Universidade de São Paulo
Escola Superior de Agricultura “Luiz de Queiroz”
LCB5735 - Anatomia Vegetal

Adaptações anatômicas foliares: folhas homobáricas e heterobáricas de diferentes ambientes; absorção foliar de água

Camila Karen Candeira da Silva
Ester Marques M. Teixeira
Jonata Freschi

ARTIGOS ESCOLHIDOS

ESALQ

Ecology | Free Access

Should structure–function relations be considered separately for homobaric vs. heterobaric leaves?†

Vally Liakoura, Mariangela N. Fotelli, Heinz Rennenberg, George Karabourniotis

ARTIGOS ESCOLHIDOS

Plant Physiol. 2022 Sep; 190(1): 113–126.
Published online 2022 May 27. doi: 10.1093/plphys/kiac251
PMCID: PMC9434155
PMID: 35639975

Auxin-driven ecophysiological diversification of leaves in domesticated tomato

Juliene d R Moreira, Bruno L Rosa, Bruno S Lira, Joni E Lima, Ludmila N F Correia, Wagner C Otoni, Antonio Figueira, Luciano Freschi, Tetsu Sakamoto, Lázaro E P Peres, Magdalena Rossi, and Agustin Zsögön

ARTIGOS ESCOLHIDOS

ESALQ

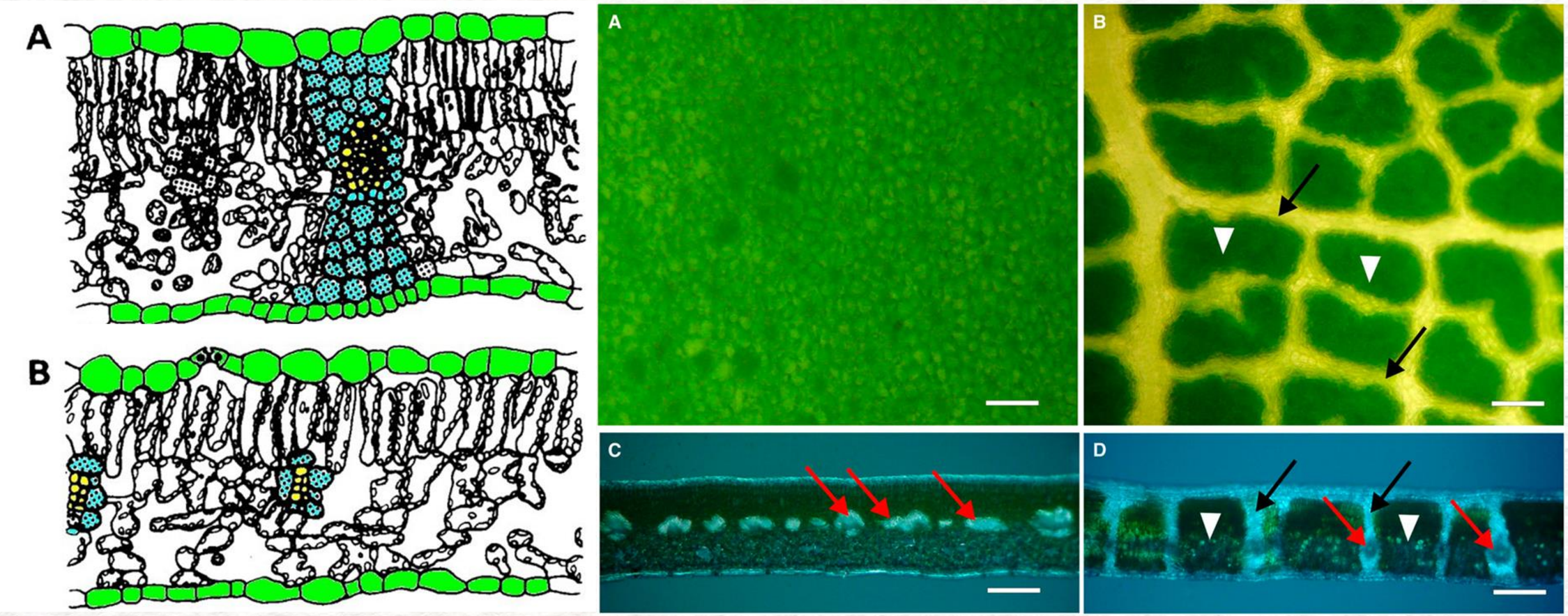
New Phytologist

Full paper | Free Access

Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae)

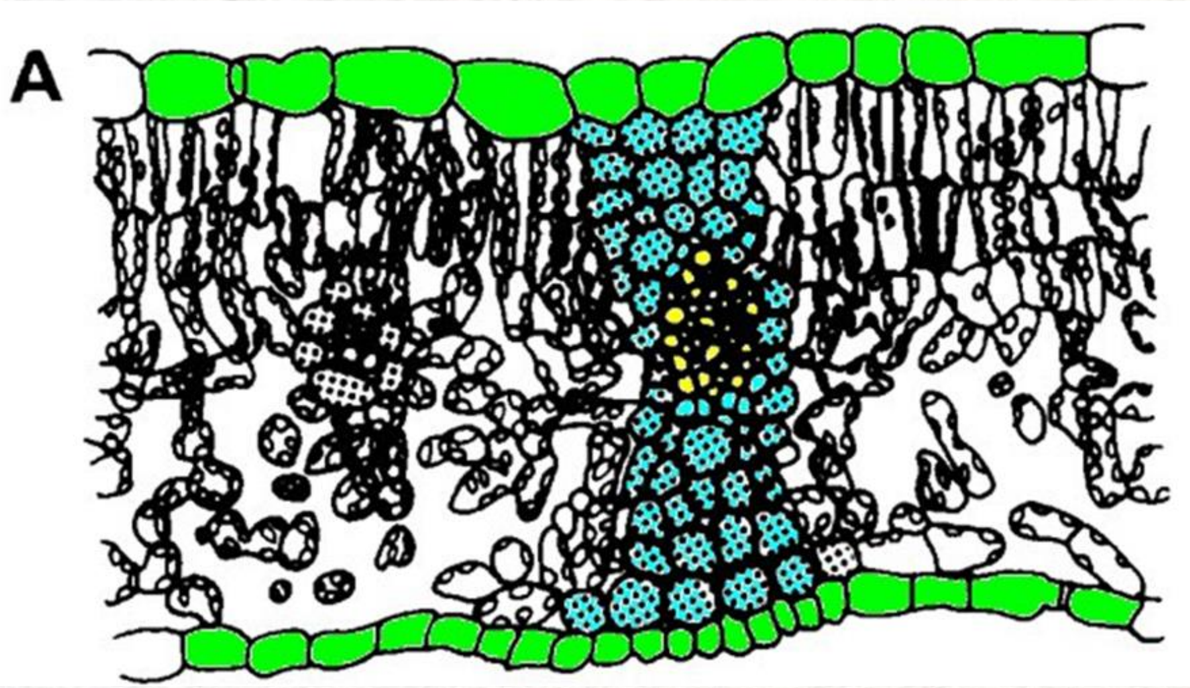
Cleiton B. Eller, Aline L. Lima, Rafael S. Oliveira

PLANTAS HOMOBÁRICAS VS HETEROBÁRICAS



Liakoura V, Fotelli MN, Rennenberg H, Karabourniotis G. Should structure-function relations be considered separately for homobaric vs. heterobaric leaves? Am J Bot. 2009 Mar;96(3):612-9. doi: 10.3732/ajb.0800166. PMID: 21628217.
Terashima I. Anatomy of non-uniform leaf photosynthesis. Photosynth Res. 1992 Mar;31(3):195-212. doi: 10.1007/BF00035537. PMID: 24408060

CARACTERÍSTICAS: CÉLULAS DO FEIXE DA BAINHA

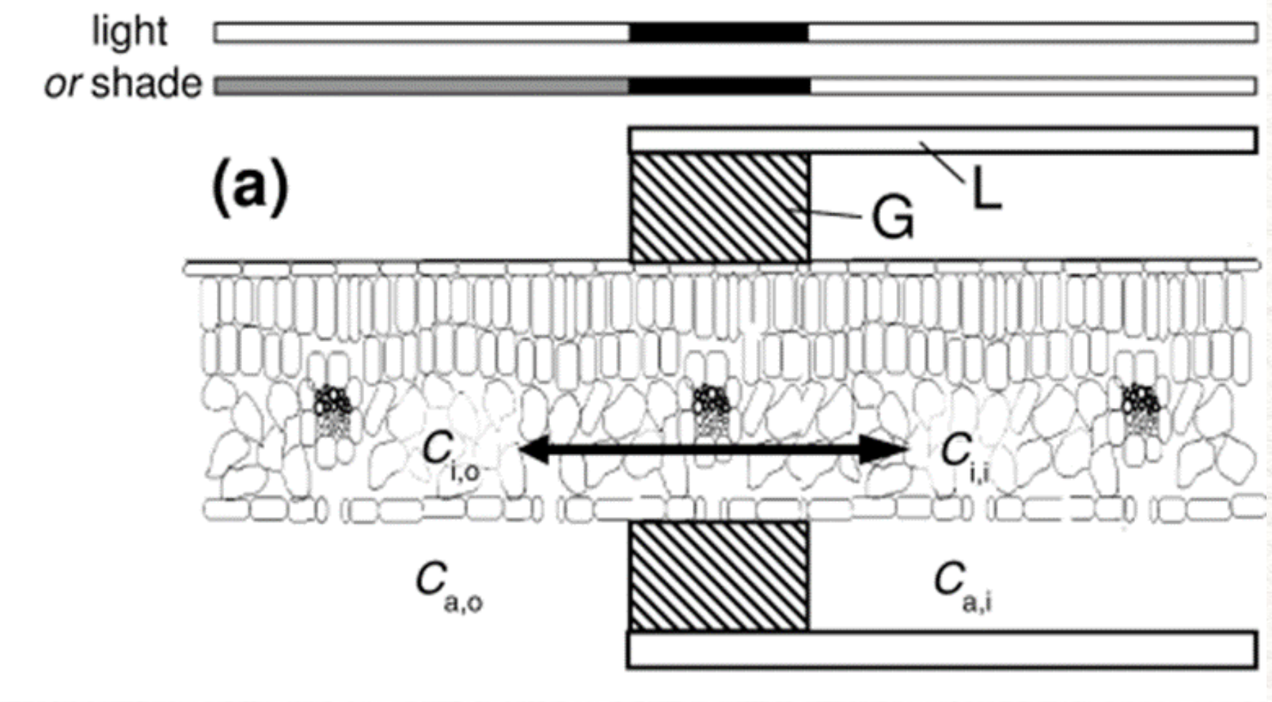


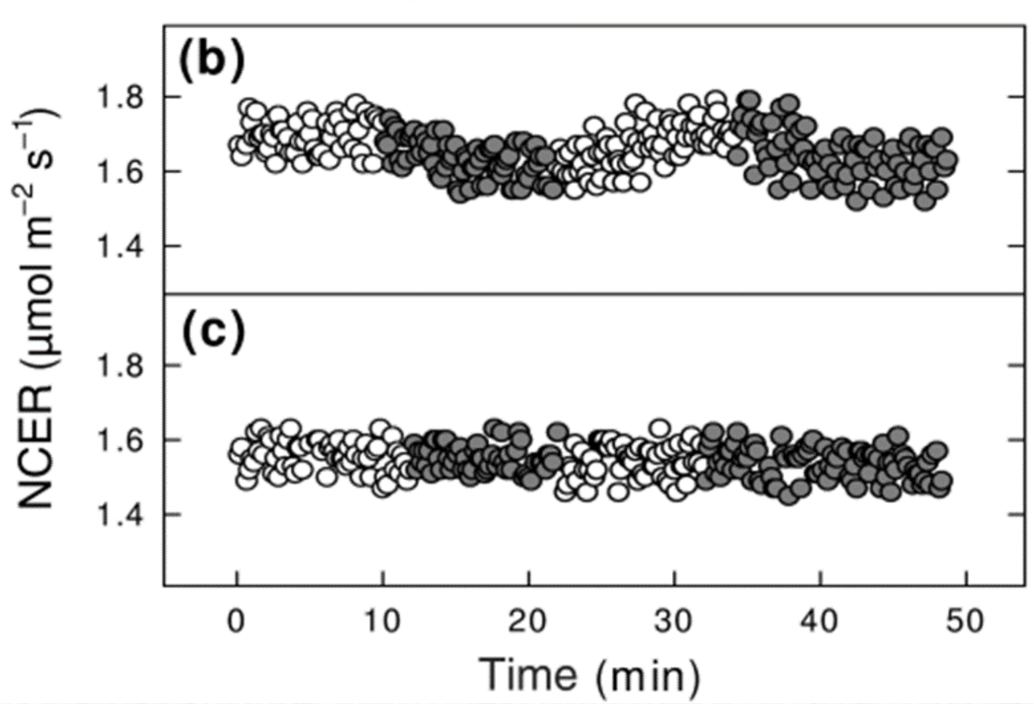
- Células normalmente parenquimáticas, ou esclerenquimáticas;
- Aclorofiladas;
- Com baixa atividade metabólica;

Terashima I. Anatomy of non-uniform leaf photosynthesis. Photosynth Res. 1992 Mar;31(3):195-212. doi: 10.1007/BF00035537. PMID: 24408060.

EBF IMPEDEM A DIFUSÃO LATERAL DE CO2

Measurements of net CO2 exchange rates (NCER) of leaf areas enclosed in a clamp-on leaf chamber when leaf parts outside the chamber were either illuminated or in shade.





Pieruschka, Roland, et al. "Lateral diffusion of CO2 from shaded to illuminated leaf parts affects photosynthesis inside homobaric leaves." New Phytologist 169.4 (2006): 779-788.

OCORRÊNCIA E CARACTERÍSTICAS

Species	Family	Phenological guild	TLA (%)	Thickness (µm)	LMA (g·m−2)	Density (g·cm−3)
A) Homobaric leaves						
Coronilla emerus L.	Fabaceae	Evergreen n		605.0 ± 6.2	95.8 ± 4.7	0.16 ± 0.01
Cotoneaster horizontalis Decne.	Rosaceae	Deciduous n		261.7 ± 5.6	89.7 ± 2.7	0.34 ± 0.01
Euonymus japonicus Thunb.	Celastraceae	Evergreen nn		411.7 ± 11.5	152.1 ± 5.2	0.37 ± 0.01
Eucalyptus sp.	Myrtaceae	Deciduous nn		255.8 ± 7.7	88.5 ± 5.9	0.35 ± 0.03
Podocarpus macrophyllus (Thunb.) D. Don	Podocarpaceae	Evergreen nn		314.0 ± 5.1	199.6 ± 18.9	0.64 ± 0.06
Mean				395.1 ± 32.0a	141.9 ± 14.1a	0.37 ± 0.03a
B) Heterobaric leaves						
Ceratonia siliqua L.	Fabaceae	Evergreen n	28.8	385.4 ± 15.3	184.5 ± 8.4	0.48 ± 0.03
Cercis siliquastrum L.	Fabaceae	Deciduous n	23.9	225.0 ± 6.3	92.0 ± 3.0	0.41 ± 0.02
Duranta plumeri Jacq.	Verbenaceae	Semideciduousnn	9.7	177.9 ± 3.1	54.1 ± 3.5	0.30 ± 0.02
Juglans regia L.	Juglandaceae	Deciduous n	23.8	246.1 ± 7.8	82.3 ± 3.2	0.33 ± 0.02
Magnolia grandiflora L.	Magnoliaceae	Evergreen nn	16.6	398.9 ± 6.1	138.4 ± 3.0	0.35 ± 0.01
Malus sylvestris (L.) Mill.	Rosaceae	Deciduous n	11.2	350.0 ± 1.5	123.4 ± 1.7	0.35 ± 0.01
Mean			19.8 ± 1.8	275.6 ± 23.1 b	106.43 ± 10.0 b	0.37 ± 0.02 a

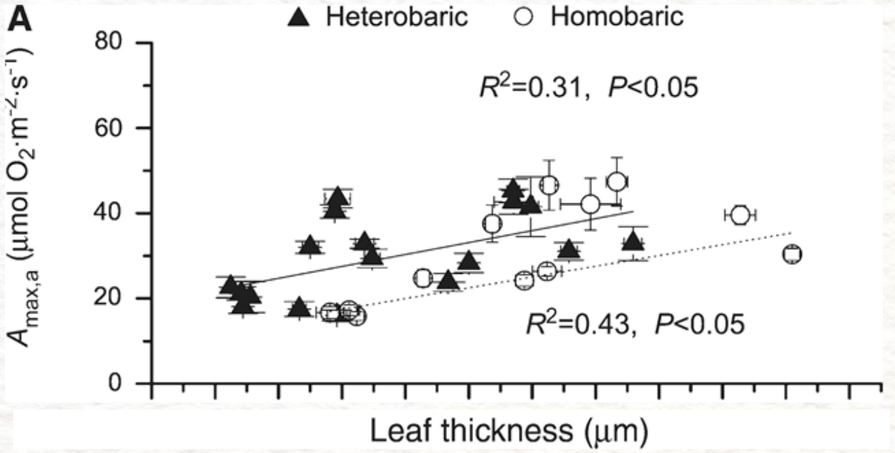
Liakoura V, Fotelli MN, Rennenberg H, Karabourniotis G. Should structure-function relations be considered separately for homobaric vs. heterobaric leaves? Am J Bot. 2009 Mar;96(3):612-9. doi: 10.3732/ajb.0800166. PMID: 21628217.

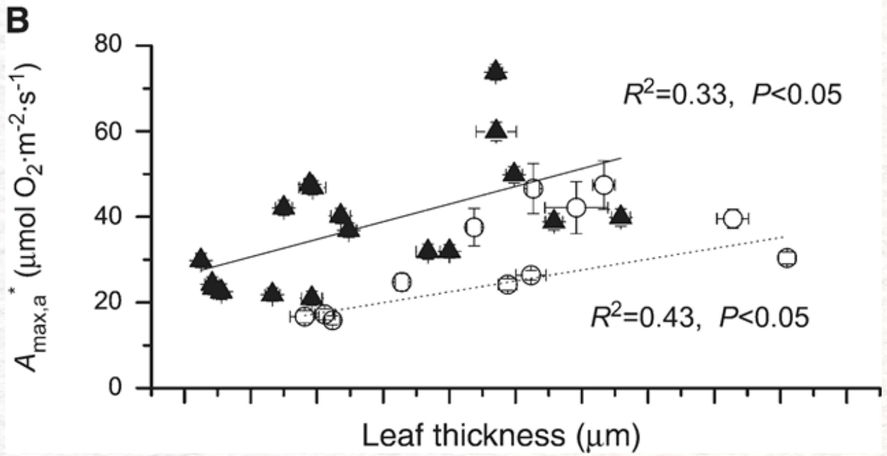
POTENCIAL FOTOSSINTÉTICO

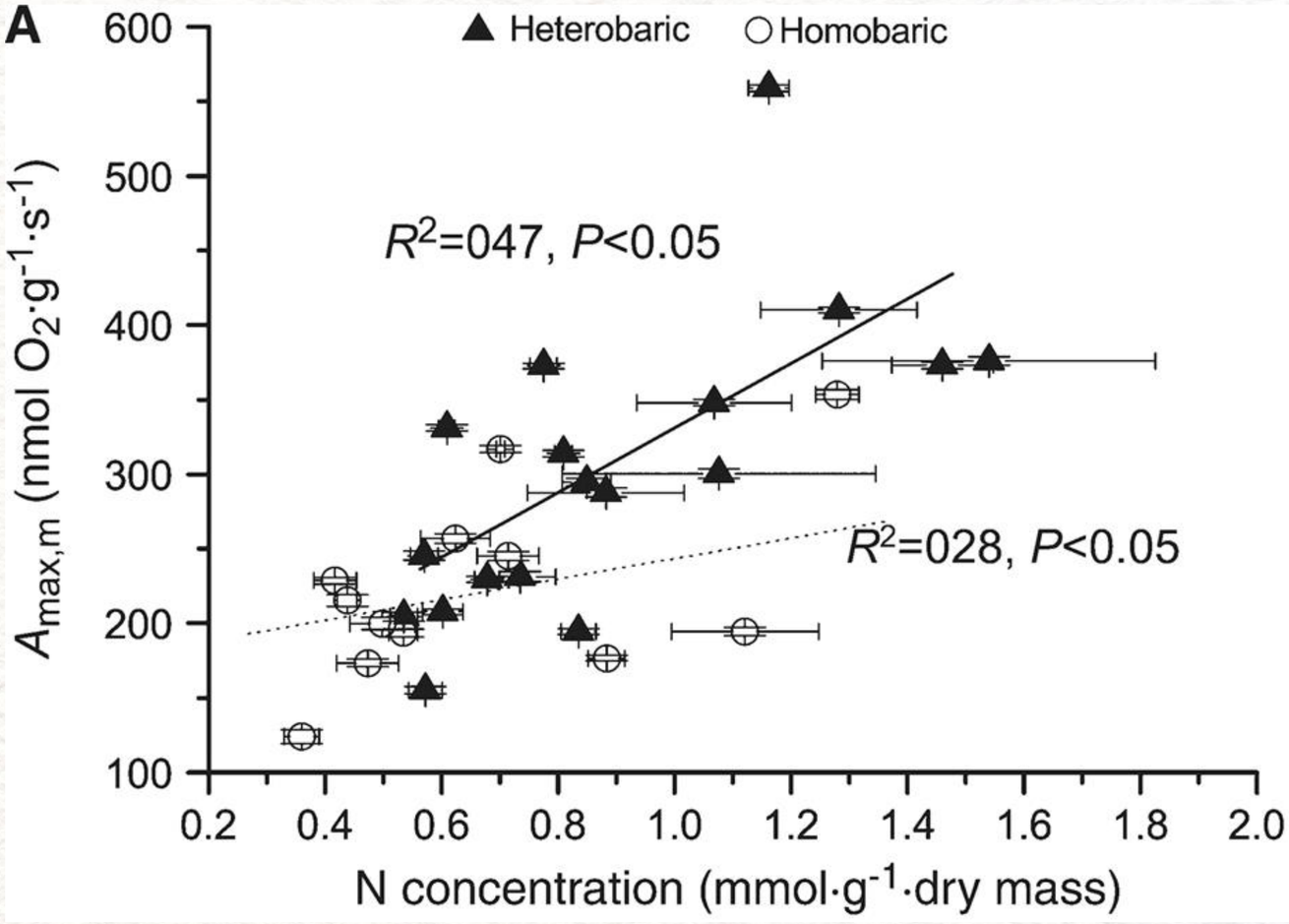
Species	A max,a [µmolO^2 m^{-2} s^{-1}]	A max,a* [µmolO^2 m^{-2} s^{-1}]	A max, N* [mmol g^{-1}s^{-1}]
A) Homobaric leaves			
Coronilla emerus L.	30.4 ± 1.4	30.4 ± 1.4	16.2 ± 1.3
Cotoneaster horizontalis Decne.	15.9 ± 1.1	15.9 ± 1.1	7.1 ± 1.6
Euonymus japonicus Thunb.	26.4 ± 1.1	26.4 ± 1.1	13.1 ± 1.0
Podocarpus macrophyllus (Thunb.) D. Don	24.8 ± 2.0	24.8 ± 2.0	12.3 ± 1.8
Mean	30.7 ± 3.4 a	30.7 ± 3.4 b	13.0 ± 1.1 b
B) Heterobaric leaves			
Ceratonia siliqua L.	42.7 ± 2.9	59.9 ± 2.2	15.8 ± 0.9
Cercis siliquastrum L.	32.0 ± 1.4	42.1 ± 1.8	15.3 ± 0.9
Duranta plumeri Jacq.	20.3 ± 3.7	22.5 ± 1.9	9.7 ± 1.0
Juglans regia L.	16.0 ± 1.3	21.0 ± 1.7	10.9 ± 1.1
Magnolia grandiflora L.	41.5 ± 7.0	49.8 ± 1.9	12.0 ± 0.6
Malus sylvestris (L.) Mill.	28.3 ± 2.3	31.9 ± 1.6	13.6 ± 0.9
Mean	29.8 ± 2.4 a	37.9 ± 3.4 a	15.8 ± 1.1 a

Liakoura V, Fotelli MN, Rennenberg H, Karabourniotis G. Should structure-function relations be considered separately for homobaric vs. heterobaric leaves? Am J Bot. 2009 Mar;96(3):612-9. doi: 10.3732/ajb.0800166. PMID: 21628217.

RELAÇÕES ANATÔMICAS X METABÓLICAS

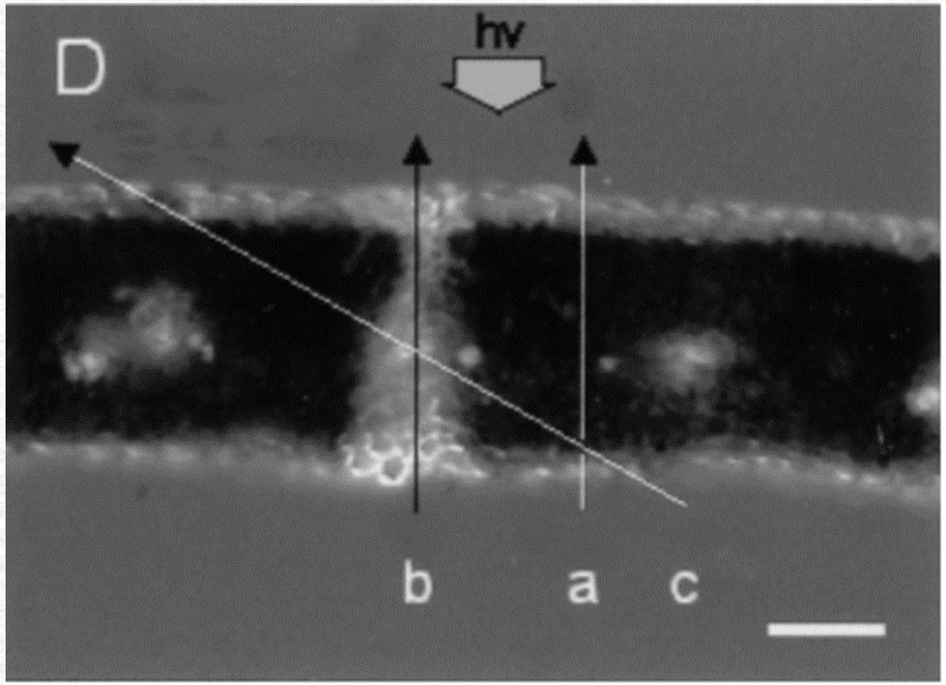


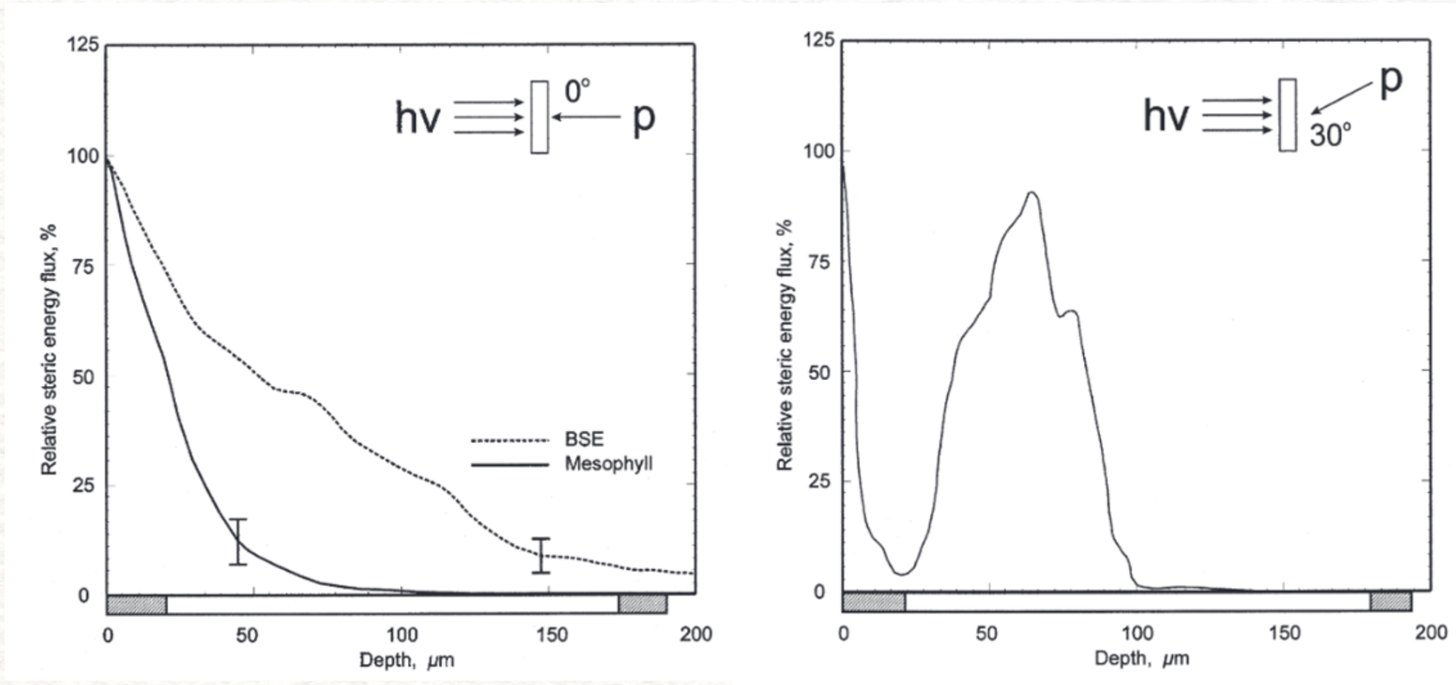




Liakoura V, Fotelli MN, Rennenberg H, Karabourniotis G. Should structure-function relations be considered separately for homobaric vs. heterobaric leaves? Am J Bot. 2009 Mar;96(3):612-9. doi: 10.3732/ajb.0800166. PMID: 21628217.

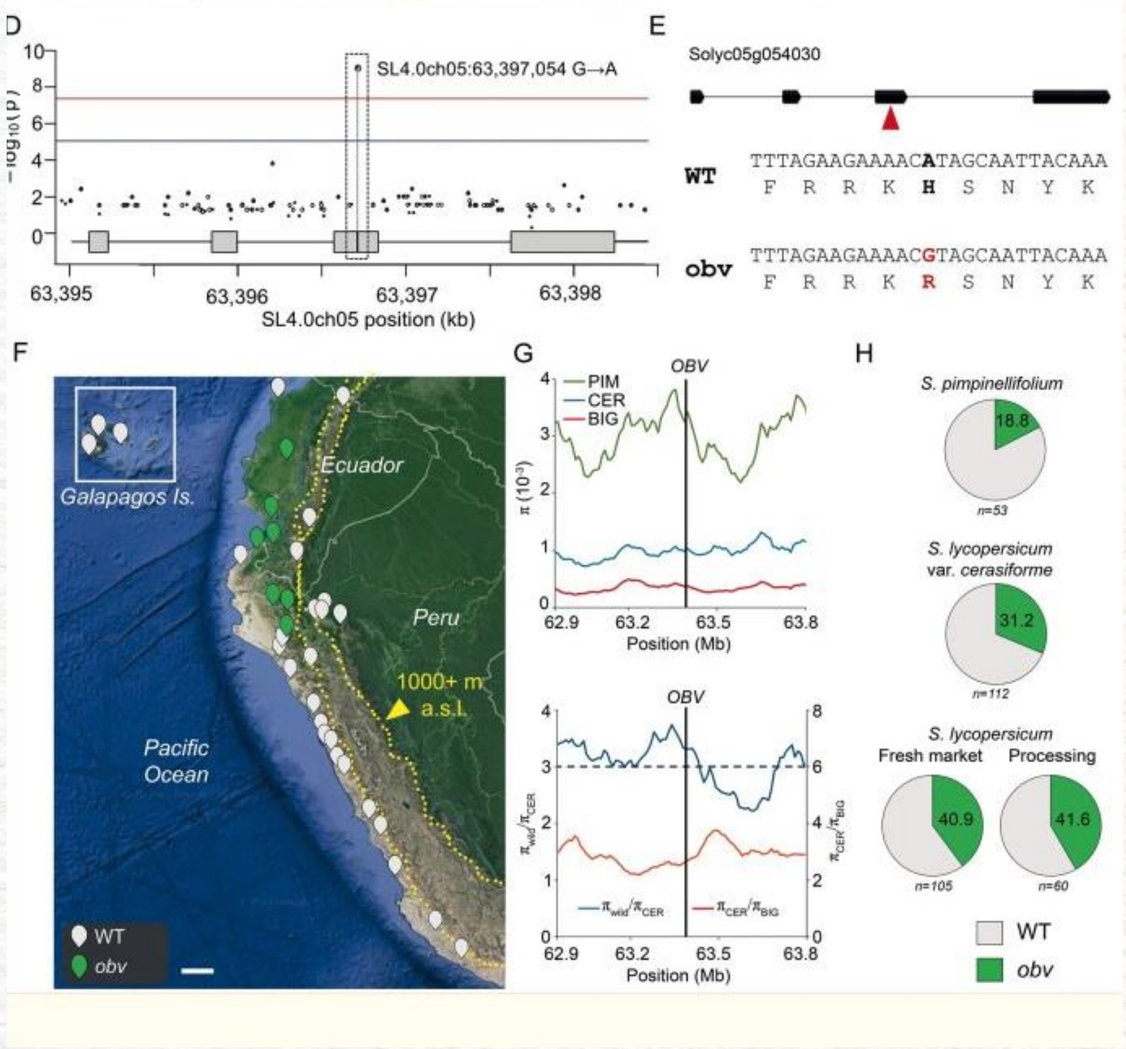
EBF ATUAM COMO CÉLULAS TRANSMISSORAS DE LUZ ÀS CAMADAS MAIS PROFUNDAS DO PARÊNQUIMA CLOROFILIANO

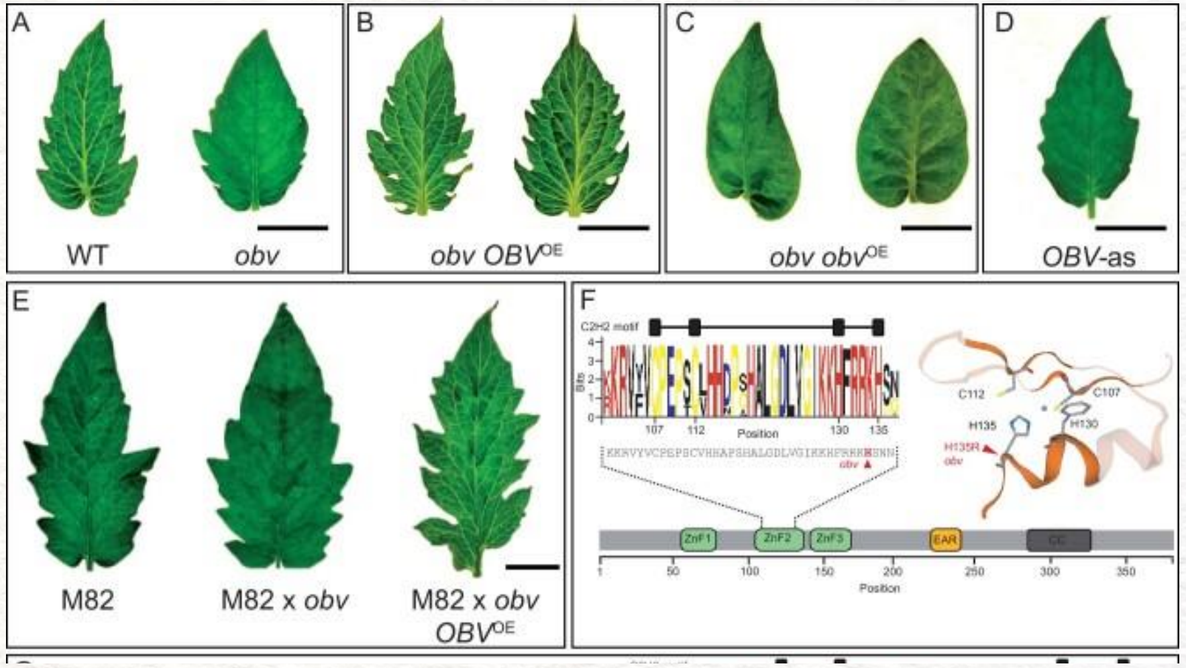




Karabourniotis, G., J. F. Bornman, and D. Nikolopoulos. "A possible optical role of the bundle sheath extensions of the heterobaric leaves of Vitis vinifera and Quercus coccifera." Plant, Cell & Environment 23.4 (2000): 423-430.

CLONAGEM DO GENE OBV





OBSCURA VENOSA (OBV)

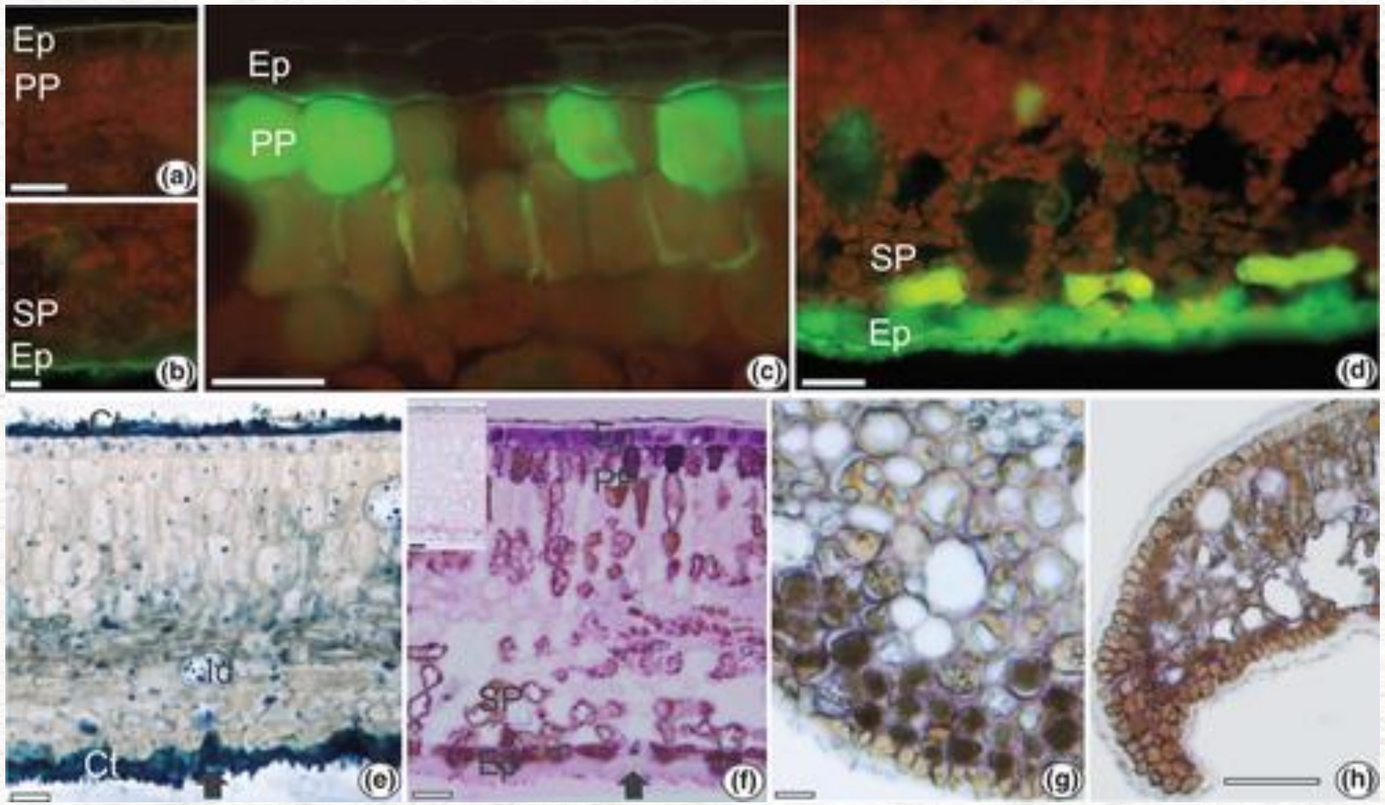
ABSORÇÃO FOLIAR DE ÁGUA

- Ecossistemas temperados e florestas montanhosas tropicais nubladas;
- Gradiente de potencial hídrico da parte externa aos tecidos internos;
- Hidratação foliar;

LOPES, A. L. (2010)

ROTA ANATÔMICA E COMPOSTOS HIDROFÍLICOS

Cortes transversais das folhas de *Drimys brasiliensis* expostos à solução traçadora apoplástica fluorescente LY e aos compostos hidrofílicos na superfície foliar.

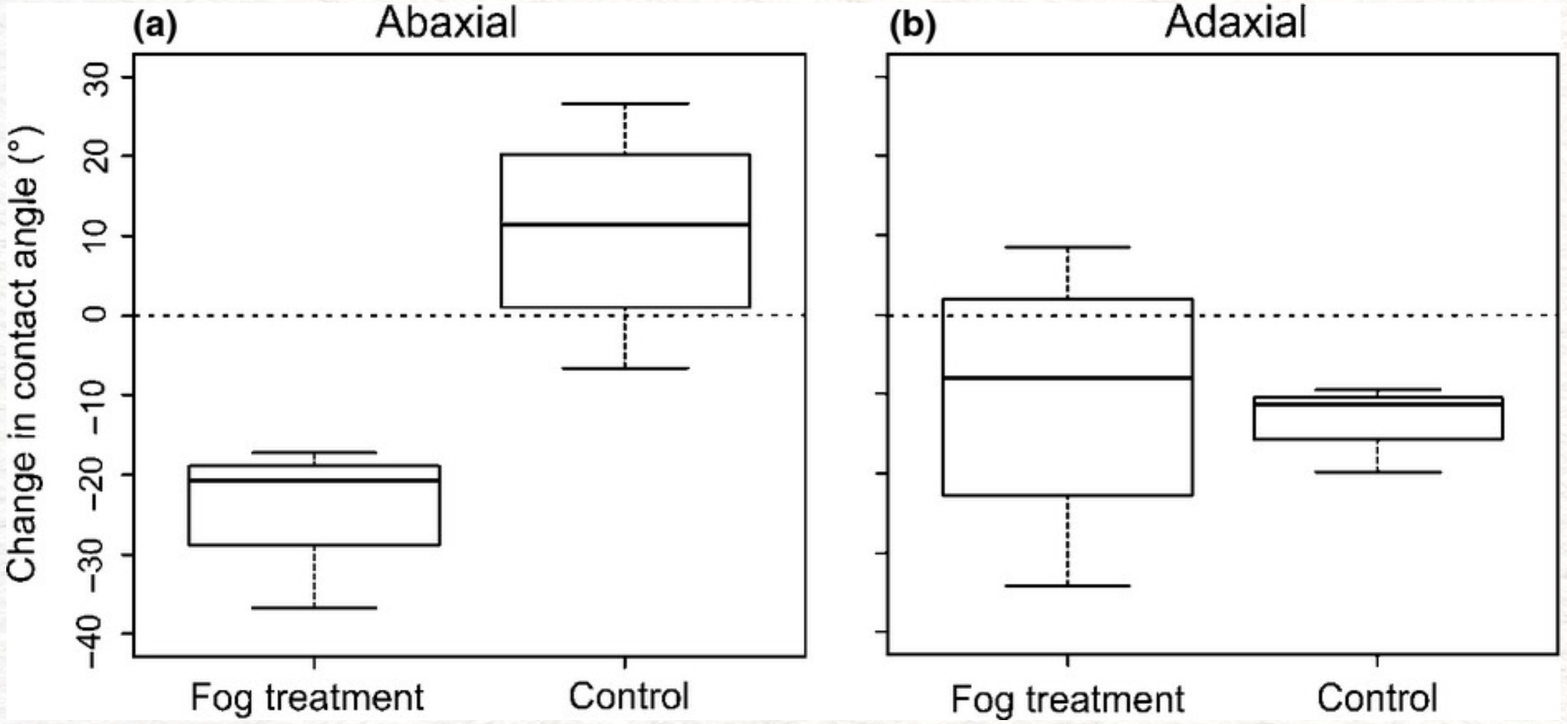


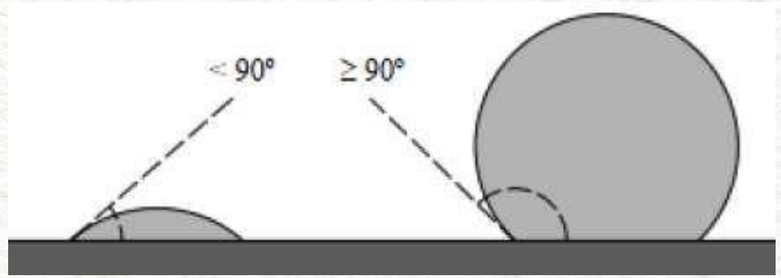
→ **Hidrofobicidade foliar**

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

HIDROFOBICIDADE DA SUPERFÍCIE FOLIAR

Mudanças na molhabilidade foliar na superfície abaxial (a) e na superfície adaxial (b) em plantas de *D. brasiliensis* expostas e não expostas à neblina.

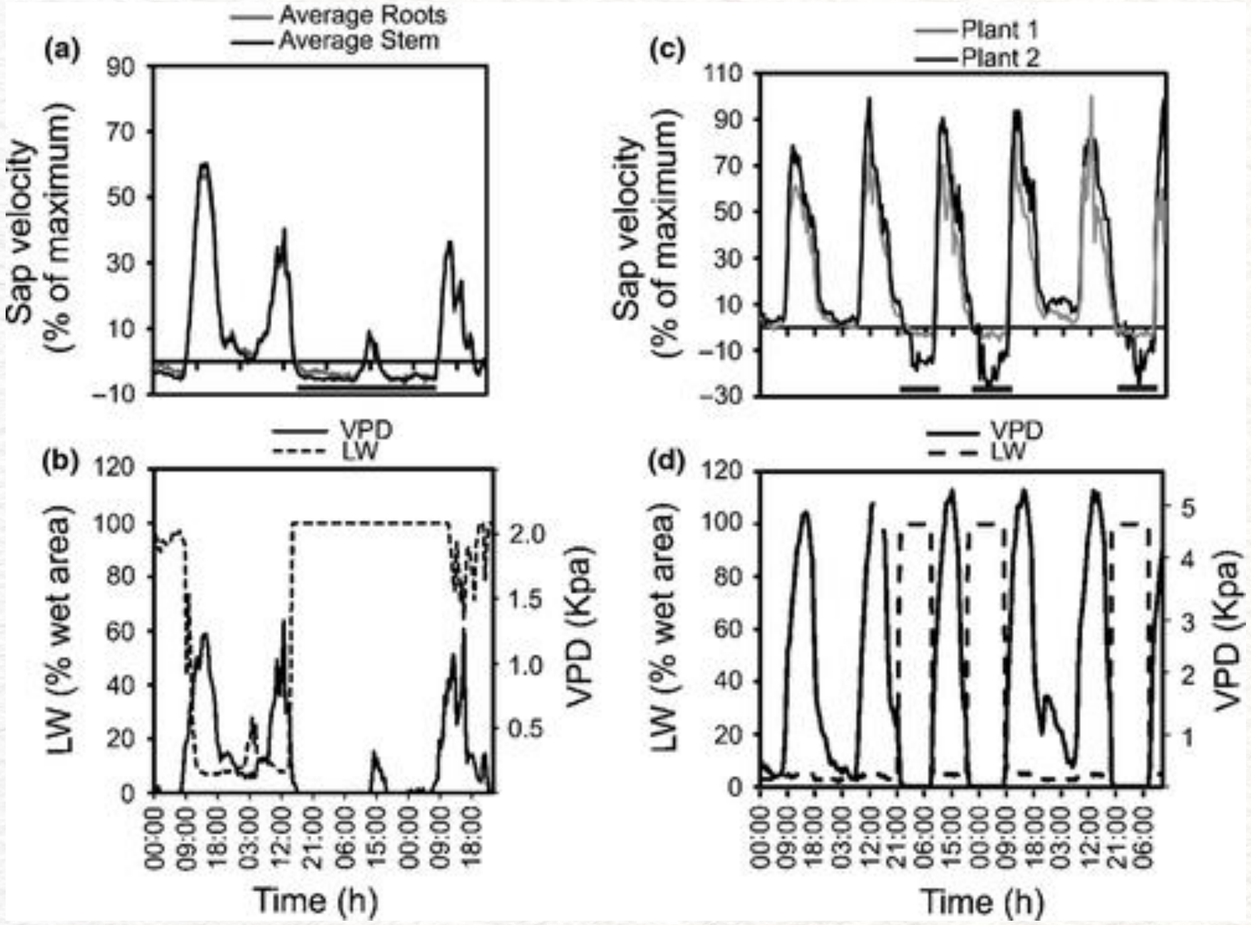




Aryal & Neuner (2010)

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

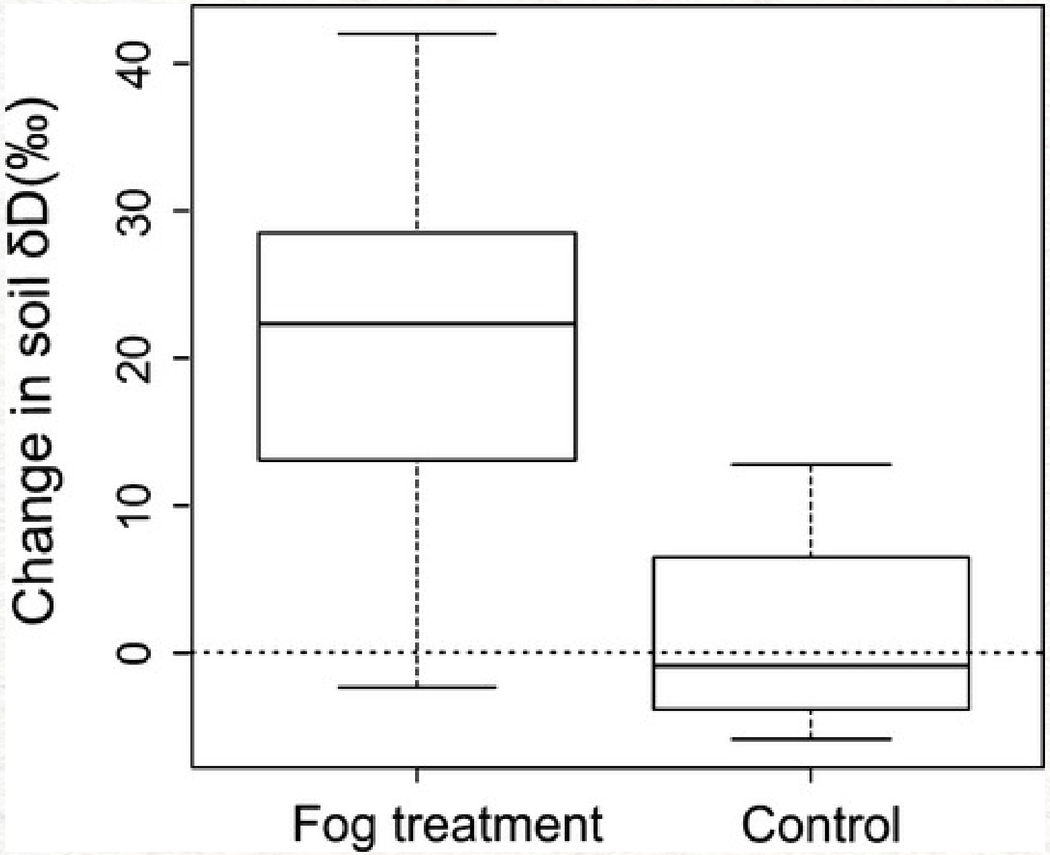
REDISTRIBUIÇÃO HIDRÁULICA INTERNA DA NEBLINA



Fluxo de seiva do caule e raiz de *D. brasiliensis* adultos em condições de campo e os dados micrometeorológicos (A-B) e em condições de estufa e seus dados micrometeorológicos (C-D).

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

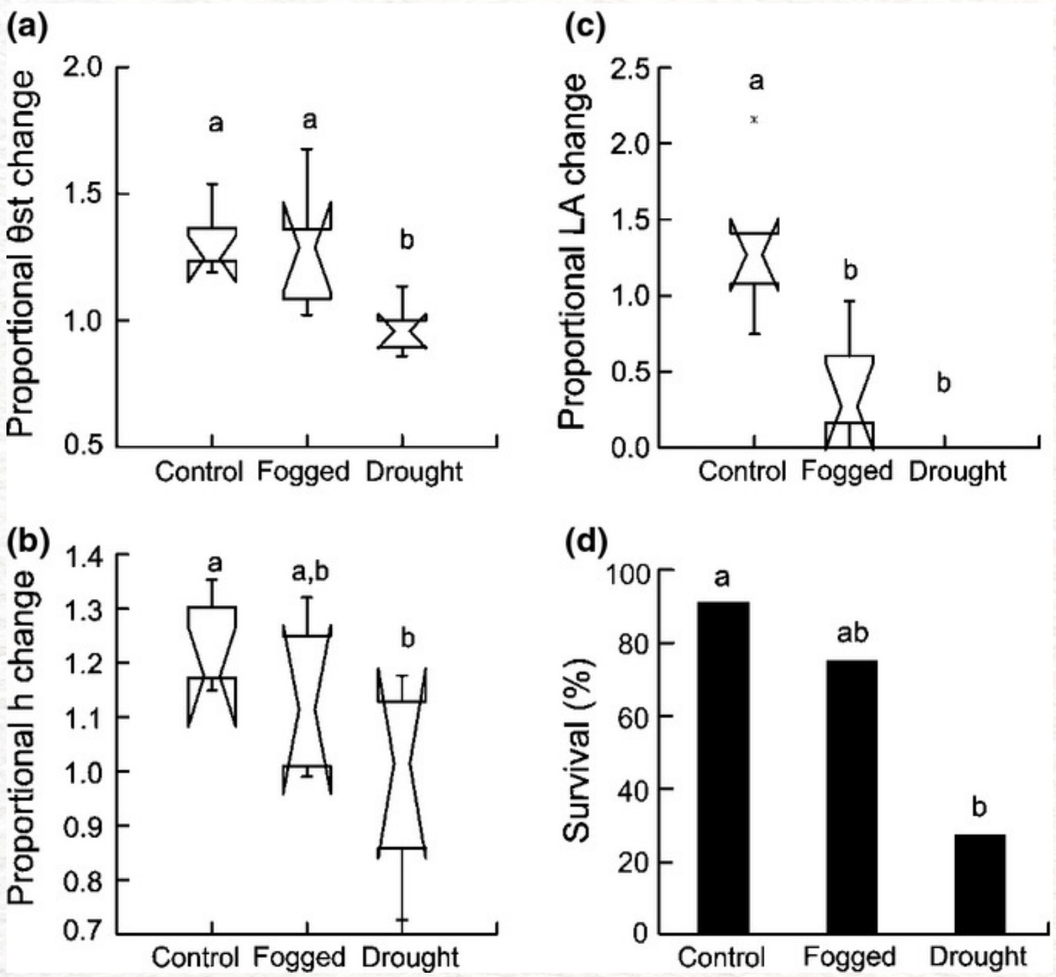
REDISTRIBUIÇÃO HIDRÁULICA INTERNA DA NEBLINA



Rastreamento isotópico com plantas expostas à neblina enriquecidas com deutério (A) e plantas controle (B).

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

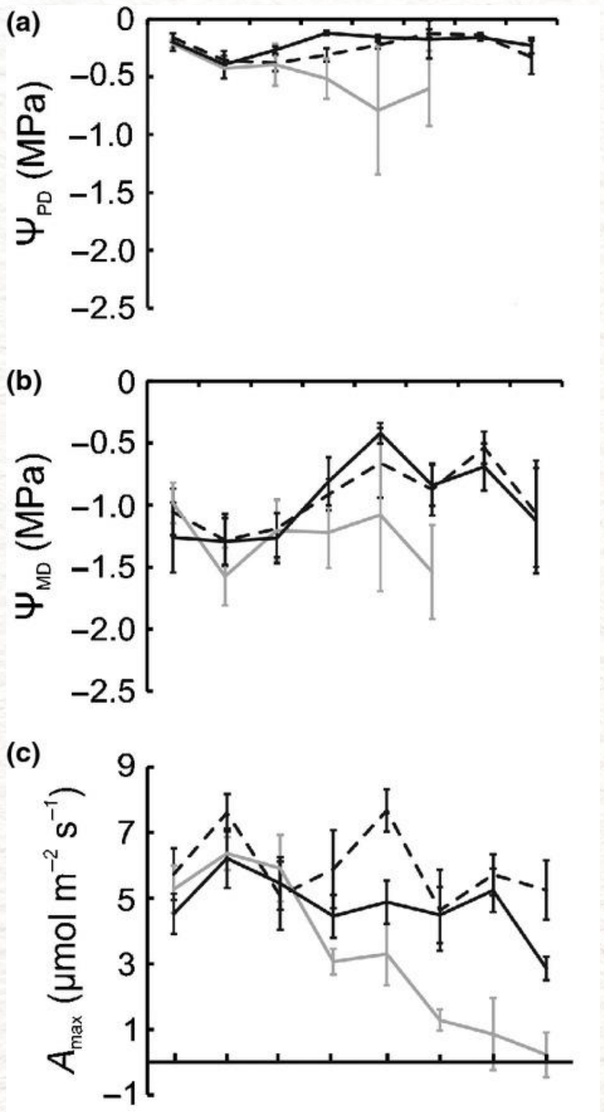
DESEMPENHO ECOFISIOLÓGICO

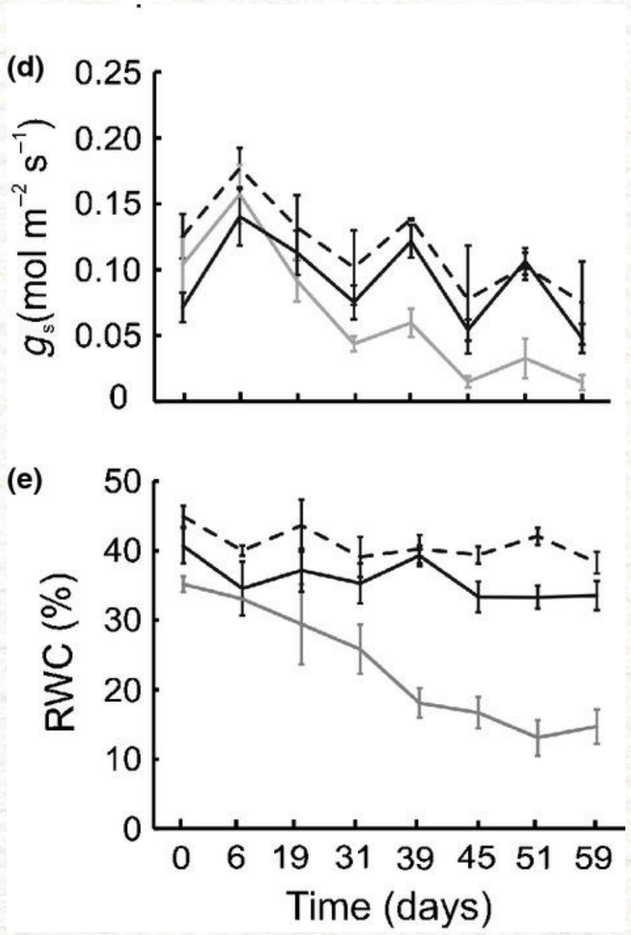


Mudanças no diâmetro do caule (θ st) (a), altura (h) (b), área foliar total estimada (AF) (c) e sobrevivência (%) de *D. brasiliensis* ao final do experimento ecofisiológico (d).

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

DESEMPENHO ECOFISIOLÓGICO



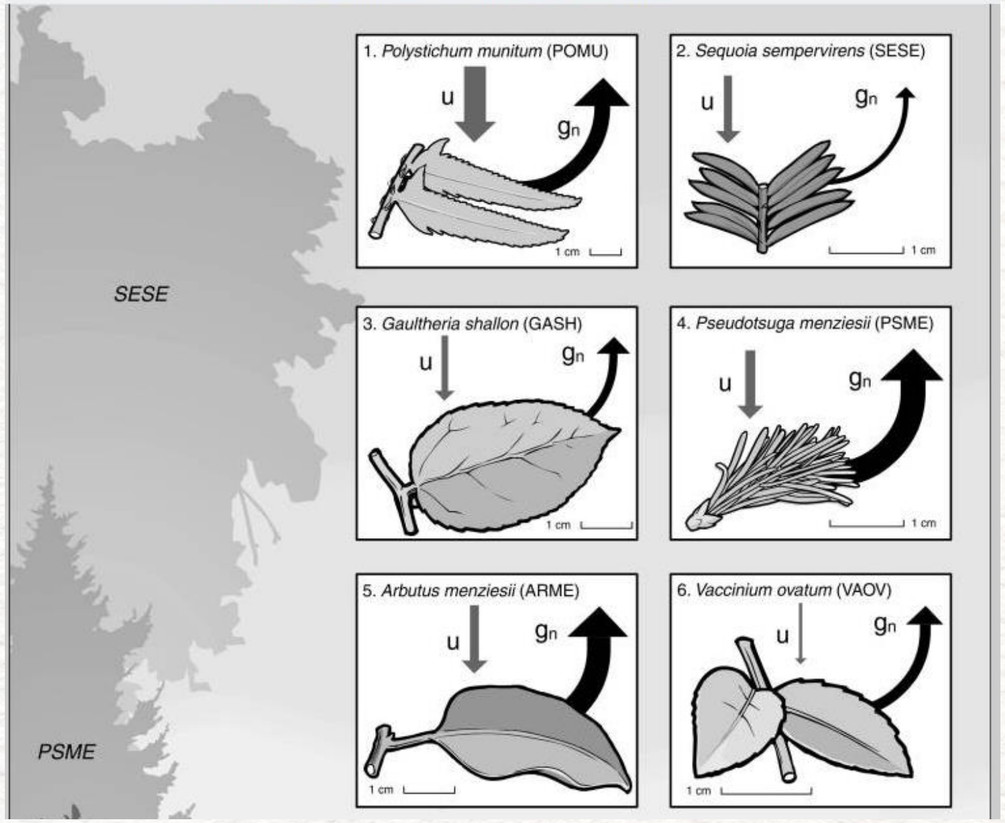


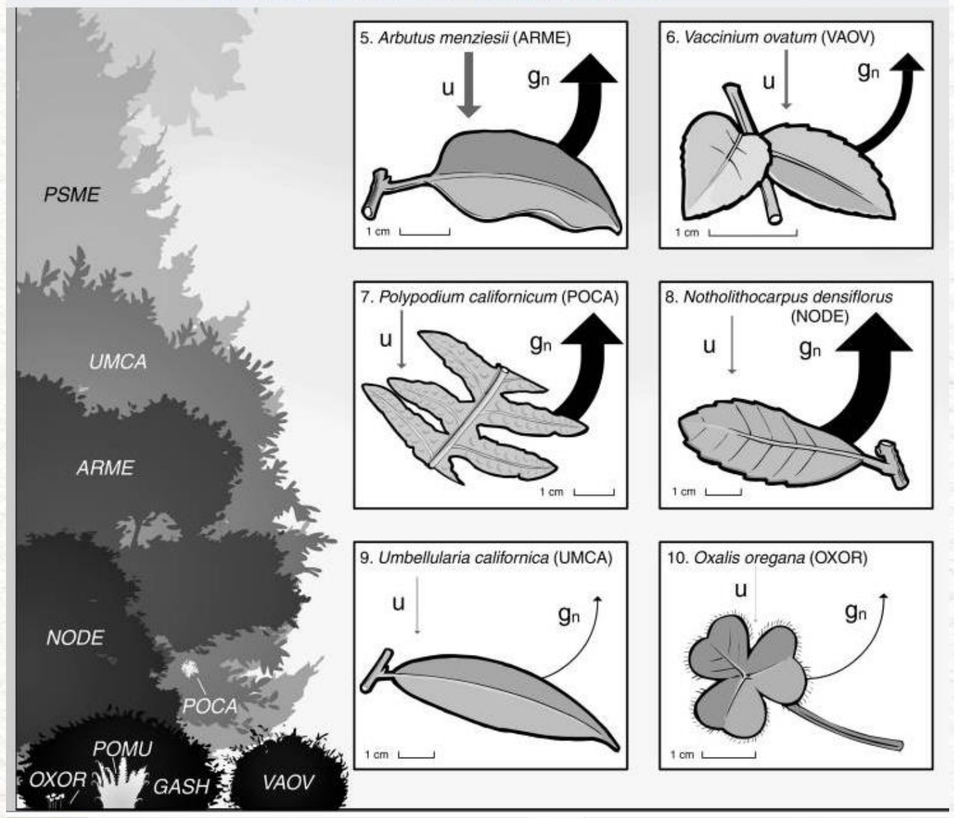
Parâmetros ecofisiológicos de *D. brasiliensis* em relação ao Controle, Nevoeiro e Seca.

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

ESTRATÉGIA DE AQUISIÇÃO DE ÁGUA

Espécies dominantes de folhas largas, coníferas e samambaias do ecossistema da floresta de sequoias. U: capacidade de absorção foliar e Gn: taxa de condutância noturna.





LIMM, E. B.; SIMONIN, K. A.; BOTHMAN, A. G.; DAWSON, T. E. Foliar water uptake: a common water acquisition strategy for plants of the redwood forest. Oecologia, v. 161, n. 3, p. 449–459, 1 set. 2009.

REFERÊNCIAS BIBLIOGRÁFICAS

Eller, C. B.; Lima, A. L.; Oliveira, R. S. Foliar uptake of fog water and transport belowground alleviates drought effects in the cloud forest tree species, *Drimys brasiliensis* (Winteraceae). New Phytologist, v. 199, n. 1, p. 151–162, 28 mar. 2013.

Karabourniotis, G., J. F. Bornman, and D. Nikolopoulos. "A possible optical role of the bundle sheath extensions of the heterobaric leaves of Vitis vinifera and Quercus coccifera." Plant, Cell & Environment 23.4 (2000): 423-430.

Liakoura V, Fotelli MN, Rennenberg H, Karabourniotis G. Should structure-function relations be considered separately for homobaric vs. heterobaric leaves? Am J Bot. 2009 Mar;96(3):612-9. doi: 10.3732/ajb.0800166. PMID: 21628217.

Limm, E. B.; Simonin, K. A.; Bothman, A. G.; Dawson, T. E. Foliar water uptake: a common water acquisition strategy for plants of the redwood forest. Oecologia, v. 161, n. 3, p. 449–459, 1 set. 2009.

Lopes, A. O papel ecológico da neblina e a absorção foliar de água em três espécies lenhosas de Matas Nebulares, Dissertação: UNICAMP, São Paulo, 143 p, 2010.

Terashima I. Anatomy of non-uniform leaf photosynthesis. Photosynth Res. 1992 Mar;31(3):195-212. doi: 10.1007/BF00035537. PMID: 24408060

Agradecemos a atenção!

ESALQ