

Idade X Tamanho X Estádio

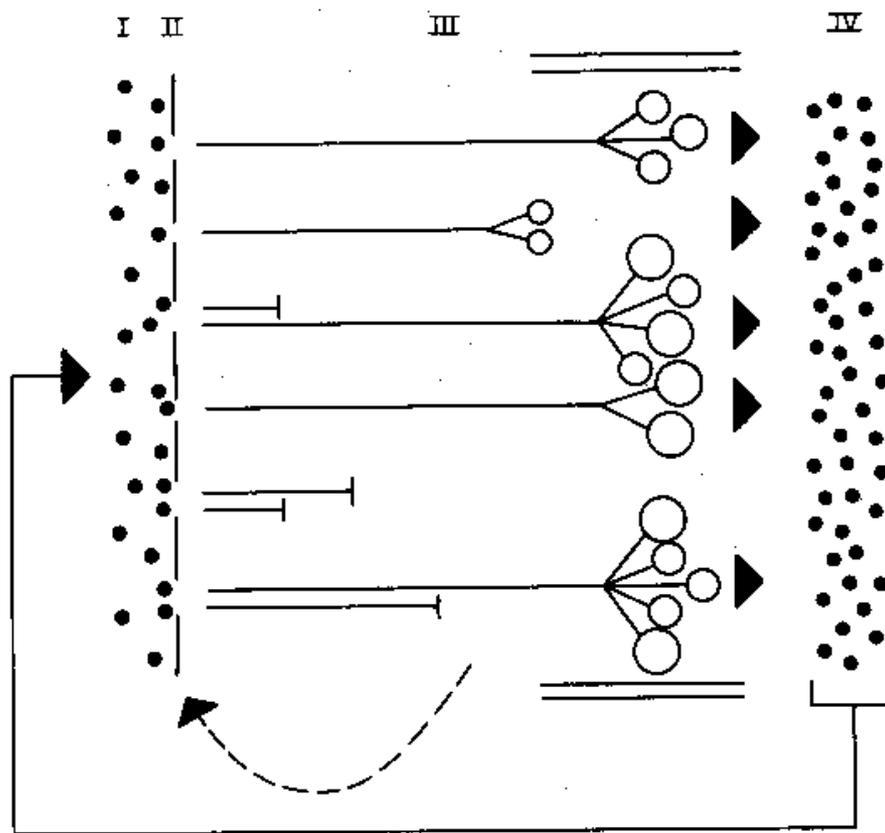


Fig. 1/11a. Elements of the population dynamics of a monocarpic (semelparous) plant.

I = the bank of seeds in the soil

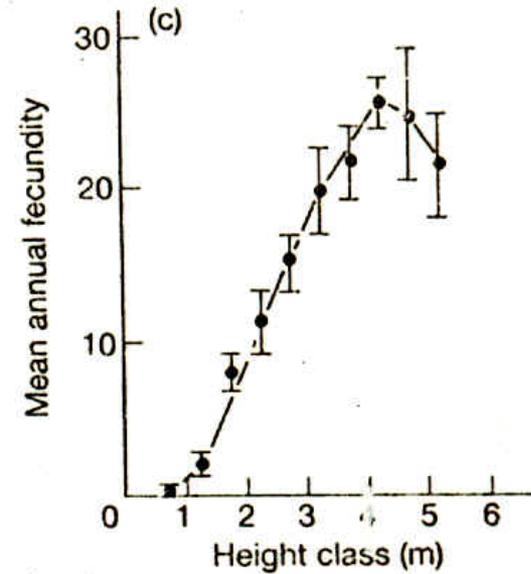
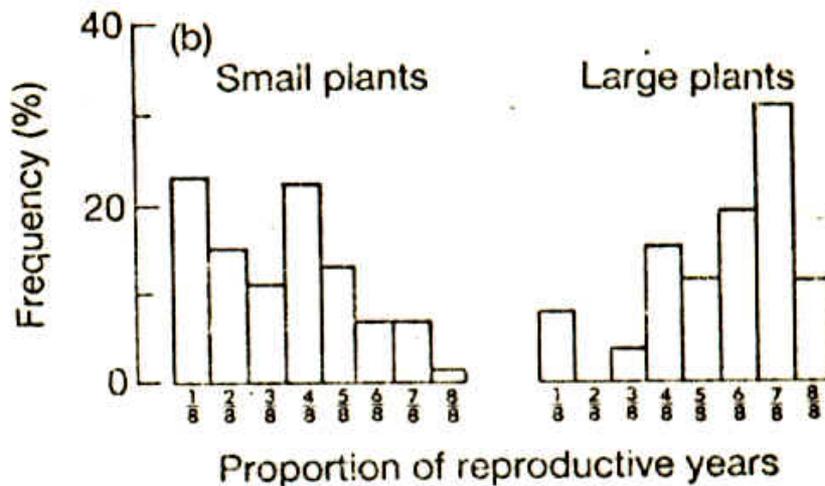
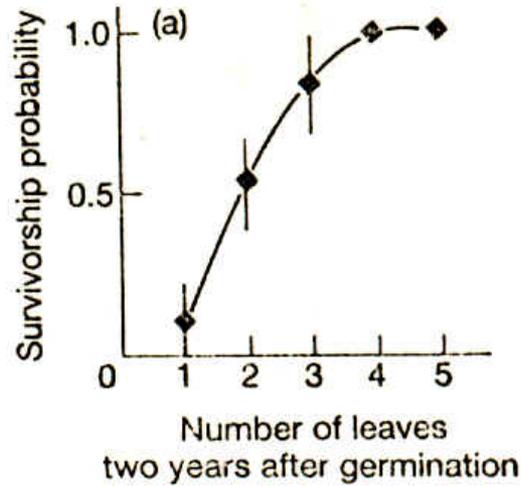
II = the recruitment of seedlings (the environmental sieve).

III = the phase of growth in mass and in number of modular units.

IV = the terminal phase of seed production.

(Adapted from Harper and White, 1971)

Tamanho



Sarukhán, J., Martínez-Ramos, M. & Piñero, D. 1984. The analysis of demographic variability at the individual level and its population consequences. In Dirzo, R. & Sarukhán, J. (eds.). *Perspectives on plant population ecology*. Sinauer, Sunderland. pp. 83-106.

Tamanho



Vochysia thyrsoidea (Vochysiaceae) - Cerrado

Hay, J.D. & Barreto, E.M.J. 1988. Natural mortality of *Vochysia thyrsoidea* in an unburnt "cerrado" near Brasília. *Biotropica* 20: 274-279

Diâmetros (cm)	Mortalidade (%) (Média 1980 a 1984)
0-4,99	0
5-9,99	0,8
10-14,99	2,2
15-19,99	2,3
20-24,99	2,5
25-29,99	3,8
30-34,99	3,9
35-39,99	5,3
40-44,99	3,1
45-49,99	8,3
50-54,99	0

Regressão linear excluindo a classe de diâmetro maior: $r^2=0,77$, $p<0,05$

Tamanho

Taxas de mortalidade (m) por classe de diametro (d). N_0 : número de indivíduos no início do estudo. D : número de indivíduos mortos durante o período (Santos et al. 1996)

d (cm)	N_0	D	m
5 - 10	902	318	0,0391
10 - 15	235	69	0,0313
15 - 20	118	32	0,0284
20 - 25	67	19	0,0300
25 - 30	48	12	0,0259
30 - 35	30	5	0,0164
35 - 40	12	2	0,0164
> 40	9	7	0,0413

Tamanho

Crescimento

$$g_i = (dbh_t - dbh_0) / \Delta t$$

Table 2: Mean annual growth (mm/yr) for trees by size classes of dbh. Means with different letters differ significantly at 5% (Tuckey's test) ($F_{(5,961)} = 6.652$, $p < 0.001$).

classes of dbh (cm)	n	growth (mm/yr)	sd
5 - 10	584	1.03 ^a	2.58
10 - 15	166	1.23 ^{ab}	2.54
15 - 20	86	1.57 ^{abc}	3.33
20 - 25	48	2.45 ^{bc}	4.76
25 - 30	36	2.95 ^c	6.11
> 30	47	3.06 ^c	6.55

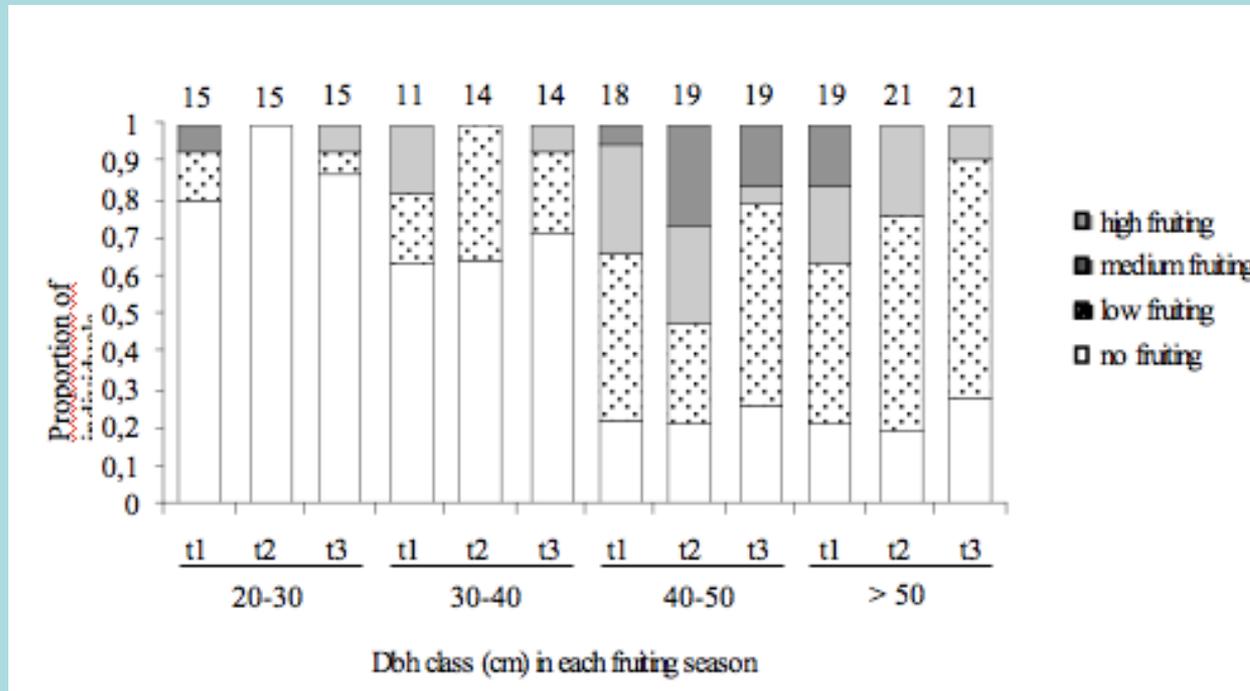
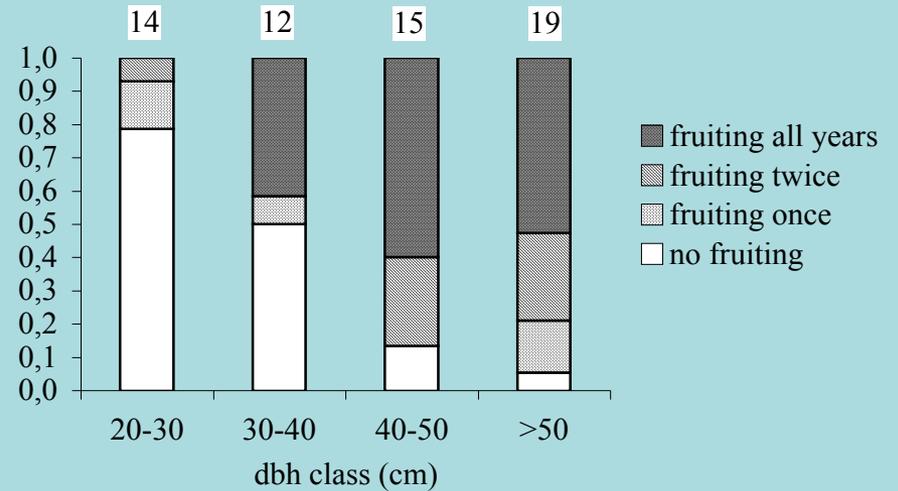
Table 3: Mean annual growth (mm/yr) for trees by ecological group. Means with different letters differ significantly at 5% (Tuckey's test) ($F_{(3,963)} = 32.395$, $p < 0.001$).

Ecological Group	n	growth (mm/yr)	sd
Pioneer	36	6.39 ^a	6.96
Early secondary	461	1.30 ^b	3.49
Late secondary	454	1.04 ^b	2.25
Without classification	16	0.58 ^b	1.43

Tamanho

Chrysophyllum lucentifolium subsp. *pachycarpum*
 Pires and T.D. Penn. (Sapotaceae)

Tese Doutorado - Marisa Gesteira Fonseca



Estádio

Syagrus romanzoffiana (Bernacci 2001)



Figuras 1-11. Estádios ontogênicos de *Syagrus romanzoffiana* (Cham.) Glassman, na floresta paludícola da Reserva de Santa Genebra, Campinas, SP. **Fruto:** 1. endocarpo em corte longitudinal, evidenciando a semente. **Plântulas:** 2. emissão do coleoptile (bainha de proteção); 3. emissão do primeiro eofilo; 4. desligamento da semente e desenvolvimento de raízes. **Juvenil, fase 1:** 5. os eofilos mais novos tomam-se largos (≥ 2 cm). **Juvenil, fase 2:** 6. as folhas mais novas tomam-se semipinactessetas (metafilo); 7. as folhas mais novas tomam-se pinatissectas (nomofilo). **Imaturo:** 8. as bainhas basais caem e deixam o estipe visível; 9. novos entrenós são produzidos e o estipe se alonga. **Virgem:** 10. aparecem as raízes caulígenas; **Reprodutivo:** 11. são produzidas as estruturas reprodutivas, que culminam no fruto. a semente; b poro germinativo; c gibosidade do endocarpo; d peciolo e bainha cotiledonares; e coleoptile; f raiz; g coifa; h eofilo; i bainha foliar; j eofilo largo (≥ 2 cm); k metafilo; l nomofilo; m região em que não é possível distinguir nós e entrenós; n entrenó; o raízes caulígenas; p nó (cicatriz foliar); q cálice persistente no fruto.

Attalea humilis (Souza 2000)

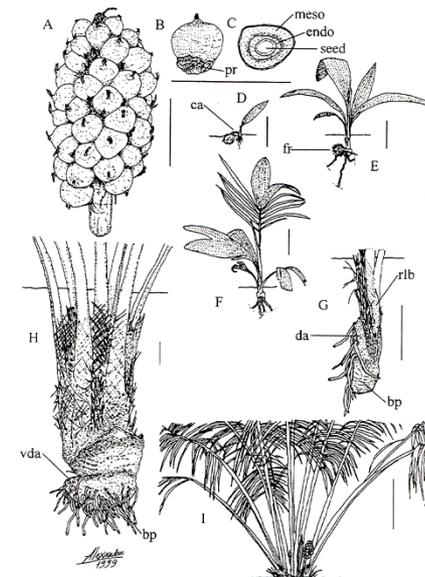


Fig. 1. Ontogenetic stages of *A. humilis humilis*. A) mature infructescence; B) external view of fruit; pr = perianth remains; C) transversal section of fruit; meso = fibrous mesocarp, endo = hardened endocarp; D) recently germinated seedling; ca = extended cotyledonary axis; E) established seedling; fr = fruit remains; F) juvenile, with transitional, but still distichous leaves; G) immature subterranean system; bp = bulbous protuberance, da = descending axis, rlb = reorientated leaf bases; H) reproductive subterranean system, with adventitious roots; vda = vestigial point of insertion of the degenerated descending axis, bp = bulbous protuberance; I) reproductive plant with spiral arrangement of leaves and mature infructescence. Scale bars: 10 cm for Figs. A - H, 1 m for Fig. I.

a)



b)



e)



c)



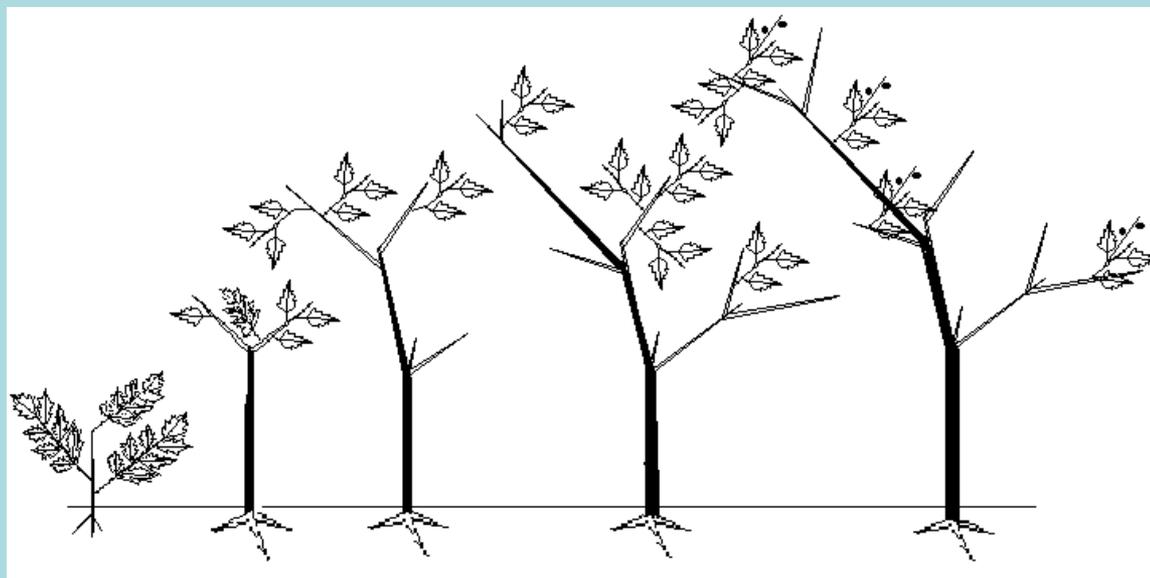
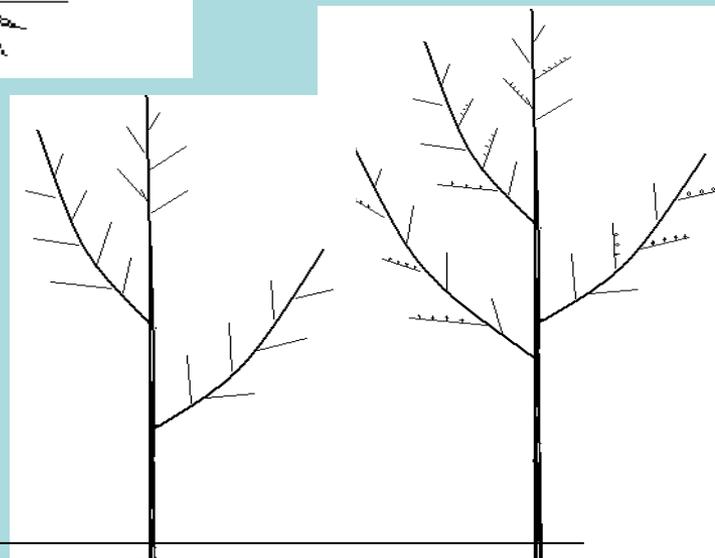
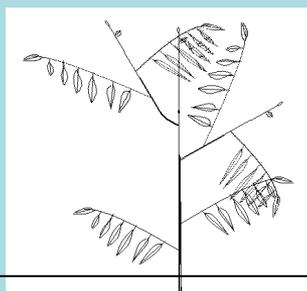
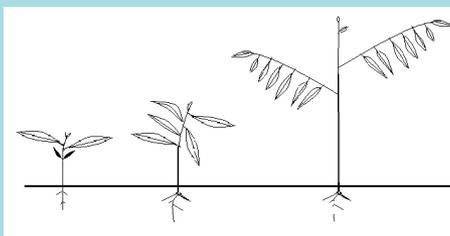
f)



d)



Daniela K. Ferraz. 2004. Ecologia de populações de *Lytrocaryum hoehnei* (Burret) Toledo (Arecaceae) na Reserva Florestal do Morro Grande, Cotia, SP. Tese Doutorado, UNICAMP.

*Roupala montana**Xylopia aromatica*

Aneliza de A.M. Melo. 2004. Tese de Mestrado

Esquema dos estádios ontogenéticos de *Roupala montana* (2.1) e *Xylopia aromatica* (2.2). Sendo A= plântula, B= Jovem 1, C= Jovem 2, D= Imaturo, E= Adulto vegetativo, F= Adulto reprodutivo e setas= reiteração. Em *Xylopia* a partir do esquema D repete-se o modelo arquitetural

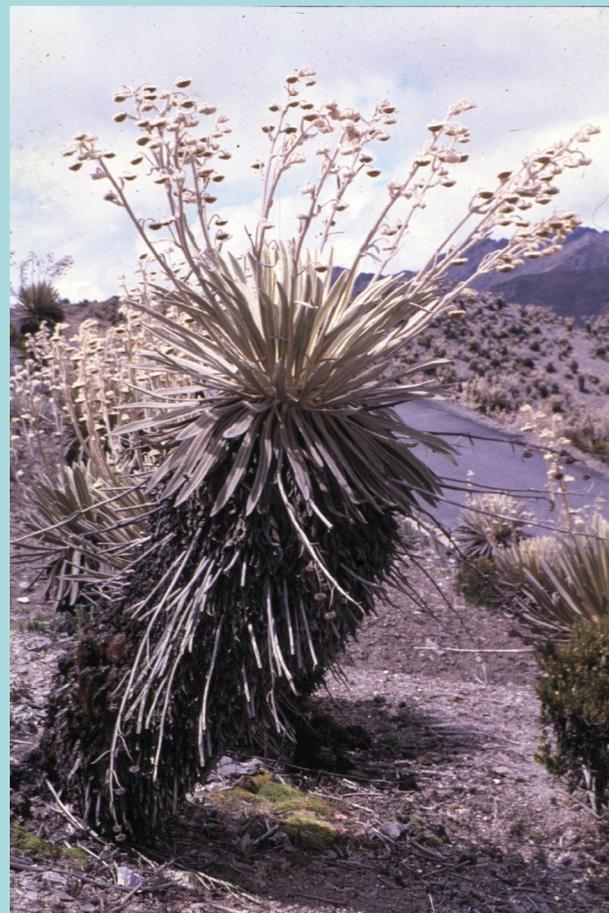
Idade X Tamanho X Estádio



Idade X Tamanho X Estádio



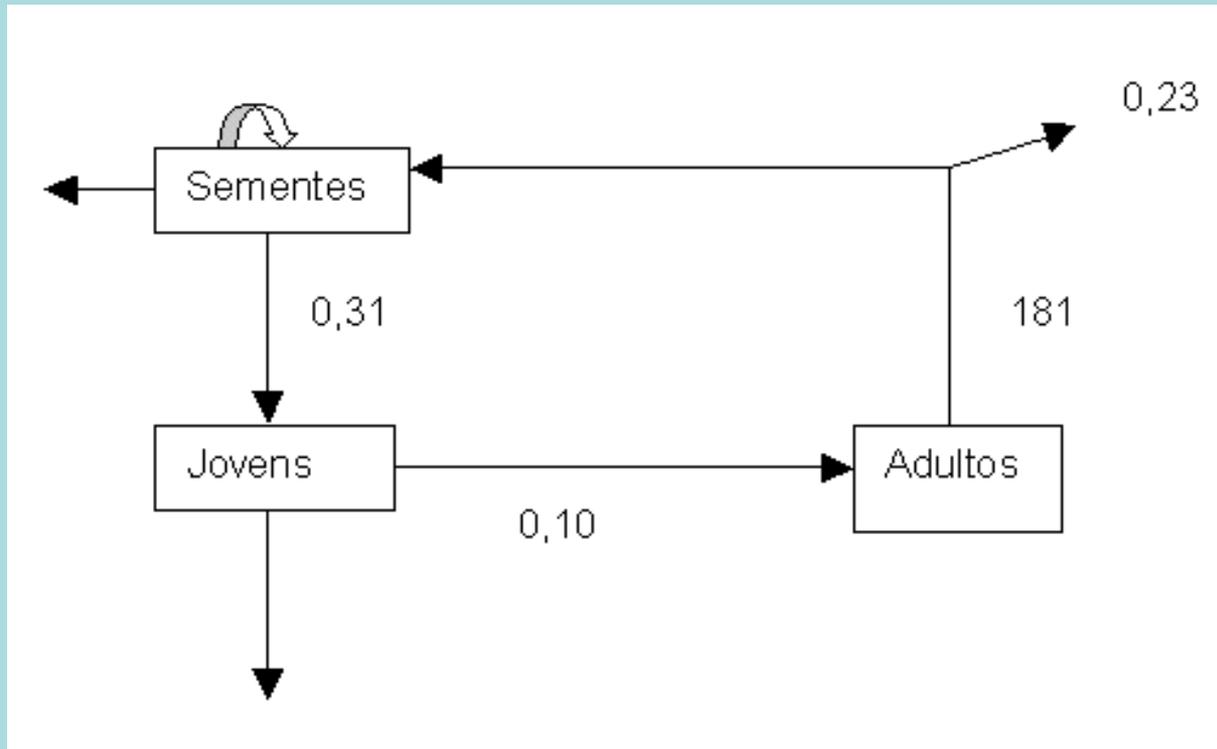
Idade X Tamanho X Estádio



Tabelas de Vida

As tabelas podem ser ainda esquemáticas, permitindo a modelagem de ciclos de vida mais complexos.

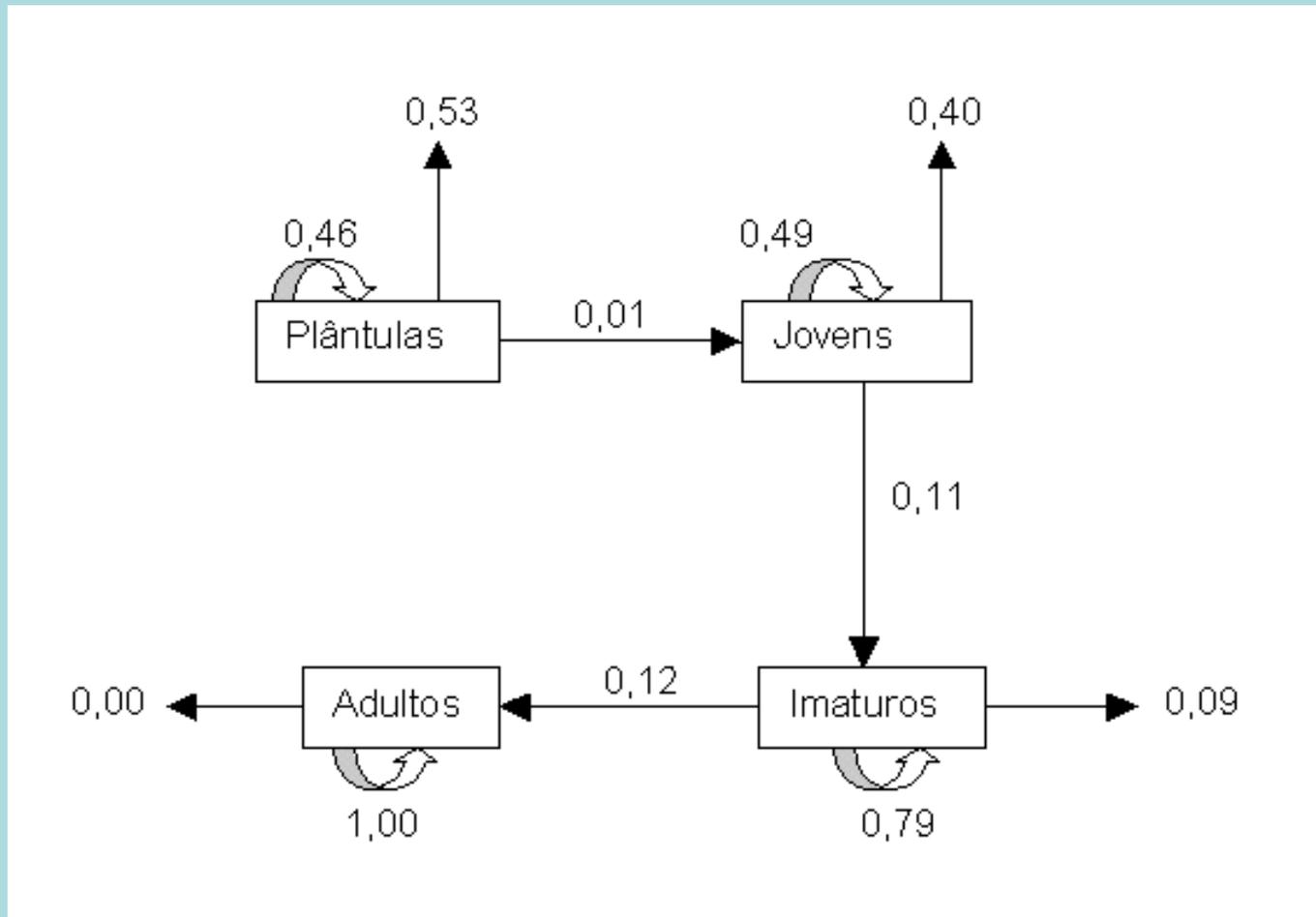
Acanthospermum hispidum (Santos, dados não publicados)



Tabelas de Vida

Exemplos de tabelas de vida esquemáticas:

Calophyllum brasiliense (Fischer & Santos 2001)



Estrutura de Tamanhos

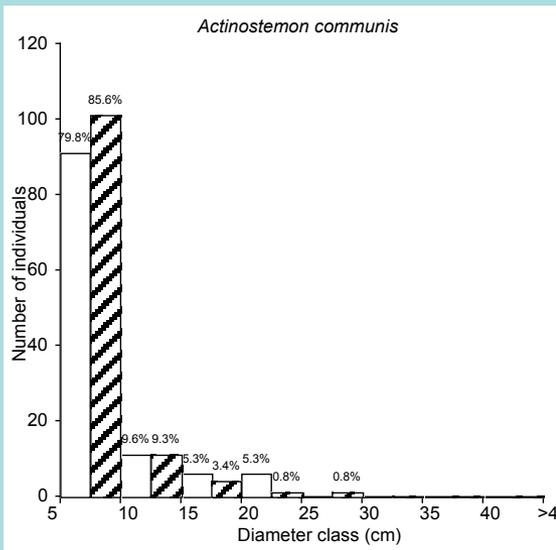
A divisão de classes

Arbitrária? → Relação entre parâmetros de tamanho (diâmetro X altura)

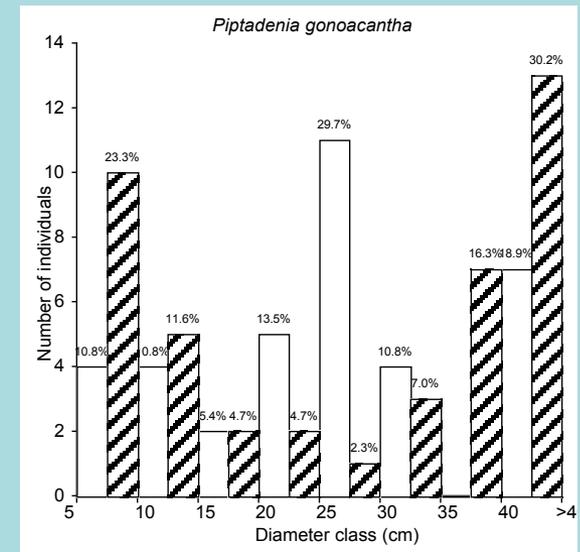
Bongers et al (1988). Vegetatio 74: 55-80

$M = \text{INT}(5 \cdot \log N)$, onde M = número de classes e N = número de indivíduos

Análises:

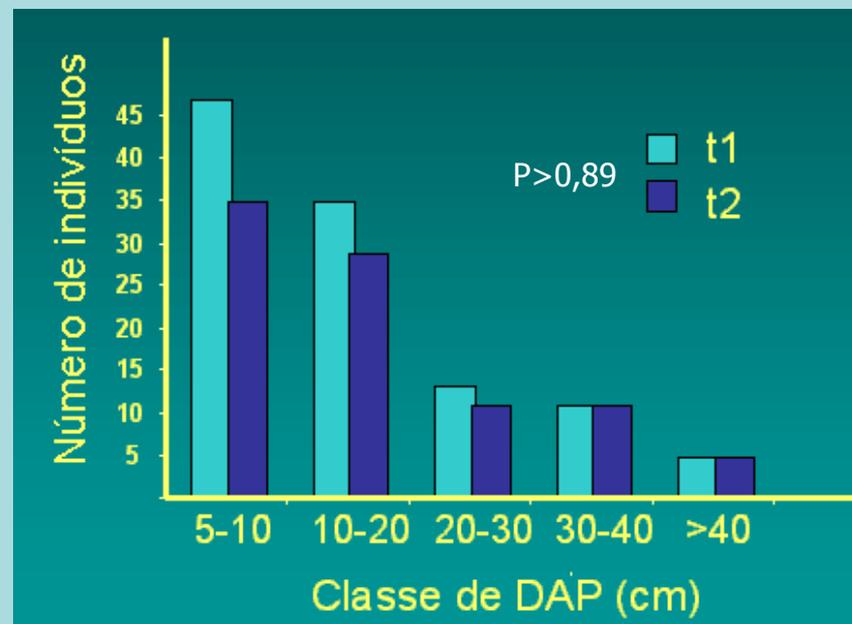
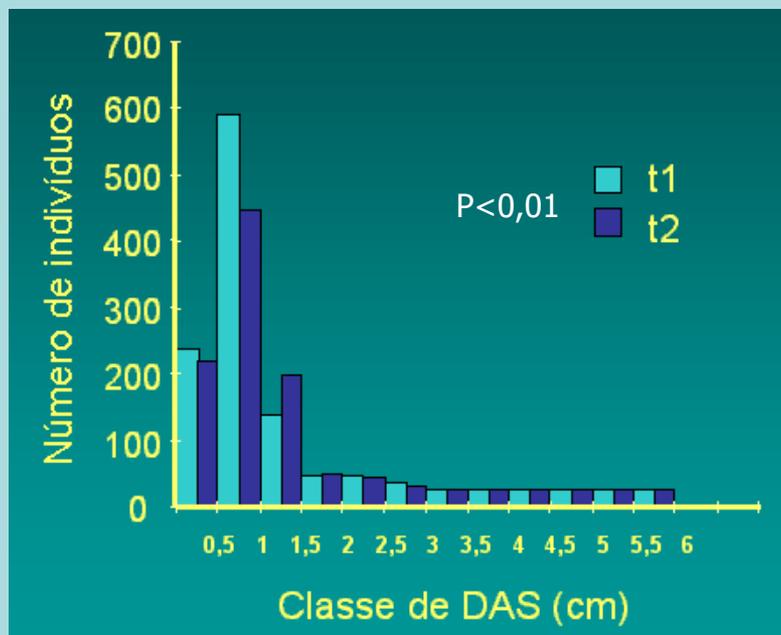


Visual



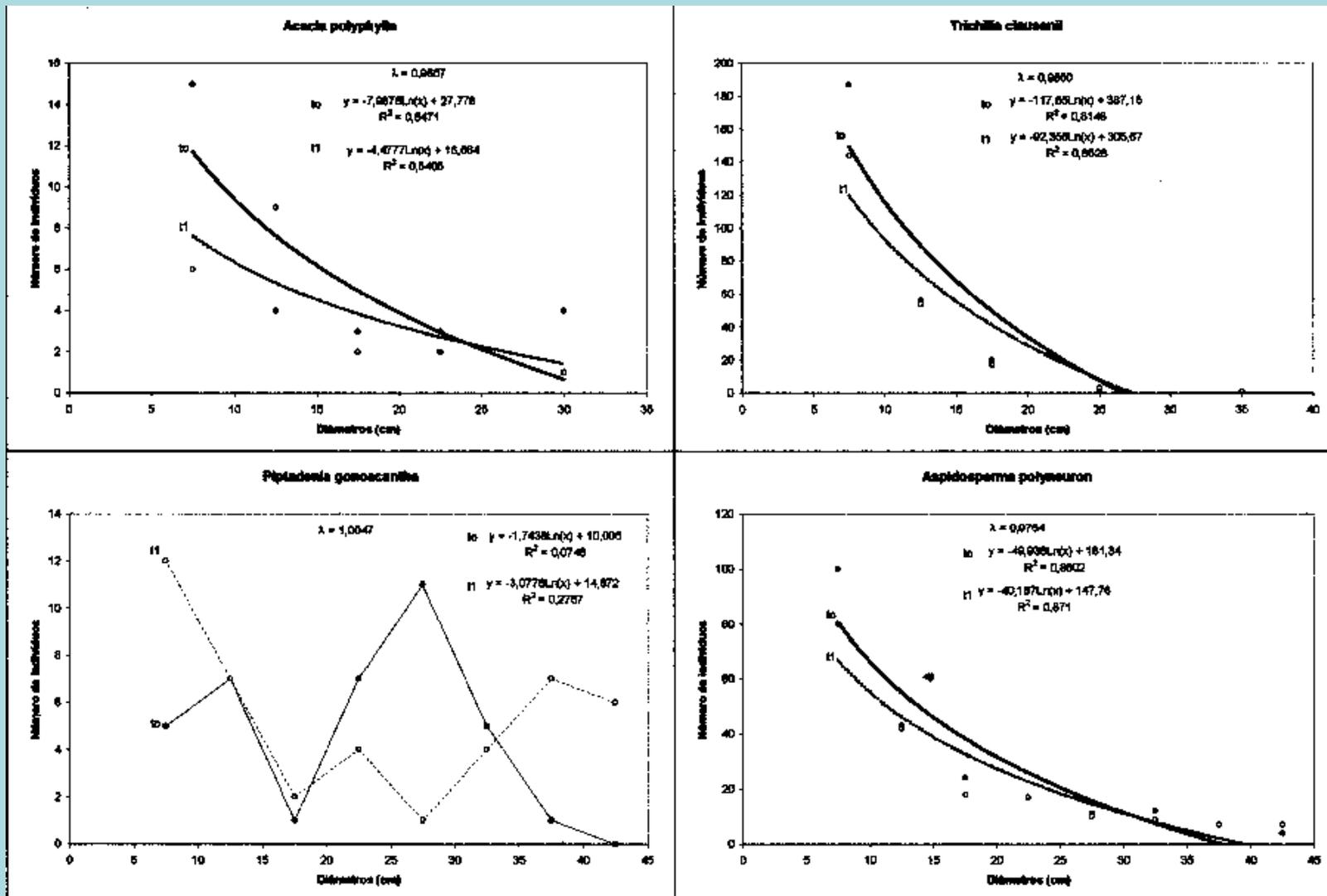
Análises:

Testes estatísticos – Kolmogorov-Smirnov



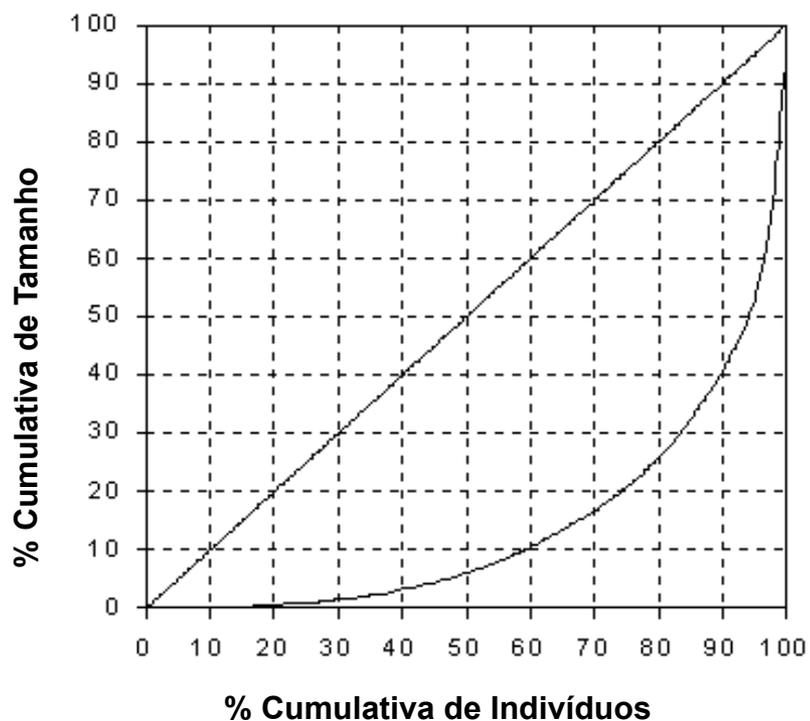
Aspidosperma polyneuron – Mata de Santa Genebra
Fonseca (2001)

Mata de Santa Genebra, SP



Análises:

Curva de Lorenz

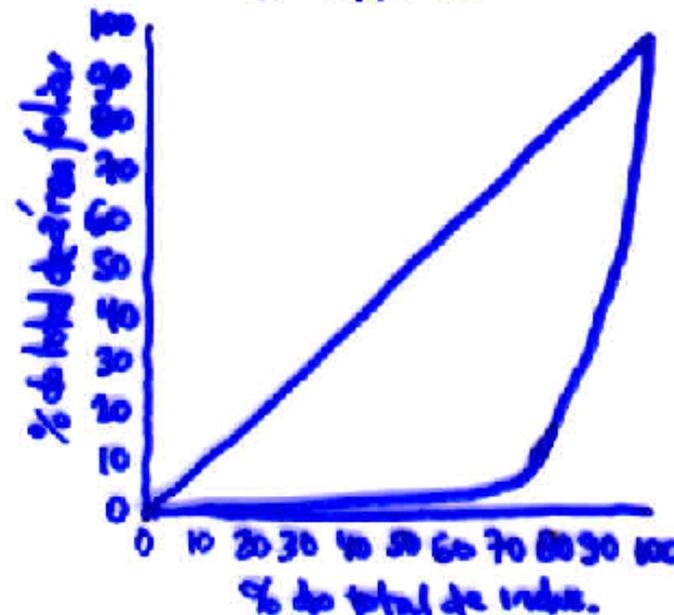


Coeficiente de Gini:

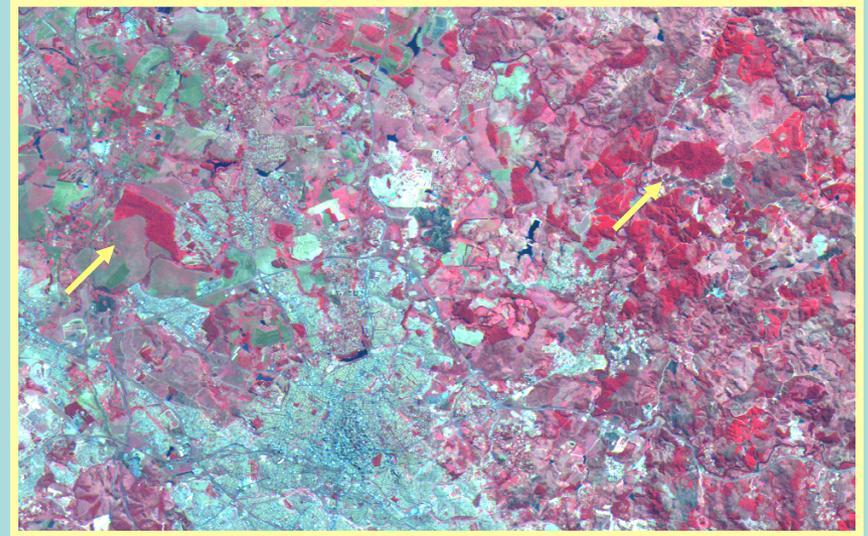
$$G = [\sum \sum (Y_i - Y_j)] / [2n^2 \bar{Y}]$$

Euterpe edulis (Carvalho 1994)

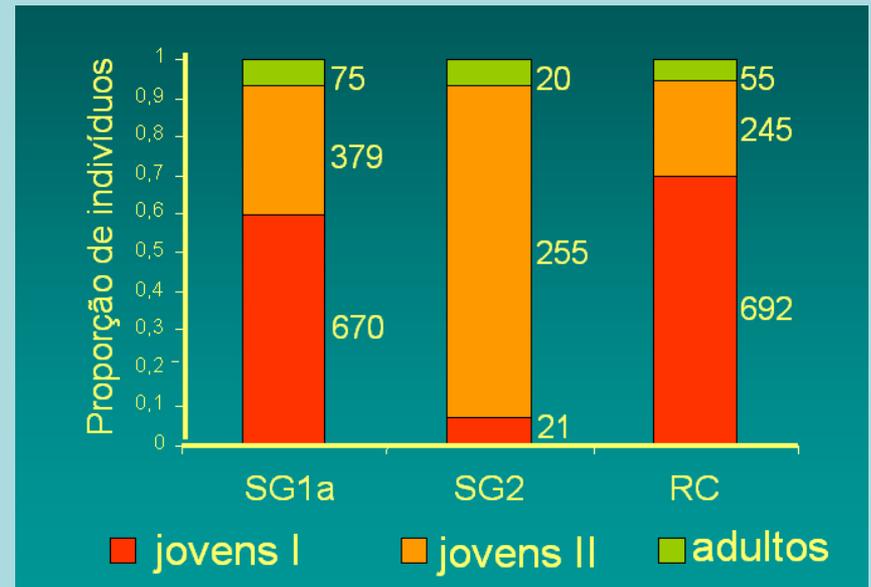
$$G = 0,7703$$



Estruturas – Variações espaciais



Fonseca, M.G. 2001. Aspectos demográficos de *Aspidosperma polyneuron* Muell. Arg. (Apocynaceae) em dois fragmentos de floresta semidecídua no município de Campinas, SP. Tese de Mestrado. UNICAMP



Alometria

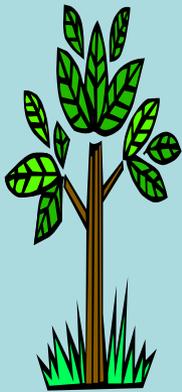
Em termos gerais, alometria pode ser definida como a relação entre variáveis de tamanho de um organismo.

Segundo Niklas (1994), alometria pode ser considerada como o estudo do crescimento de uma parte do organismo em relação ao todo, como o estudo das conseqüências do tamanho na forma do organismo, ou ainda, como a propriedade que certos objetos têm de conservarem sua geometria e forma enquanto eles variam de tamanho. O estudo das relações alométricas é utilizado para descrever relações quantitativas entre mudanças no tamanho de diversos organismos e uma variedade de características morfológicas, fisiológicas, de história de vida ou de comportamento (Harvey & Pagel 1991).

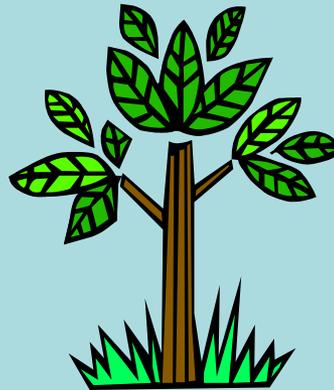
A relação mais utilizada em alometria de plantas é aquela entre o diâmetro do tronco e a altura total da árvore. Com base nesta relação foram propostos vários modelos que procuram explicar como se combinam as forças em um caule, de modo que este se mantenha de pé e sustente uma copa (Sposito 1994). Estes modelos vêm sendo utilizados para se comparar grandes grupos taxonômicos (Niklas 1993), plantas com diferentes alturas (King 1990), plantas pioneiras com plantas de estádios sucessionais mais avançados (Rich et al. 1986) e diferentes espécies de árvores em uma área (King 1995).

McMahon 1970

$$D = 0,1 H^{3/2}$$



similaridade geométrica
 $b = 1,0$

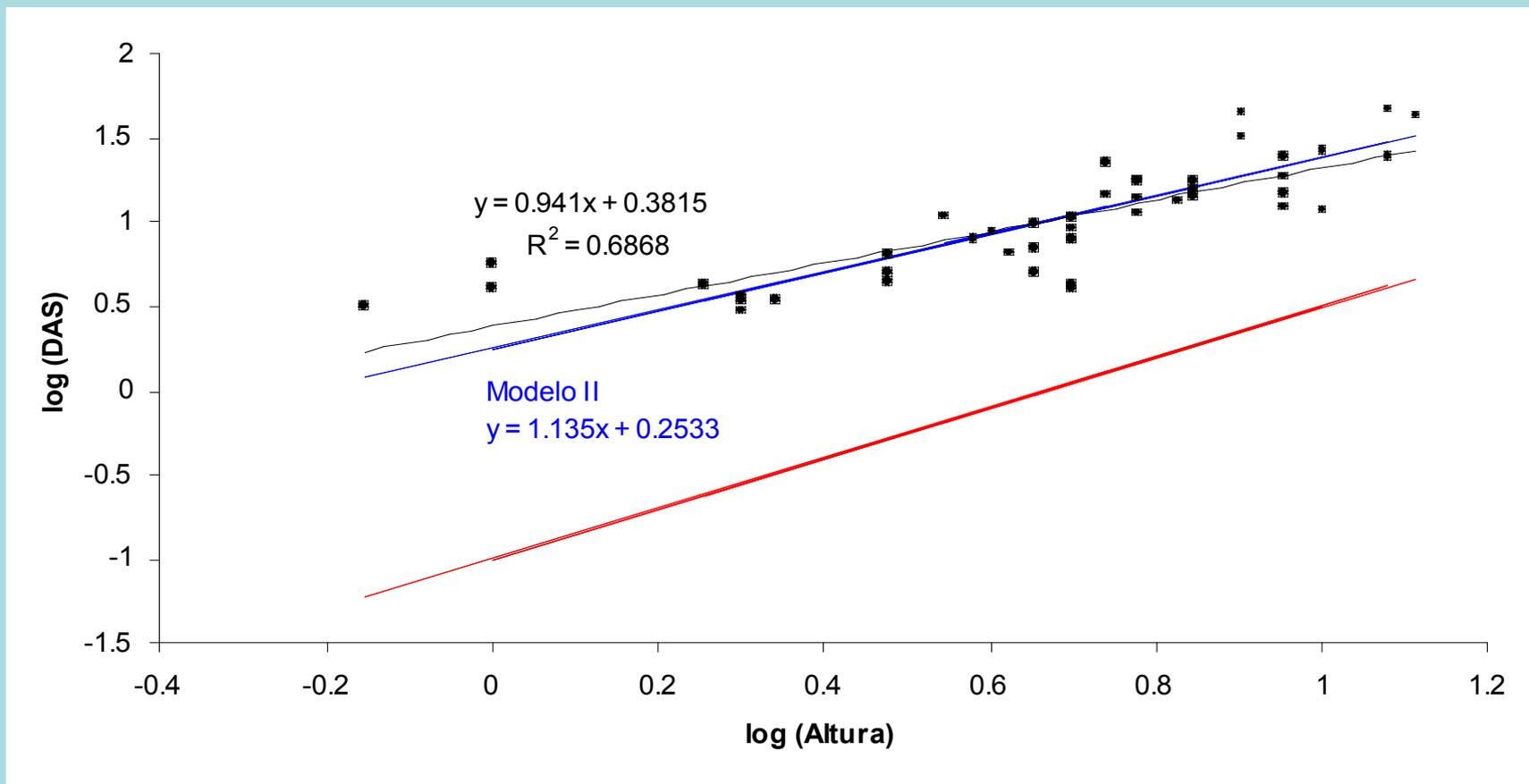


similaridade elástica
 $b = 1,5$



similaridade estresse
 $b = 2,0$

Espécies lenhosas – Cerrado – Valério



Sposito, T.C. & Santos, F.A.M. 2001.
Scaling of stem and crown in eight
Cecropia (Cecropiaceae) species of
Brazil. American Journal of Botany 88
(5): 939-949.

Sposito, T.C. & Santos, F.A.M. 2001.
Architectural patterns of eight
Cecropia (Cecropiaceae) species of
Brazil. Flora 196: 215-226.

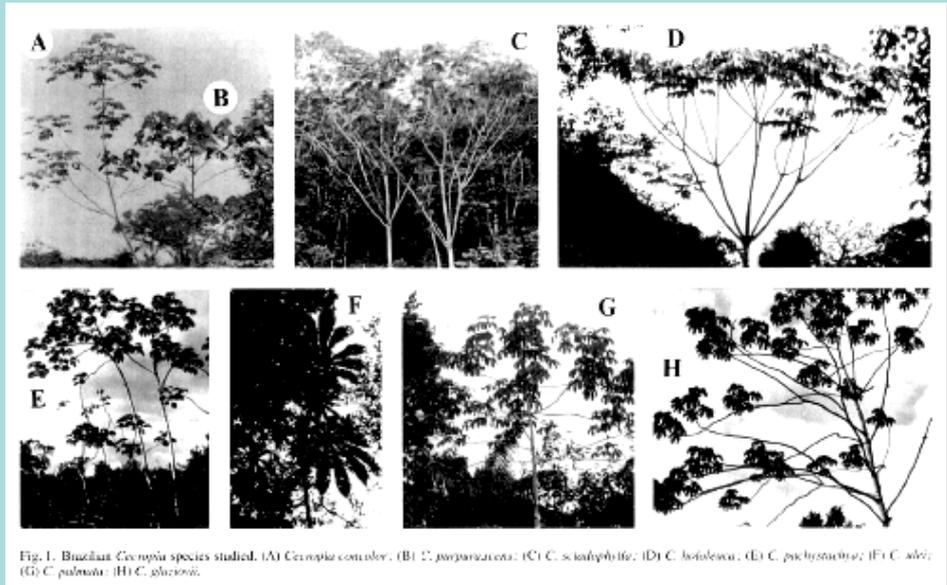
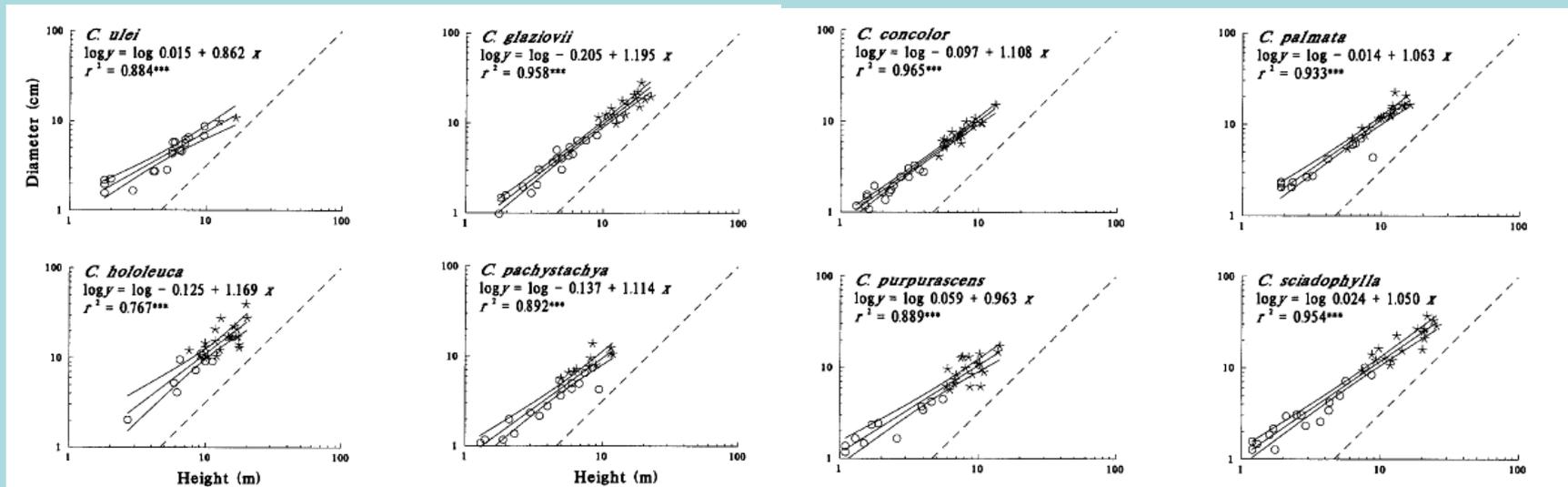
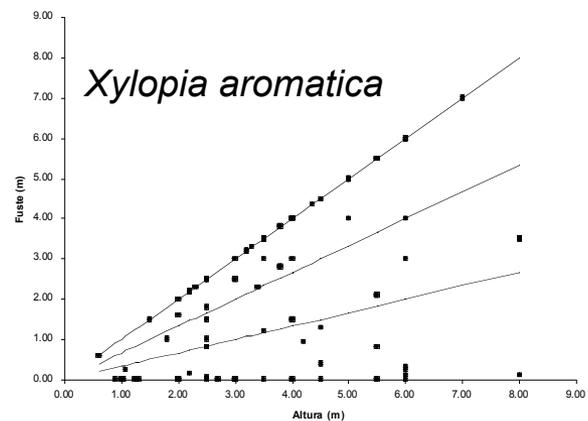
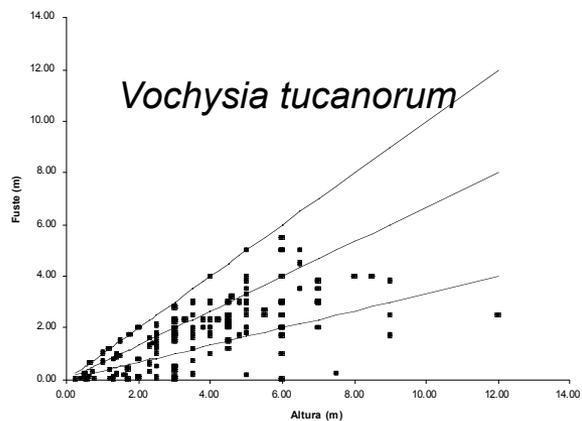
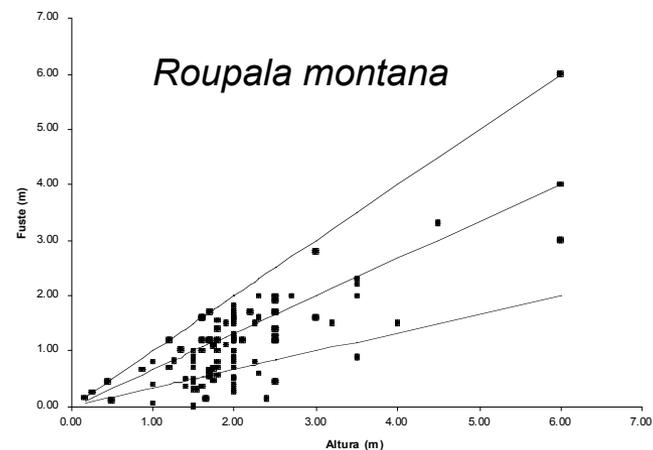
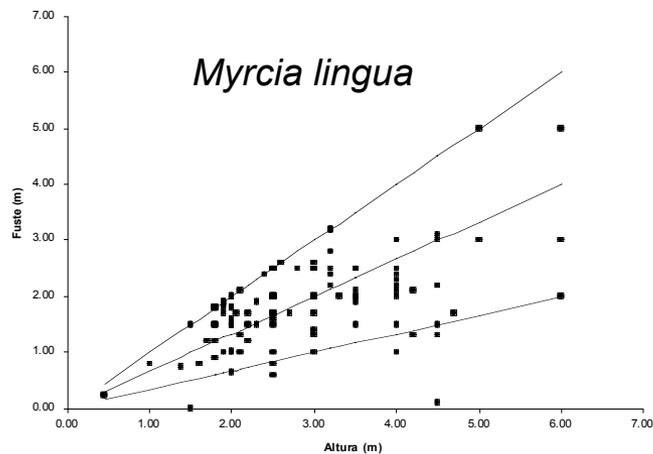


Fig. 1. Brazilian *Cecropia* species studied. (A) *Cecropia concolor*; (B) *C. purpurascens*; (C) *C. sciadophtylla*; (D) *C. hololeuca*; (E) *C. pachystachya*; (F) *C. ulai*; (G) *C. palmata*; (H) *C. glaziovii*.



Santos, Martins & Tamashiro (dados não publicados). Relação entre altura total e altura do fuste para 4 espécies arbóreas de cerrado. Itirapina, SP



Holbrook & Putz (1989). American Journal of Botany 76: 1740-1749

Liquidambar styraciflua (Hamamelidaceae)



Liquidambar styraciflua (Hamamelidaceae)

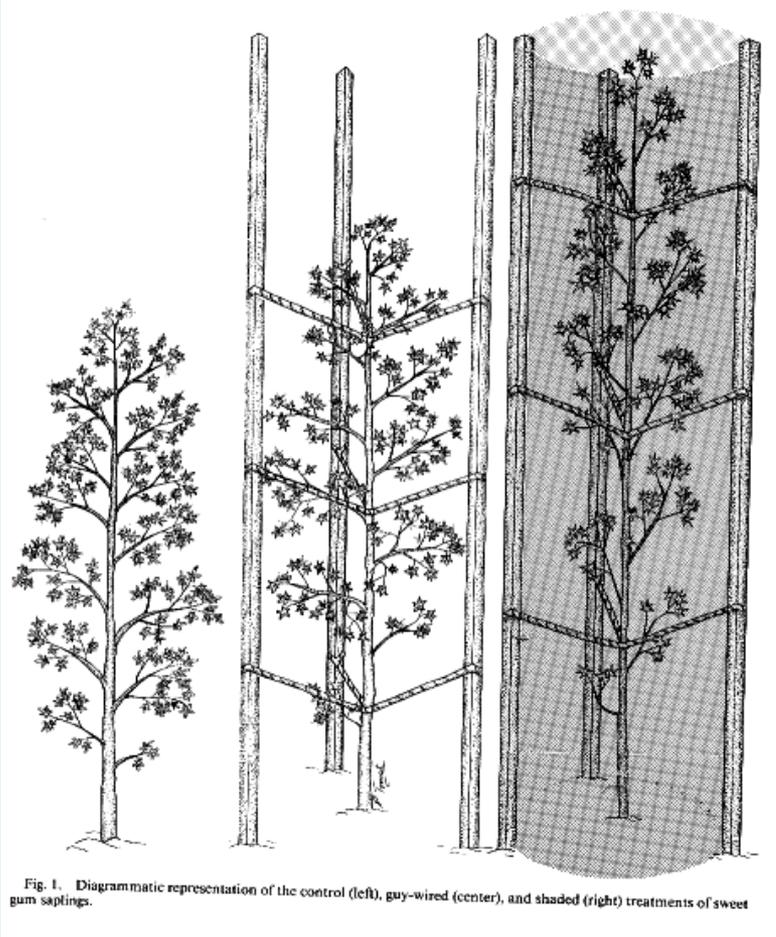
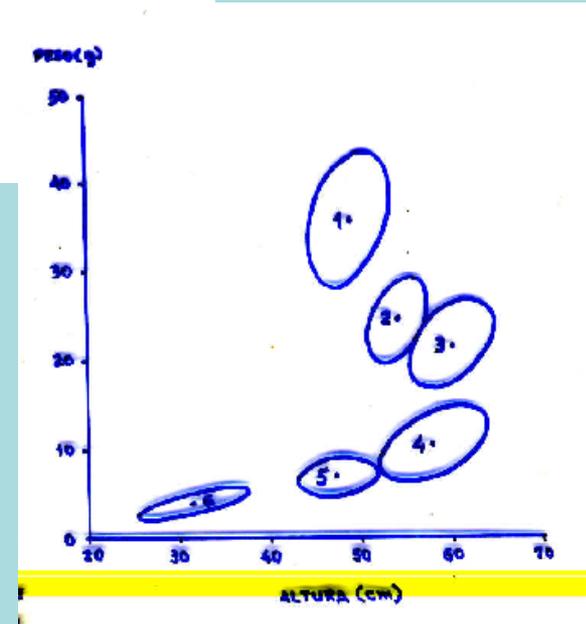
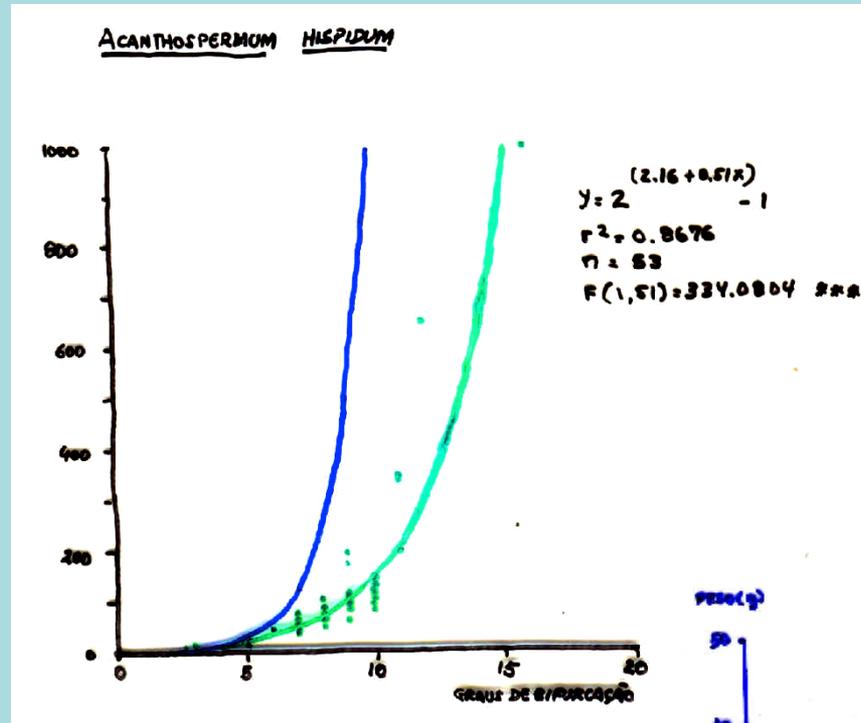


Fig. 1. Diagrammatic representation of the control (left), guy-wired (center), and shaded (right) treatments of sweet gum saplings.

TABLE 2. Comparison of the critical buckling dimensions of experimentally grown sweet gum trees calculated according to five allometrical models. Note that saplings enclosed in shade cloth cylinders were also guy-wired. Means ($N = 8$ trees per treatment) with different superscripts are significantly different ($P < 0.05$) according to ANOVA followed by multiple comparisons (t method, Sokal and Rohlf, 1981, p. 246). Standard errors are noted in parentheses below the means

Model		Treatment		
		Control	Constrained	Shaded
Greenhill (1881) I	% critical height	69.7 ^a (2.44)	80.9 ^b (2.58)	106.8 ^c (2.63)
Greenhill (1881) II	% critical height	44.6 ^a (1.56)	51.8 ^b (1.65)	68.4 ^c (1.68)
Gere and Carter (1963)	% critical height	49.6 ^a (2.92)	62.4 ^b (2.89)	116.1 ^c (5.39)
King and Loucks (1978)	% critical diameter	182.7 ^a (8.54)	140.7 ^b (6.99)	77.2 ^c (3.22)
Holbrook and Putz (this paper)	% critical height	76.7 ^a (1.87)	85.2 ^b (2.37)	113.8 ^c (2.09)
	% critical diameter	115.7 ^a (1.49)	110.0 ^b (1.81)	92.9 ^c (1.05)

Santos, F.A.M. (dados não publicados). *Acanthospermum hispidum*

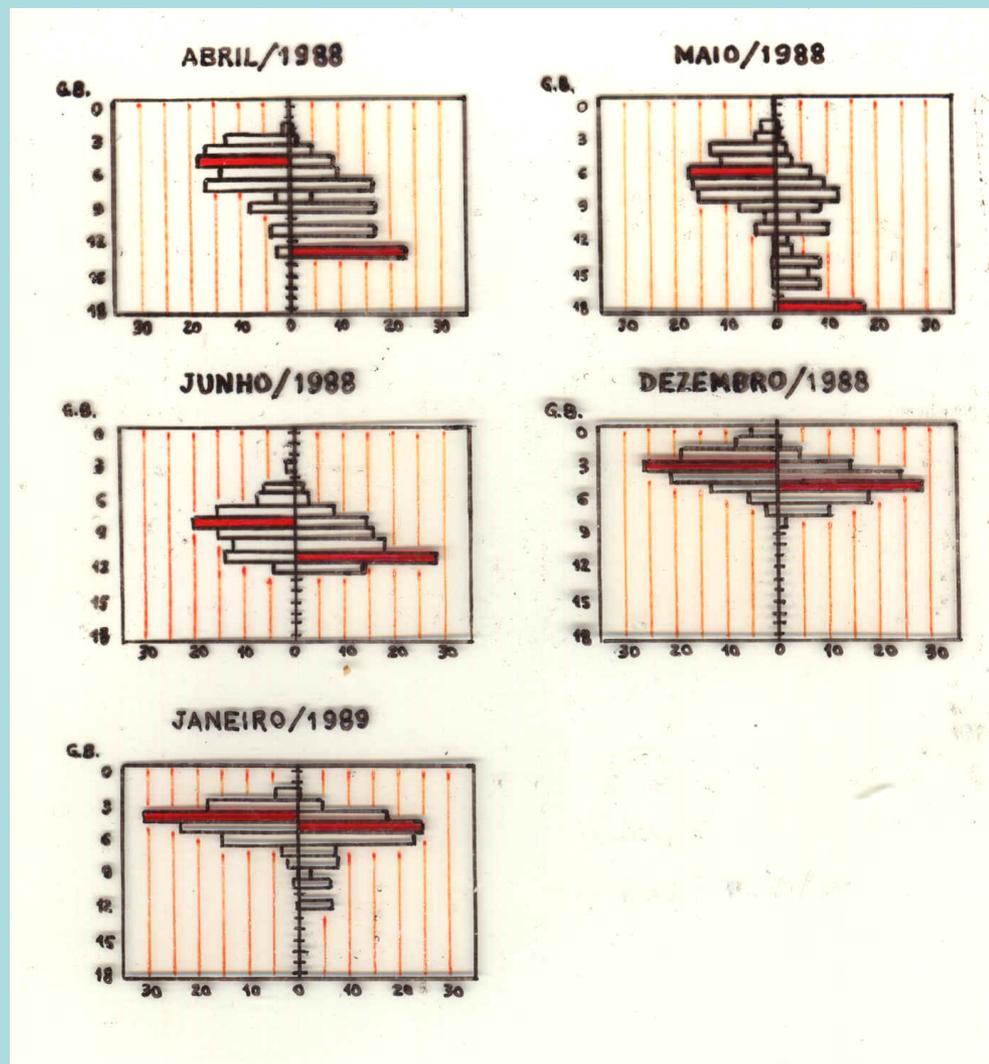
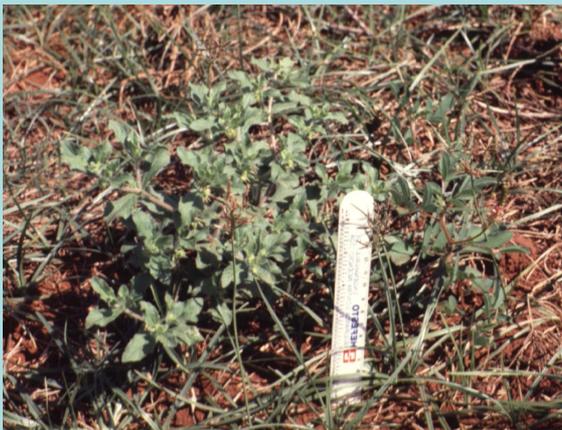


Acanthospermum hispidum DC.

(Compositae). Número de indivíduos por classe de tamanho (graus de bifurcação – GB) e número de sementes produzidas pelos indivíduos de cada classe de tamanho.

– Plantação de algodão – IAC, Campinas.

(Santos, F.A.M., dados não publicados).



Young, T.P. & Perkocha, V. 1994. Treefalls, crown asymmetry, and buttresses. *Journal of Ecology* 82: 319-324.

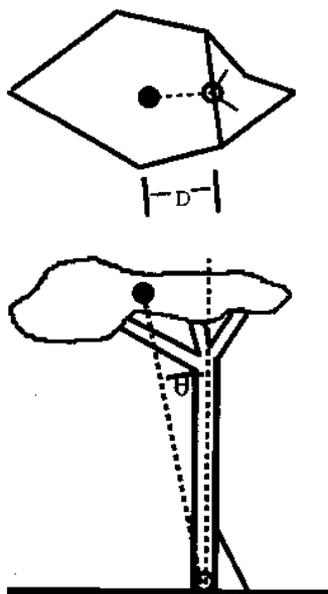


Fig. 1 Measurements made on trees (see text). The vertical projection of crown area is shown above a profile of the tree, with the open circle indicating the location of the base of the bole. The solid circle represents the centre of area of the projected crown. *D* is the distance between these two points. Θ is the angle between vertical and the centre of crown area. The solid line passing through the open circle in the crown projection is the line of maximum asymmetry. The two shorter lines represent the orientations of the two largest buttresses.

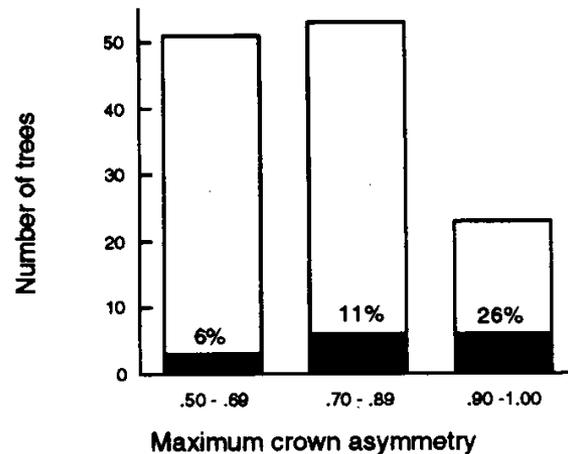


Fig. 3 The number trees with different crown asymmetries in February 1987 (open bars), and the number and percent of those trees that fell between February 1987 and September 1993 (solid bars).

$$\text{Assimetria máxima} = A_{\text{max}}/A_{\text{total}}$$

0,5 = simetria
1,0 = completa assimetria

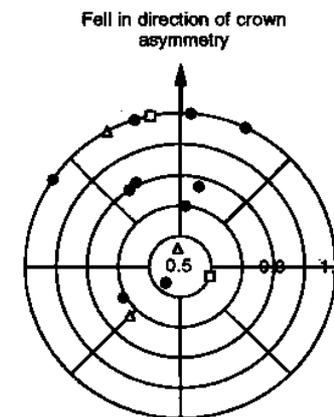


Fig. 4 Treefall direction relative to the direction and severity of crown asymmetry (Panama). Trees that fell in the same exact direction as their centre of crown mass would lie on the line directly above the centre; those falling away from the direction of the centre of crown mass would lie on the line directly below the centre. The distance from the centre is proportional to maximum crown asymmetry (a value of 0.5 represents symmetrical crowns). Solid circles represent 'normal' treefalls; open triangles represent trees that died standing and fell later often after sloughing branches; open squares represent trees that were brought down by larger trees falling into them.