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PATTERNS OF TRANSVERSE COMMISSURES IN EUTERPEINAE (PALMAE)

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RESUMEN

Se estudió el patrón de comisuras transversales en los folíolos de veintiocho especies de palmas pertenecientes a cinco géneros de la subtribu Euterpeinae. Las especies de *Prestoea* y *Oenocarpus* tienen un patrón continuo entre las largas venas longitudinales, mientras que las especies de *Euterpe*, *Neonicholsonia* y *Hyospathe* tienen un patrón esparcido. Estos resultados soportan la actual opinión de considerar a *Euterpe* y *Prestoea* como dos géneros distintos y revela una cercana relación taxonómica entre *Prestoea* y *Oenocarpus* anteriormente no observada.

Palabras clave: comisura transversal, anatomía foliar, Palmae, Euterpeinae.

ABSTRACT

The pattern of transverse commissures in the leaflets of twenty-eight palm species belonging to the five genera of the subtribe Euterpeinae was studied. *Prestoea* and *Oenocarpus* species have a continuous pattern between the large longitudinal veins while *Euterpe*, *Neonicholsonia* and *Hyospathe* species have a scattered pattern. These results support the current concept of *Euterpe* and *Prestoea* as two distinct genera and show a closer taxonomic relationship between *Prestoea* and *Oenocarpus* not formerly observed.

Keywords: transverse commissure, leaf anatomy, Palmae, Euterpeinae.

INTRODUCTION

Transverse veins or transverse commissures (TC) are leaf veins that travel across the leaves, transverse to the characteristic parallel and longitudinal veins present in monocots in general. In palms TC often follow an irregular course

(Fig. 1a). They connect only with large longitudinal veins and are either located at the same level as the longitudinal veins or at the level of the adaxial or abaxial mesophyll, running above or below the small longitudinal veins (Tomlinson 1961).

Uhl (1972) studied the leaf anatomy of the members of the *Chelyocarpus* alliance and observed that TC in this group can be distinct in size, course, and position along the lamina or can be absent. In *Cryosophila* TC are short and frequently lacking. *Itaya* can be segregated from *Chelyocarpus* and *Cryosophila* by seven anatomical characters, one of which is the presence of a secondary system of transverse veins in addition to the typical TC.

Strudwick (1993) observed differences in the pattern of distribution of TC among three species of *Euterpe* and three species of *Prestoea*. He found that TC rarely connect adjacent main veins in *Euterpe*, forming a scattered pattern between the veins. In *Prestoea* multiple transverse commissures are found joining adjacent main veins (except in *P. montana*), forming a continuous pattern.

The present study is an anatomical survey of TC pattern in the leaflets of palm species belonging to the genera of the subtribe Euterpeinae; the results are used to assess possible taxonomic relationships among the genera.

MATERIAL AND METHODS

Twenty-eight species of Euterpeinae palms, including eleven varieties, were selected for the present study (Table 1). The former *Jessenia* species are treated here as members of the genus *Oenocarpus*, following the suggestion of Bernal *et al.* (1991). *Euterpe*, *Prestoea* and *Neonicholsonia* species were classified according to the recent revision by Henderson and Galeano (1996). The identification of *Hyospathe* species follows Skov and Balslev (1989).

Samples for anatomical study were taken from herbarium specimens stored in NY. Leaflets from the middle part of the leaf rachis were sampled at their middle portion. Each sample consisted of a small piece of ca. 2.5 cm in length and of variable width to include the midrib and one of the leaf margins. For the species with simple leaves or broad segments, such as *Prestoea simplicifolia*, all *Hyospathe* and some *Oenocarpus* species, the samples included a leaf margin and the first prominent longitudinal vein (rib), but never exceeded 3 cm in width. The samples were rehydrated, cleared and stained following a protocol based on Martens and Uhl (1984) and Strudwick (1993). The pattern of TC was observed in a Nikon light binocular microscope equipped with a 35 mm camera.

The large longitudinal veins (LV) are classified as primary or secondary veins in the presentation of the results and the discussion. Primary veins are here considered all veins, excluding the midrib, prominent on the abaxial surface of the leaflets. Secondary veins are all the other longitudinal veins not prominent abaxially. Tomlinson (1961) refers to these veins only as large longitudinal veins or ribs.

RESULTS

All *Prestoea* species have elongated and regularly organized TC, forming a continuous pattern (Fig. 1b). The commissures link primary to secondary LV or primary to primary LV. The later case was observed in *P. pubigera*, *P. schultzeana*, *P. longipetiolata* var. *roseospadix*, *P. longepetiolata* var. *longepetiolata*, *P. carderi*, and *P. acuminata* var. *montana*.

In *Euterpe* the TC are shortened and irregularly arranged in a scattered pattern along the lamina (Fig. 1c). *Euterpe broadwayi*, *E. catinga* and *E. edulis* sometimes have a few elongated and continuous TC distributed among a larger number of short and scattered TC. In all species studied the TC link primary to secondary LV or secondary to secondary LV.

Oenocarpus has a continuous pattern. The TC link secondary to secondary LV only (Fig. 1d).

In *Neonicholsonia* the TC link primary to primary LV, but are short and scattered along the leaflet (Fig. 2a).

Hyospathe has a scattered pattern. It was observed that in both species studied the TC link primary to secondary and secondary to secondary LV within the same species (Fig. 2b).

DISCUSSION

Considering its TC pattern, Euterpeinae can be divided into two major groups. The first group, containing *Prestoea* and *Oenocarpus*, is characterized by TC with a continuous pattern. This was never reported previously. The second group includes *Euterpe*, *Neonicholsonia* and *Hyospathe* and is characterized by short TC, scattered and irregularly distributed between the LV. Although *E. broadwayi*, *E. catinga* and *E. edulis* sometimes contain a few continuous TC among a greater number of scattered ones, the majority of *Euterpe* species here examined have a clear scattered TC pattern.

The resemblance of TC pattern between some *Euterpe* and *Prestoea* species is not unexpected and was found by Strudwick (1993). These genera have a disputed taxonomic history; some authors suggest they be treated as a single genus (Burret 1929, Wessels Boer 1988), while others advocate for their segregation (Moore 1963, Uhl and Dransfield 1987, Henderson and Galeano 1996). The results presented here, as well as that of Strudwick (1993), support the proposition of distinct genera.

The pattern of TC in palm leaves seems to be a useful character for distinguishing between closely related genera, as shown in the cases of *Itaya* versus the other members of *Chelyocarpus* alliance (Uhl 1972) and *Prestoea* versus *Euterpe* (Strudwick 1993, this study). However, TC pattern is only one among several characters needed for a complete phylogenetic study of the subtribe Euterpeinae.

Table 1. Taxa and specimens of Euterpeinae examined.

Taxa	Specimen examined
<i>Prestoea acuminata</i> (Willd.) H.E. Moore var. <i>acuminata</i>	BOLIVIA. Cochabamba, 14 Oct 1994, <i>Moraes et al.</i> 1871 (NY)
<i>P. acuminata</i> H.E. Moore var. <i>montana</i> (Graham) Henderson & Galeano	PUERTO RICO. La Quimina, 25 Jan 1983, <i>Henderson</i> 3 (NY)
<i>P. carderi</i> Hooker f.	VENEZUELA. Yaracuy, 9 Oct 1967, <i>W. Boer</i> 2030 (NY)
<i>P. decurrens</i> (H. Wendl. ex Burret) H.E. Moore	ECUADOR. Cotopaxi, 6 Apr 1986, <i>H. Balslev</i> 62029 (NY)
<i>P. ensiformis</i> (Ruiz & Pavón) H.E. Moore	PANAMA. Panama, 29 Nov 1985, <i>de Nevers & Henderson</i> 6411 (NY)
<i>P. longepetiolata</i> (Oerst.) H.E. Moore var. <i>longepetiolata</i>	COSTA RICA. Puntarenas, 277 May 1986, <i>de Nevers</i> 7764 (NY)
<i>P. longepetiolata</i> (Oerst.) H.E. Moore	
var. <i>roseospadix</i> (L.H. Bailey) Henderson & Galeano	
<i>P. pubens</i> H.E. Moore var. <i>semispicata</i> (de Nevers & Henderson) Henderson & Galeano	PANAMA. Chiquirí, 17 Jan 1986, <i>de Nevers & G. McPherson</i> 6829 (NY)
<i>P. schultzeana</i> (Burret) H.E. Moore	PANAMA. San Blas, 21 Dec 1985, <i>de Nevers & H. Herrera</i> 6671 (NY)
<i>P. pubigera</i> (Griseb. & H. Wendl.) Hooker f.	PERU. Oxapampa, 21 Jun 1982, <i>D. Smith</i> 2016 (NY)
<i>P. simplicifolia</i> Galeano	TRINIDAD. Northern Range, 18 Aug 1991, <i>Henderson & F. Coelho</i> 1623 (NY)
<i>P. tenuiramosa</i> (Dammer) H.E. Moore	COLOMBIA. Antioquia, 20 Mar 1982, <i>R. Bernal & G. Galeano</i> 261 (NY)
<i>Euterpe broadwayi</i> Beccari	VENEZUELA. Bolívar, 14–19 Aug 1970, <i>H.E. Moore et al.</i> 9717 (NY)
<i>E. catinga</i> Wallace var. <i>catinga</i>	TRINIDAD. Northern Range, 18 Aug 1991, <i>Henderson & F. Coelho</i> 1624 (NY)
<i>E. catinga</i> Wallace var. <i>roraimae</i> (Dammer) Henderson & Galeano	VENEZUELA. Amazonas, 6 Feb 1985, <i>Henderson</i> 12 (NY)
<i>E. edulis</i> Martius	VENEZUELA. Bolívar, 14–19 Aug 1970, <i>H. E. Moore et al.</i> 9715 (NY)
<i>E. longibracteata</i> Barb. Rodr.	BRAZIL. Bahia, 17 Jan 1989, <i>L. Noblick</i> 4741 (NY)
<i>E. luminosa</i> Henderson, Galeano & Meza	SURINAM. Knopaimoi, 20 Sep 1994, <i>Granville</i> 12603 (NY)
<i>E. oleracea</i> Martius	PERU. Pasco, 24 May 1989, <i>Henderson et al.</i> 1032 (NY)
<i>E. precatoria</i> Martius var. <i>longevaginata</i> (Martius) Henderson	BRAZIL. Pará, 22 Jul 1986, <i>Scariot</i> 7 (NY)
<i>E. precatoria</i> Martius var. <i>precatoria</i>	BRAZIL. Acre, 16 Oct 1989, <i>Henderson et al.</i> 1138 (NY)
<i>Oenocarpus bacaba</i> Martius	BRAZIL. Amazonas, 9 Jan 1991, <i>Henderson et al.</i> 1530 (NY)
<i>O. baltickii</i> Kahn	BRAZIL. Rondônia, 17 Apr 1987, <i>M. Nee</i> 34886 (NY)
<i>O. batava</i> Martius var. <i>batava</i>	BRAZIL. Acre, 19 Oct 1989, <i>Henderson et al.</i> 1147 (NY)
<i>O. batava</i> Martius var. <i>oligocarpa</i> (Griseb. & H. Wendl.) Henderson	COLOMBIA. Vaupes, 3 Jul 1976, <i>Zarucchi & M. Baltick</i> 1809 (NY)
	TRINIDAD. Valencia, 23 Aug 1963, <i>W. Boer</i> 1623 (NY)

Table 1. Continuation.

Taxa	Specimen examined
<i>O. circumtextus</i> Martius	COLOMBIA. Amazonas, 8 Mar 1990, Galeano et al. 1974 (NY)
<i>O. distichus</i> Martius	BRAZIL. Goiás, 5 Dec 1985, E. Lleras et al. 2079 (NY)
<i>O. mapora</i> H. Karsten	ECUADOR. Napo, 7 Dec 1983, H. Balslev & D. Irvine 4639 (NY)
<i>O. minor</i> Martius	COLOMBIA. Antioquia, 15 Nov 1980, Galeano & R. Bernal 277 (NY)
<i>O. simplex</i> Bernal, Galeano & Henderson	COLOMBIA. Amazonas, 10 Mar 1990, Galeano et al. 2027 (NY)
<i>Hyospathe elegans</i> Martius	COLOMBIA. Antioquia, 24 Feb 1985, Henderson & R. Bernal 155 (NY)
<i>H. macrorachis</i> Burret	ECUADOR. Napo, 27 Apr 1986, H. Balslev et al. 62073 (NY)
<i>Neonicholsonia watsonii</i> Dammer	COSTA RICA. Puntarenas, 28 Dec 1984, Henderson 76 (NY)

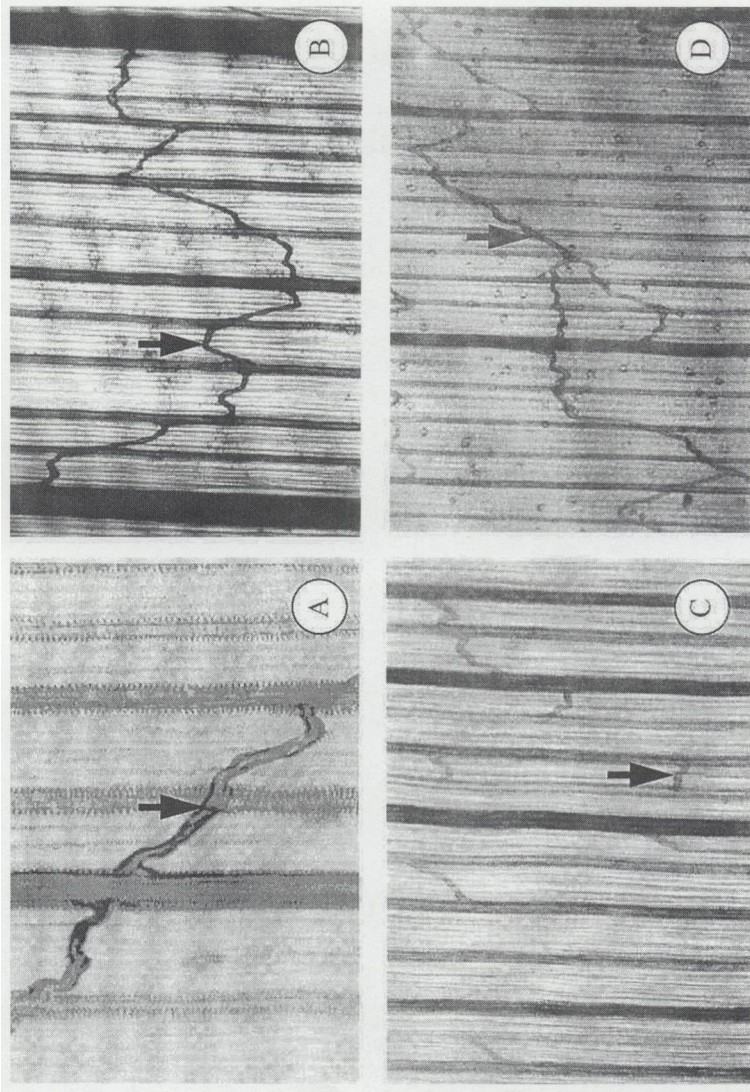


Fig. 1. Transverse commissures in cleared leaves of Euterpeinae palms: **a.** detail of a TC running below a small longitudinal vein in *E. precatoria* var. *precatoria* (Henderson *et al.* 1530); **b.** continuous TC in the leaf of *Prestoea acuminata* var. *acuminata* (Moraes *et al.* 1871); **c.** short and scattered TC of *E. catinga* var. *roraimae* (H. E. Moore *et al.* 9715); **d.** continuous TC in the leaves of *Oenocarpus balickii* (Henderson *et al.* 1147).

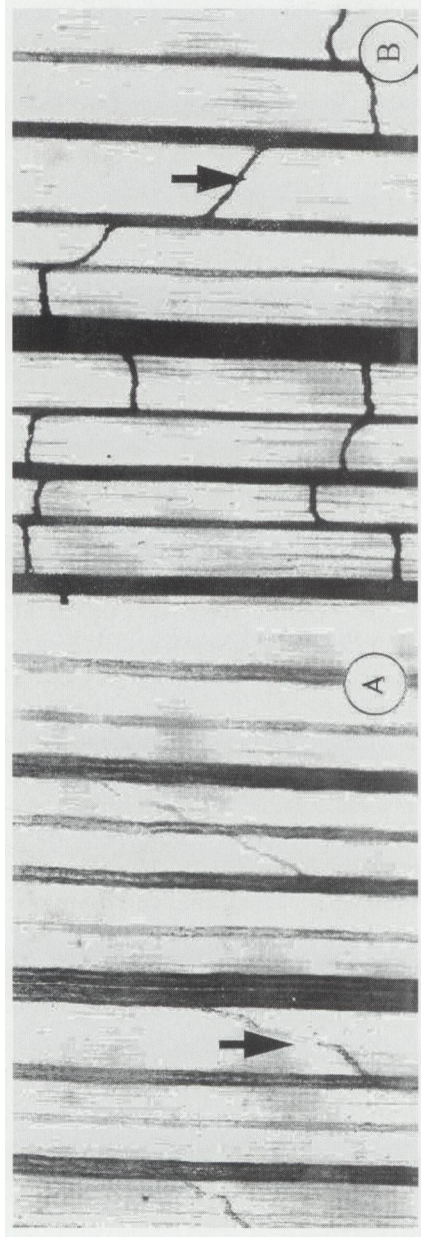


Fig. 2. Transverse commissures in cleared leaves of Euterpeinae palms: **a.** short and scattered TC of *Neonicholsonia wasonii* (Henderson 76); **b.** short and scattered TC of *Hyospathe macrorachis* (H. Balslev et al. 62073).

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