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Scientific Note

Laticifers distribution in secondary phloem of the Amazon wood species

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Abstract

In this paper described the anatomical distribution of laticifers from the bark of *Hura crepitans* and *Ficus maxima*, typical floodplain trees in the Amazon forest. By observing samples which were processed by usual plant anatomy techniques, it was possible to verify that there were laticifers presenting radial distribution in the secondary stem phloem of *F. maxima*, and a diffuse distribution in the axial phloem in *H. crepitans*.

Keywords: Amazon rainforest, *laticifers, secondary phloem*

Distribuição dos laticíferos no floema secundário de espécies lenhosas da Amazônia

Resumo

Neste trabalho foi descrito a distribuição anatômica dos laticíferos da casca de *Hura crepitans* L. e *Ficus maxima* Mill., árvores típicas da várzea da Floresta amazônica. A partir de amostras processadas segundo técnicas usuais de Anatomia vegetal, verificaram-se laticíferos com distribuição radial no floema secundário do tronco de *F. maxima*, e com distribuição difusa axial no floema secundário de *H. crepitans*.

Palavras-chave: Floresta amazônica, laticíferos, floema secundário

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The presence of laticifers in the bark is common in species of Apocynaceae, Clusiaceae, Euphorbiaceae, Moraceae and Sapotaceae in the Amazon forest (Ribeiro et al., 1999), whose success laticiferous plants in different environments compared to non laticiferous, is due to functions commonly attributed to latex to protect against herbivory and sealing injuries (Metcalfe, 1967; Mahlberg, 1993). Furthermore, amazon laticiferous plants are widely known by use of the latex for medicinal and toxic purposes for traditional peoples living in floodplains of Amazon forest (Braga et al., 2007).

It is reported that in direct contact with skin or when inhaled, the latex of *H. crepitans* (assacu in portuguese) causes headaches, mouth and throat sores (Barg, 2004), and it is still used to stun fish schools when launched directly on the water while fishing in the Amazon rivers (Zahn & Hecker, 1992). The secretion in natura diluted with water and other preparations obtained from the latex of *F. maxima* (caxinguba in portuguese) are taken without any therapeutic proof as antihelminthics by traditional Amazon peoples.

For *H. crepitans* and *F. maxima* are unknown anatomical reports on laticifers in the bark of these species. However, there are anatomic studies to laticifers of Apocynaceae, Euphorbiaceae and Moraceae were published by Brazilian researchers (Milanez, 1966; Valente & Carvalho, 1973; Appezzato-da-Glória & Estelita, 1997; Larrosa & Duarte, 2005; Demarco et al., 2006; Palhares et al., 2007; Demarco & Castro, 2008; Krentkowski & Duarte, 2012). To contribute with future results on these potential vector species present with medicinal properties of latex, is described the anatomical distribution of laticifers from bark of *Hura crepitans* and *Ficus maxima*, tree species typical of the floodplains of Solimões and Amazonas river in Amazon rainforest.

We analyzed samples of the secondary phloem of the five trees of *F. maxima* and *H. crepitans* of the populations of the floodplains of Solimões river in Amazon forest (03° 05 '59" S / 63° 01' 52" W), Coari county, Amazonas state, Brazil (Figures 1A-C). Collections were made from February/2008 to February/2010. Vouchers of *F. maxima* were deposited in the Herbarium INPA of National Institute of Amazonian Research - INPA, and vouchers of *H. crepitans* were deposited in the Herbarium HUAM of Federal University of Amazonas - UFAM.

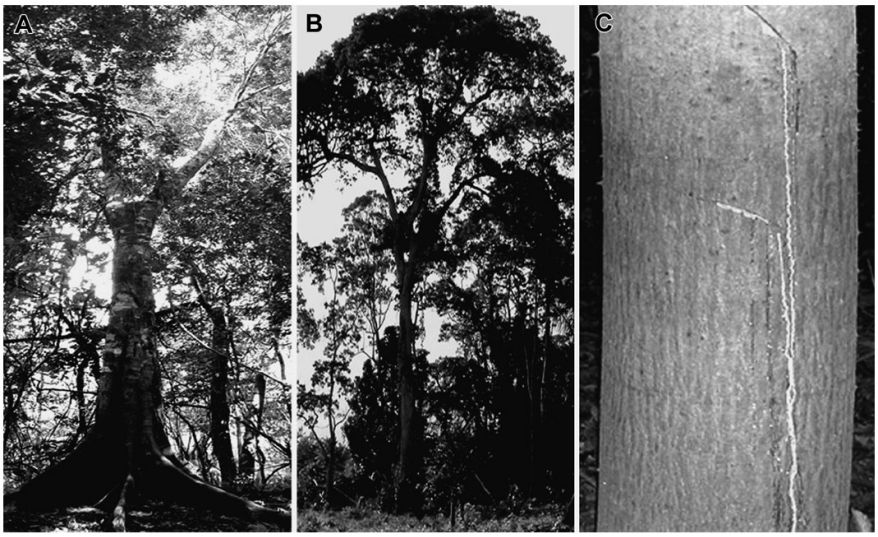

Figure 1. A. *Ficus maxima*. B. *Hura crepitans*. C. Latex detachment of the bark injured of *H. crepitans*.

Laticifers was described from secondary phloem samples of the trunk by were fixed in Karnovsky solution (Karnovsky, 1965), dehydrated in 50, 70 and 80% alcohol, embedded in HistoResin (hydroxyethylmethacrylate; Leica, Germany), following the manufacturer's instructions, and cut in a semiautomatic microtome. The sections (10 µm) were stained in an aqueous solution of toluidine blue at pH 4.7 (O'Brien et al., 1964) and mounted in new Entellan synthetic resin (Merck, Germany).

Ficus maxima and *Hura crepitans* are typical trees of lowland areas of the Amazon forest (Figures 1A-C). This species has in common the presence of latex in its bark, which is immediate release upon injury to the bark, as shown in *H. crepitans* (Figure 1C), and after a short time, these specie bark latex coagulates

and seals the injured place. This demonstrates the efficiency of the secretion contained in laticifers in sealing injured areas, preventing the entry of microorganisms (Demarco et al., 2006). It is said that the thickened primary cell walls of laticifers possess adcrustantes substances sealing the laticifer system from other adjacent cells (Fineran et al., 1988; Castro & Machado, 2006). However, when this latex samples are collected and kept in inert containers, the latex does not coagulate. Solubility is a characteristic sought by researchers who work with latex processing in laboratory, indicating the possibility of using the latex of *F. maxima* and *H. crepitans* as for the bioactive substance prospection.

Laticifers possess radial distribution in the secondary phloem trunk of *F. maxima*, and diffuse distribution in the axial phloem *H. crepitans* (Figures 2A-F). The radial distribution of laticifers is a characteristic shared by very few species, being observed as for the stem *Cryptostegia grandiflora* (Milanez, 1966), *Ficus altissima* (Vreede, 1949), *Pimelodendron amboinicum* (Sudo & Fujii, 1987), *Croton panamensis* and *C. conduplicatus* (Rudall, 1989), *Morus nigra* (Veenendall & Outer, 1990). In *Brosimum gaudichaudii* the perpendicular distribution of laticifers in rays of roots was also described (Palhares et al., 2007). Most likely there is a correlation between the secretion contained in the latex and the anatomical distribution pattern of latex in *F. maxima* and *H. crepitans*. Reserve substances to the parenchyma of the bark are usually connected to the supply of metabolites to vascular cambium at the beginning of the growing season of plants, and the supply of carbon stocks necessary for the stimulation of growth after injury of organs (Machado et al., 2005; Larrosa & Duarte, 2005; Demarco et al., 2006; Palhares et al., 2007; Demarco & Castro, 2008; Krentkowski & Duarte, 2012).

Distribution patterns of laticifers of *F. maxima* and *H. crepitans* are similar to of many laticiferous plants. However, field observations on secretion of the latex of these plants after injury, associated with the prior knowledge of its uses, leads us to indicate these species for exploration of bioactive substances in the latex laboratory for formulation of probable drugs in the antihelminthic treatment.

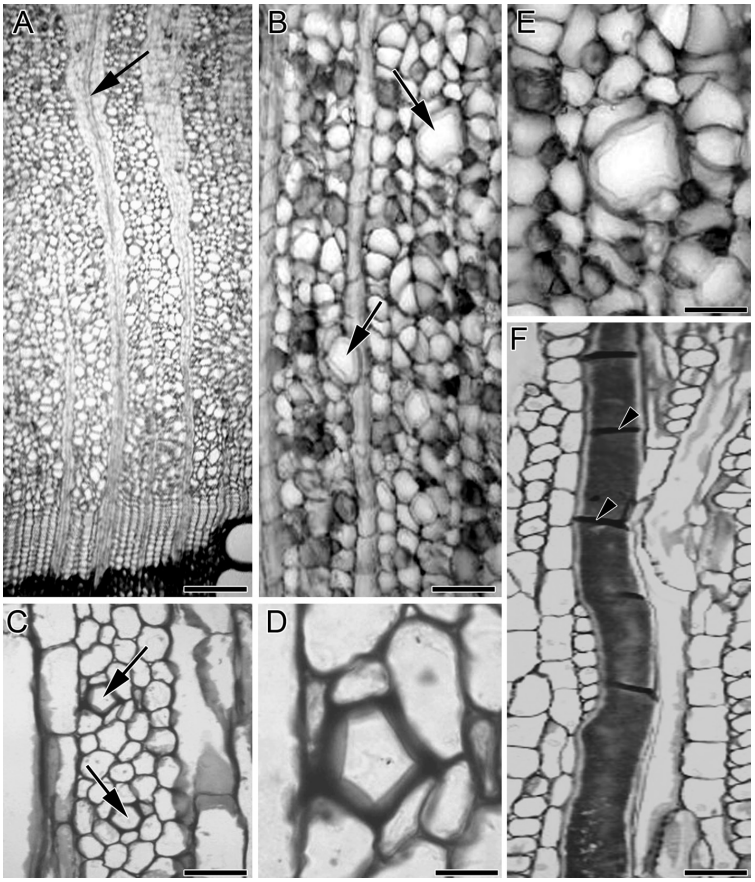

Figure 1. Secondary phloem of trunk. A, D, E. Cross sections. B, C, F, G. Longitudinal sections. Arrows shows laticifers in *Ficus maxima* and *Hura crepitans.* F. Sections showed transversal cell wall of laticifer in arrowheads. G. Laticifer with collapsed cell walls - see arrowheads. Bars (A = 5 µm, B,D,G = 20 µm, C,E,F = 40 µm)

References

Appezzato-da-Glória, B., Estelita, M.E.M. 1997. Laticifers systems in *Mandevilla illustris* and *M. velutina* Apocynaceae. *Acta Societatis Botanicorum Poloniae* 66: 301-306.

Barg, D.G., 2004. *Plantas tóxicas*. Instituto Brasileiro de Estudos Homeopáticos, São Paulo, Brazil. 96p.

Braga, P.I., Silva, S.M., Braga, J.O., Nascimento, K.G., Rabelo, S.L. 2007. *A vegetação das comunidades da área de influência do Projeto Piatam e do gasoduto Coari-Manaus*. EDUA, Manaus, Brazil. 134p.

Castro, M.M., Machado, S.R. 2006. Células e tecidos secretores. In: Appezzato-da-Glória, B.A., Carmello-Guerreiro, S.M. (eds.) *Anatomia vegetal*. UFV, Viçosa, Brazil. p. 179-203.

Demarco, D., Castro, M.M. 2008. Laticíferos articulados anastomosados em espécies de Asclepiadeae (Asclepiadoideae, Apocynaceae) e suas implicações ecológicas. *Revista Brasileira de Botânica* 31: 701-703.

Demarco, D., Kinoshita, L.S., Castro, M.M. 2006. Laticíferos articulados anastomosados - novos registros para Apocynaceae. *Revista Brasileira de Botânica* 29: 133-144.

Fineran, B.A., Condon, J.M., Ingerfeld, M. 1988. An impregnated suberized wall layer in laticifers of the Convolvulaceae and its resemblance to that in walls of oil cells. *Protoplasma* 147: 42-54.

Karnovsky, M.J. 1965. A formaldehyde-glutaraldehyde fixative if high osmolality for use in electron microscopy. *Journal of Cell Biology* 27: 137-138.

Krentkowski, F.L, Duarte, M.R. 2012. Morpho-anatomical analysis of *Aspidosperma olivaceum* and *A. polyneuron*, Apocynaceae. *Brazilian Journal of Pharmacognosy* 22: 937-945.

Larossa, C.R.R., Duarte, M.R. 2005. Contribuição ao estudo anatômico do caule de *Himatanthus sucuuba*(Spruce ex Müll. Arg.) Woodson, Apocynaceae. *Brazilian Journal of Pharmacognosy* 15: 110-114.

Machado, S.R., Marcati, C.R., Morretes, B.L., Angyalossy, V. 2005. Comparative bark anatomy of root and stem in *Styrax camporum* Pohl. (Styracaceae). *Iawa Journal* 26: 477-487.

Mahlberg, P.G. 1993. Laticifers: an historical perspective. *The Botanical Review* 59: 1-23.

Metcalfe, C.R. 1967. Distribution of latex in the plant kingdom. *Economic Botany* 21: 115-127.

Milanez, F.R., 1966. Contribuição ao conhecimento anatômico de *Cryptostegia grandiflora*-II. Nota sobre a estrutura secundária. *Rodriguésia* 25: 335-350.

O'Brien, T.P.; Feder, N.; McCully, M.E. 1964. Polychromatic staining of plant cell walls by toluidine blue. *Protoplasma* 59: 368-373.

Palhares, D., Paula, L.E., Pereira, L.R., Santos-Silveira, C.E. 2007. Comparative anatomy of the bark of stems, roots and xylopodium of *Brosimum gaudichaudii* (Moraceae). *Iawa Journal* 28: 315-324.

Ribeiro, J. E., Hopkins, M. J., Vicentini, A., Sothers, C., Costa, M. A., Brito, J., Souza, M. A., Martins, L. H., Lohmann, L. G., Assunção, P. A., Pereira, E., Silva, C. F., Mesquita, M., Procópio, L. 1999. *Flora da Reserva Ducke: guia de identificação das plantas vasculares de uma floresta de terra firme na Amazônia Central*. Inpa-DFID, Manaus, Brazil. 798 p.

Rudall, P. 1989. Laticifers in vascular cambium and wood of *Croton* spp. (Euphorbiaceae). *Iawa Bulletin* 10: 379-383.

Sudo, S., Fujii, T. 1987. Latex tubes in the rays of *Pimelodendron amboinicum* Hassk. (Euphorbiaceae). *Iawa Bulletin* 8: 109-112.

Valente, M.C., carvalho, L.A.F. 1973. Plantas da caatinga. I - Apocynaceae. Anatomia e desenvolvimento de *Aspidosperma pyrifolium* Mart. var. *molle* Muell. Arg. - "Pereiro". *Brazilian Journal of Biology* 33: 285-301.

Veenendal, W., Outer, R. 1990. Distribuition and development of the non-articulated branched laticifers of *Morus nigra* L. (Moraceae). *Acta Botanica Neerlandica* 39: 285-296.

Vreede, M.C. 1949. Topography of the laticiferous system in the genus *Ficus*. *Annals of Botanical Garden Buitenzorg* 51: 125-149.

Zahn, P., Hecker, E. 1992. Possible iatrogenic risk of cancer associated with a homeopathic drug derived from *Hura crepitans* as evaluated by biological short-term assays and chemical analysis (HPLC). *Planta Medica* 58: 1 (Suppl.)