)	4 (3)	5	3	3	4	4 (1)	3	4	1	3				
V angustifolia Goet & Henr	Menezes CFCR 9664	Grão-Mogol (Minas Gerais)			–		–		–				1	1		65		33				
V auriculata N Menezes sp nov	Mello-Silva CFCR 7837	Pedra Menina (Minas Gerais)	–	1	1	t	t	t	t	t	t	t	1	14	1	45	t	36	t	1		
V bahiana L B Smith & Ayensu	Menezes 654	Garden specim (R Janeiro)	1	3	3	3	2	2	2	4	2	3	3	3	5	15	9	39	1	–		–
V bahiana L B Smith & Ayensu	Menezes 782	Garden specim (R Janeiro)		–	1	1	1	5	3	8	3	3	5	1	t	14	5	50		–	–	
V bahiana L B Smith & Ayensu	Menezes 898	Medina (Minas Gerais)	–	t	1	1 (1)	1 (2)	1 (1)	6 (1)	5	t	t	t	15	1	29	2	32	t	1		—

V barbata Goet & Henr.	Mello-Silva CFCR 8594	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	4	3	93	t	t	—	—	—	—	—	—	—
V bradei Schulze-Menz ex Markgraf	Mello-Silva CFCR 8351	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	t	—	32	1	65	—	2	—	—	
V brevifolia Seubert	Menezes 295	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	t	t	1	t	57	t	31	t	11	—	t	—	—	
V breviscapa Mart. ex Schultes f.	Mello-Silva CFCR 8629	Diamantina (Minas Gerais)	—	t	1	t	—	t	—	—	—	2	2	20	1	26	1	41	1	5	—	—	
V burle-marxii L B Smith & Ayensu	Harley 19287	M do Chapéu (Bahia)	—	t	9	2 (1)	2 (1)	1 (t)	1 (t)	3	2	22	8	40	1	5	—	1	—	—	—	—	
V caruncularis Mart ex Seubert	Menezes 91	S do Cipó (Minas Gerais)	—	2	3 (2)	4 (1)	2 (2)	2 (1)	1 (1)	8 (t)	t	3	1	22	—	25	—	17	—	3	—	—	
V aff *caruncularis* Mart. ex Seubert	Mello-Silva CFCR 8607	Diamantina (Minas Gerais)	—	—	—	t	t	1	—	t	—	5	9	82	1	2	—	—	—	—	—	—	
V. ciliata L. B. Smith	Mello-Silva CFCR 9061	Itaçambira (Minas Gerais)	—	t	t	—	1	—	1	3	7	13	51	21	2	1	—	—	—	—	—	—	
V compacta Mart ex Schultes f	Menezes CFCR 2869	Ouro Branco (Minas Gerais)	—	—	—	—	1	9 (t)	1 (t)	2	3 (t)	5	10	48	2	19	—	t	—	—	—	—	
V compacta Mart. ex Schultes f.	Mello-Silva CFCR 9737	S da Piedade (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	t	100	—	t	—	t	—	—	—	—	
V coronata L. B. Smith	Furlan CFCR 3364	Diamantina (Minas Gerais)	—	—	—	—	—	t	t	t	—	5	t	40	t	47	t	8	—	—	—	—	
V. coronata L B Smith	Mello-Silva CFCR 8570	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	5	1	83	t	10	—	1	—	—	—	—	
V crassicaulis Mart. ex Schultes f.	Menezes 194	S. do Cipó (Minas Gerais)	—	2 (1)	6 (3)	7 (6)	6 (5)	5 (6)	4 (3)	2 (2)	2 (1)	3	4	15	2	13	—	2	—	—	—	—	
V crinita Goet. & Henr.	Mello-Silva CFCR 9722	Tiradentes (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	t	—	23	—	69	t	8	—	—	
V cryptantha Seubert	Mello-Silva CFCR 8561	Diamantina (Minas Gerais)	—	t	t	t	t	t (t)	t	t (t)	t (t)	2	34	62	1	1	—	—	—	—	—	—	
V. dasypus Seubert	A. Lima s.n. (SPF 34041)	Maraú (Bahia)	—	t	t (t)	t (t)	t (t)	t (t)	t (t)	8	t	t	2	88	t	2	—	—	—	—	—	—	
V. declinans Goet & Henr	Menezes 217	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	t	79	—	18	—	3	—	—	—	—	
V declinans Goet & Henr	Mello-Silva CFCR 9779	Dimantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	1	98	t	1	—	—	—	—	—	—	
V. epidendroides Mart ex Schultes f	Furlan CFCR 3212	Gouveia (Minas Gerais)	—	—	—	—	—	—	—	3	—	—	—	4	—	47	t	44	t	2	—	—	
V. epidendroides Mart. ex Schultes f.	Menezes 213	S. do Cipó (Minas Gerais)	1	2 (1)	3 (2)	4 (2)	5 (3)	5 (2)	4 (5)	8 (2)	3 (1)	9 (1)	11 (1)	23	t	1	—	1	—	—	—	—	
V epidendroides Mart ex Schultes f	Mello-Silva CFCR 8655	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	t	2	25	t	47	t	25	t	1	—	—	
V. everaldoi N Menezes sp nov	Giulietti CFCR 1760	Gouveia (Minas Gerais)	—	10 (4)	6	2 (4)	8 (4)	1 (2)	4 (1)	13	1	t	2 (t)	37 (1)	—	—	—	—	—	—	—	—	

Table 1 *Continued*

Species	Voucher specimen*	Location	Chain lengths†																			
			18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
V. exilis Goet & Henr	Menezes 270	C Veadeiros (Goiás)	3	3	6	6	8	7	6	26	4	7	4	20	t	t	—	—		—		—
V flavicans Mart ex Schultes f	Heringer 12084	Brasília (Dist Fed)	-	-		—		2	1 (1)	2 (1)	t (1)	14 (t)	t	61 (t)	t	17		t			-	
V fruticosa L B Smith	Harley CFCR 6230	Tiúba Réis (Minas Gerais)		t (t)	t	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	t	1	8	3	33	4	44	2	5	t	
V fruticosa L. B. Smith	Menezes CFCR 8813	Tiúba Réis (Minas Gerais)	—	t	t	t	—	—	-	—		2	4	67	1	13	3	10		—		—
V geotegens L B Smith & Ayensu	Mello-Silva CFCR 8700	Datas (Minas Gerais)		—		—		-	-		—	3	1	73	1	22		-	—		—	
V glabra Mikan	Menezes CFCR 3276	Gouveia (Minas Gerais)	-	t (1)	1	1 (1)	1 (1)	2 (1)	1 (1)	2 (1)	1 (1)	5	t	1	t	4	t	38	3	34	t	—
V glandulifera Goet & Henr	Lewis CFSC 7804	S do Cipó (Minas Gerais)	-			—		—		t	t	t	2	3	11	16	20	44	2	2		
V glandulifera Goet & Henr	Mello-Silva CFCR 8677	Diamantina (Minas Gerais)		—			—		—		-	—	t	1	1	18	2	67	1	10		-
V grao-mogolensis L B Smith	Mello-Silva CFCR 8337	Grão-Mogol (Minas Gerais)	-		-					-	-	12	t	60	t	19		9		t		
V harleyi L B Smith & Ayensu	Arraes CFCR 7010	Mucugê (Bahia)				—			—		-	1		95		4			-			
V aff *hatschbachii* L B Smith & Ayensu	Menezes 1028	Guinda (Minas Gerais)					—							1		41	t	56		2		—
V aff *hatschbachii* L B Smith & Ayensu	Mello-Silva CFCR 8659	Diamantina (Minas Gerais)				—		t	-		-	t	t	1	t	36	1	60	t	2	-	
V hemisphaerica Seubert	Mello-Silva CFCR 7414	Piatã (Bahia)	t	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	1	1	40	3	42	1	10	—	2				—
V intermedia Seubert	Thomas CFCR 8701	Datas (Minas Gerais)	-					—				1	1	33	1	32	1	29	t	2	-	
V jolyi L B Smith	Giulietti CFCR 7092	Mucugê (Bahia)		t	1 (t)	1 (t)	1 (t)	t (t)	t (t)	1 (t)	1 (t)	25	6	62	1	1	-			-		—

V leptopetala Goet & Henr.	Menezes 1103	S do Cipó (Minas Gerais)	—	—	—	—	—	23	1	2	t	t	2	5	1	33	1	32	t	t	—	—
V lilacina L B. Smith & Ayensu	Menezes 473	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	2	t	47	t	50	t	1	—	—
V lilacina L B Smith & Ayensu	Menezes 421	S do Cipó (Minas Gerais)			—	—	—	—	—	—	t	t	2	3	2	47	2	43	t	1	—	—
V luteola Mello-Silva & N Menezes	Mello-Silva CFCR 8989	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	t	6	94	t	t	—	—	—	—	—	—
V marcescens L B Smith	Mello-Silva CFCR 8456	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	t	—	14	t	23	1	60	—	2	—	—
V maxillarioides L B Smith	Mello-Silva CFCR 8425	Grão-Mogol (Minas Gerais)	—	t	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	t (t)	1	1	83	2	11	—	2	—	—	—	—
V metzgerae L B Smith	Menezes 175	S. do Cipó (Minas Gerais)	—	—	1	2 (t)	3 (2)	3 (2)	3 (2)	3 (2)	1 (2)	1	—	3	1	29	t	40	t	—	—	—
V nanuzae L. B Smith & Ayensu	Menezes 157	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	7	—	t	—	9	t	40	t	44	—	t	—	—
V nivea L. B. Smith & Ayensu	Mello-Silva CFCR 5458	Pedra Menina (Minas Gerais)	—	3	2 (t)	t (t)	1 (t)	t (t)	t (t)	1	t	14	3	72	t	4	—	—	—	—	—	—
V nuda L B. Smith & Ayensu	Menezes CFCR 8831	Diamantina (Minas Gerais)	2	3	7 (3)	1	t (t)	1	t (t)	t	1	3	12	65	1	1	—	—	—	—	—	—
V patens L. B Smith & Ayensu	Menezes 477	S do Cipó (Minas Gerais)	—	—	—	—	—	—	—	—	—	2	—	37	—	36	—	25	—	—	—	—
V piresiana L B. Smith	Menezes 71	S do Cipó (Minas Gerais)	—	—	2	3	5 (5)	8 (4)	5 (3)	5 (2)	2 (1)	4 (1)	25 (1)	24	—	—	—	—	—	—	—	—
V prolifera Mello-Silva sp nov.	Mello-Silva CFCR 9661	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	—	—	t	10	1	85	t	4	—	—
V aff *pterocarpa* L B Smith & Ayensu	Mello-Silva CFCR 8565	Diamantina (Minas Gerais)	t	t (t)	t (t)	t (t)	t (t)	t	t	2	t	6	3	22	1	58	1	7	t	t	—	—
V pusilla Pohl	Giulietti CFCR 2244	Diamantina (Minas Gerais)	—	—	—	t	t	2 (t)	1	t	t	3	5	86	1	2	—	—	—	—	—	—
V pusilla Pohl	Menezes 962	S. do Cipó (Minas Gerais)	—	—	—	—	t	—	—	t	1	9	8	78	—	4	t	—	—	—	—	—
V spiralis L B. Smith	Mello-Silva CFCR 8491	Grão-Mogol (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	1	t	t	17	t	75	1	6	—	—

Table 1 *Continued*

Species	Voucher specimen*	Location	Chain lengths† 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
V stipitata L B Smith & Ayensu	Menezes 284	S do Cipó (Minas Gerais)	—	1	2 (1)	3	2 (2)	29 (2)	2 (1)	2 (2)	1 (1)	5	t	4	t	10	t	26	t	4	—	—
V subalata L B Smith & Ayensu	Menezes 879	S do Cipó (Minas Gerais)										4		17	t	50	1	27	t	1		
V aff *subalata* L B Smith & Ayensu	Menezes CFSC 9498	S do Cipó (Minas Gerais)											1	28	2	37	1	29	t	2		
V taxifolia (Mart ex Schultes f) Mart ex Seubert	Menezes 66	S do Cipó (Minas Gerais)	—		2	4 (4)	5 (7)	4 (6)	4	2 (2)	1 (1)	3	19	31	—	5	—	—	—	—	—	—
V tenella Mart ex Schultes f	Hensold CFCR 2787	S do Caraca (Minas Gerais)		—	—	—		—	—					3	t	47	1	49				
V variabilis Mart ex Schultes f	Menezes 195	S do Cipó (Minas Gerais)				t		1	t	3	—	t	—	1	1	12	2	66	t	14		
V variabilis Mart ex Schultes f	Menezes 969	Diamantina (Minas Gerais)	1	2	3	2	1 (1)	1 (1)	1	t	t	3	10	63	2	5	—	4	—	—	—	—
V variabilis Mart ex Schultes f	Mantovani CFSC 7785	S do Cipó (Minas Gerais)												1	1	15	2	68	t	13		
V variabilis Mart ex Schultes f	Mello-Silva CFCR 8660	Diamantina (Minas Gerais)										t	2	95	1	2	—	—	—	—	—	
V aff *variabilis* Mart ex Schultes f	Mello-Silva CFCR 8566	Diamantina (Minas Gerais)			2	t	t	t	1	6	5	41	32	13								
V wasshausenii L B Smith & Ayensu	Menezes CFSC 9447	S do Cipó (Minas Gerais)	1	1 (t)	t (t)	1 (t)	t (t)	t		t		2	2	50	t	36		7				
Genus *Vellozia* sect *Radia*																						
V hirsuta Goet & Henr	Mello-Silva CFCR 8606	Diamantina (Minas Gerais)		t	t	t	t	2 (t)		t		4	2	69	5	17		1				
V hirsuta Goet & Henr	Mello-Silva CFCR 8877	Grão-Mogol (Minas Gerais)		t	t (t)	1	t (t)	1 (t)		5	t	16	4	63	1	9	t	t				
V lanata Pohl	Menezes 1004	S Pirineus (Goiás)			4	3	3	3	2	8	1 (1)	6	t	53		9		8				
V markgrafii Schulze-Menz ex Markgraf	Mello-Silva CFCR 8976	Grão-Mogol (Minas Gerais)	—							t		6	3	81	1	9	—					

V. riedeliana Goet. & Henr	Menezes 344	S do Cipó (Minas Gerais)	—	t	1	2	1 (1)	8 (1)	1 (1)	5 (1)	t (t)	8	1	56	t	13	—	—	—	—	—	—
V. riedeliana Goet & Henr	Menezes CFCR 8817	Trinta Réis (Minas Gerais)	—	—	—	—	—	4	t	5	t	15	3	60	t	13	t	t	—	—	—	—
Xerophyta abietina (Mart) Sprengel	Menezes 332	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	1	26	2	26	2	37	2	4	—	—
X abietina (Mart) Sprengel	Menezes 1197	Diamantina (Minas Gerais)	—	—	—	—	—	—	—	—	—	—	2	17	—	17	—	57	1	6	—	—
X cinerascens Mart ex Schultes f	A Lima s.n. (SPF 33239)	Petrolina (Pernambuco)	—	—	—	t	t	t	t	t	t	t	2	26	3	32	2	33	1	1	—	—
X cinerascens Mart ex Schultes f	A. Lima s n. (SPF 33240)	Petrolina (Pernambuco)	-	-	-	-	—	-	—	—	—	—	—	37	2	35	1	25	t	t	—	—
X. cinerascens Mart ex Schultes f	Menezes 777	Garden specim (Pernambuco)	t	t	t	t	t	t	t	t	t	1	5	40	6	29	4	15	—	—	—	—
X. giuliettiae N Menezes sp nov	Menezes 1207	Diamantina (Minas Gerais)	—	1	1	t	t	1	t	6	1	5	4	72	2	6	t	1	—	—	—	—
X minima (Pohl) Baker	Giulietti CFCR 2509	Diamantina (Minas Gerais)	—	2	3	2	1	2	2	2	3	7	30	39	2	4	t	1	—	—	—	—
X minima (Pohl) Baker	Menezes 331	S do Cipó (Minas Gerais)	—	—	—	2	6	9	8	13	4	5	6	35	t	4	—	8	—	—	—	—
X minima (Pohl) Baker	Mello-Silva CFCR 5508	Pedra Menina (Minas Gerais)	—	—	—	—	—	—	—	—	—	1	4	60	1	10	—	22	—	2	—	—
X plicata (Mart.) Sprengel	Krieger 20285	Juiz de Fora (Minas Gerais)	—	—	—	—	—	—	—	—	—	1	—	9	1	54	3	32	—	—	—	—
X plicata (Mart.) Sprengel	Menezes 210	Milagres (Bahia)	—	—	—	—	—	—	—	—	—	—	—	7	1	35	5	49	1	2	—	—
X. plicata (Mart) Sprengel	Menezes 1012	Gentio do Ouro (Bahia)	—	—	—	—	—	—	-	—	—	—	—	12	2	39	3	44	—	—	—	—
X. plicata (Mart) Sprengel	Menezes s n (SPF 34280)	B J da Lapa (Bahia)	—	—	—	—	—	—	—	—	—	—	t	13	3	50	5	29	—	—	—	—
X sellowii (Seubert) Baker	Mello-Silva CFCR 9734	S da Piedade (Minas Gerais)	—	—	—	—	—	—	—	t	1	2	6	89	1	1	—	—	—	—	—	—
X tragacantha Mart ex Schultes f	Menezes 519	S do Caraça (Minas Gerais)	—	—	—	t	t	1	1	2	3	13	16	64	t	—	—	—	—	—	—	—

*CFCR collection Flora of 'campos rupestres'
CFSC collection Flora of Serra do Cipó
† t = traces.

deae (frequently with C_{29} as the main alkane) and the other Barbacenioideae (in general with C_{33} or C_{35} as the main alkane) Similarly, the relatively high amounts of C_{37} (together with the highest amounts of C_{35}, combined with the absence of chains shorter than C_{31}) found exclusively in two of the three species of *Burlemarxia* represent support for the establishment of this genus [2] On the other hand, only smaller differences can be discerned between *Aylthonia* and *Barbacenia*, the species of the latter presenting a higher frequency of alkanes with short chains in the foliar waxes than the species of the former. With regard to the genera of Velloziodeae the alkane chemistry does not support the re-establishment of *Xerophyta* for Brazilian species [2], as no differences can be seen between the general distribution of the foliar alkanes of this genus and that of *Vellozia*

No appreciable differences could be found between the alkane profiles of the species of the two sections of *Pleurostima*. As to the sections of *Vellozia*, the species of section *Vellozia* represent a very heterogenous group, in terms of the alkane chemistry, as compared to the species of section *Radia*, all the species so far investigated of the latter having C_{29} as the main foliar alkane

A preliminary appraisal of the reliability of the alkane profiles as taxonomic markers at the specific and lower hierarchic levels can be provided by the analysis of the results of species for which several specimens were assayed (Table 1) Most of these species show similar profiles of their specimens (e g. *A umbrosa*, *V* aff *hatschbachii* and *V riedeliana*, among others) Some species, however, present rather different profiles (e g. *V epidendroides*, *V coronata* and *V variabilis*) In some species, differences in alkane profiles parallel a great plasticity in gross morphology and/or anatomy, as are the cases of *V epidendroides* and *V variabilis*. But some species that are highly homogenous on morphological and anatomical grounds (*X plicata*, for example) show a plasticity on their alkane profiles similar to those of the 'problematic' species A more comprehensive study of morphological and chemical plasticity and polymorphism in populations of Velloziaceae is clearly necessary to achieve a proper evaluation of alkane profiles as taxonomic characters at the specific and lower hierarchic levels.

EXPERIMENTAL

A number of specimens were collected in areas of 'campos rupestres' in the states of Minas Gerais, Bahia and Goiás (Brazil) Some specimens of *Pleurostima* were collected in the littoral of the states of Rio de Janeiro and Espírito Santo (Brazil) The leaves were air-dried prior to extraction Other specimens were taken from herbarium collections Care was taken to select only specimens that had not been treated with organic solvent for preservation Voucher specimens are deposited in the Herbarium of the Departamento de Botânica, Instituto de Biociências, Universidade de São Paulo (SPF)

Epicuticular waxes were extracted ×3 by rapid immersion (20 sec) of the leaves in $CHCl_3$ Sepn of the alkane fraction was achieved through CC using silica gel and petrol as eluent The distribution of alkanes was determined by FID-GC by comparison of R_ts with those of authentic samples of *n*-alkanes Peaks of minor alkanes with R_ts intermediate between two successive *n*-homologues were assumed to correspond with *br*-alkanes, as (i) several investigations (e g ref [7]) have shown that such alkanes have R_ts slightly earlier than the *n*-homologue with the same number of carbon atoms, and (ii) *br*-alkanes of tobacco wax (see e g ref. [8]) presented the same retention times as some of the above mentioned peaks Chromatographic conditions used a 2 m × 3 mm column packed with 1% OV-101, N_2 at 30 ml/min, temp prog 180° to 280° at 8°/min, temp of inj and det 280°

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