

Saribus Resurrected

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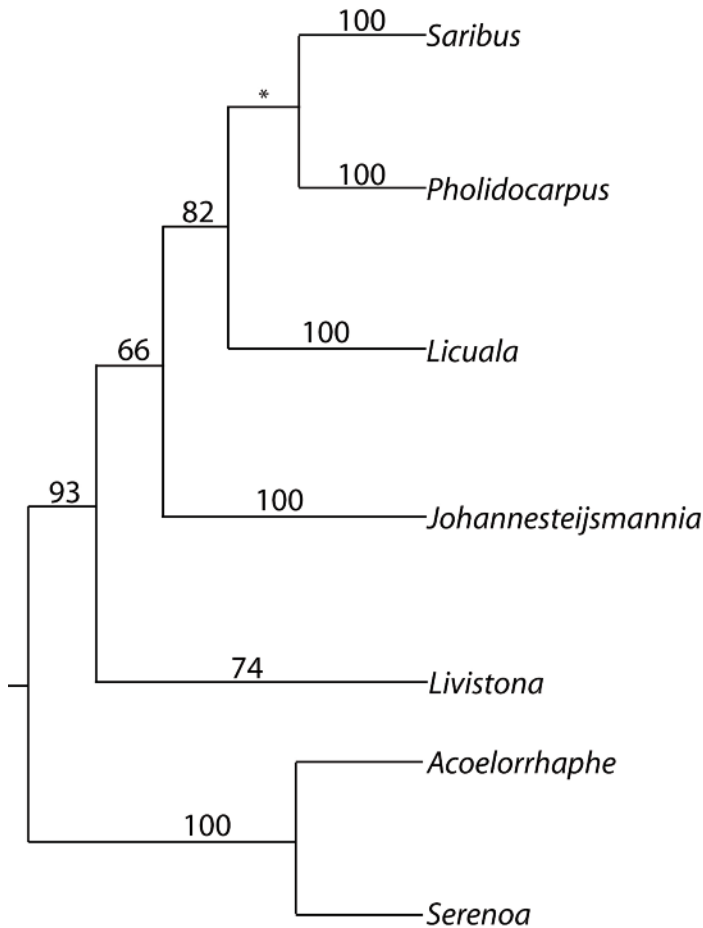
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Recent analysis of molecular data uncovered the startling fact that *Livistona*, as currently recognized, is not a natural, coherent genus and that eight of its species, including the widely cultivated *Livistona rotundifolia*, along with the rare *Pritchardiopsis jeanneneyi* constitute a distinct genus, for which the earliest name is *Saribus*.

The palm tribe Trachycarpeae contains some of the most widely cultivated fan palms, such as *Livistona chinensis*, *Pritchardia pacifica*, *Trachycarpus fortunei* and *Washingtonia filifera*. The group is among the most widespread of all palm tribes and its species are conspicuous components of many different vegetation types, from deserts and pinelands to tropical rainforests.

Despite more than a decade of DNA-based phylogenetic research aimed at revealing evolutionary relationships of palms (e.g. Asmussen et al. 2006, Baker et al. 2009), the Trachycarpeae remains one of the most significant areas of phylogenetic ambiguity within the family due to poor resolution among genera and low support for relationships. To address this problem, a focused tribal-level analysis using DNA evidence has been conducted recently, based on dense sampling across 113 species and six different regions of the genome (Bacon et al., in review). This new phylogenetic framework has provided the best estimate of relationships among the genera of Trachycarpeae available to date and has yielded some surprising taxonomic and biogeographic insights.

Our primary goal was to test the delimitation of the genera of Trachycarpeae by determining whether or not they constitute natural evolutionary units containing all descendants of a common ancestor (monophyletic groups). Our molecular data indicated that the majority of genera were indeed monophyletic. *Livistona*, however, was not found to be monophyletic, but was divided among two different groups that were not each other's closest relative (Fig. 1). One group comprised three *Livistona* species (*L. merrillii*, *L. rotundifolia* and *L. woodfordii*) and two samples of the monotypic *Pritchardiopsis jeanneneyi*. The second group included 19 *Livistona* species from eastern Asia, south-east Asia, Australia and Africa. The grouping of the three *Livistona* species and *Pritchardiopsis* was highly supported and was more closely related to *Pholidocarpus*, *Licuala* and *Johannesteijsmannia* than to the remaining species of *Livistona*. Thus, to render all Trachycarpeae genera monophyletic, this group requires recognition at the genus level. A generic name, *Saribus* (Blume 1838) typified on *Saribus rotundifolius* (Lam.) Blume (syn. *Livistona rotundifolia* (Lam.) Mart.), is already available for this group. It takes priority over



1. Phylogeny of relationships between *Saribus* and the remaining genera of subtribe Livistoninae (tribe Trachycarpeae) based on Bacon et al. (in review). Numbers on branches are parsimony support values for each node on the tree. The asterisk indicates support less than 50%. *Saribus* is well-supported (100%) and separate from *Livistona*.

the other generic name in the group, *Pritchardiopsis* (Beccari 1910), which must be placed as a synonym of *Saribus* because of its later publication date.

Saribus includes a Philippines endemic species (*S. merrillii*), a group of Papuan species (*S. brevifolius*, *S. chokolatinus*, *S. papuanus*, *S. rotundifolius*, *S. surru*, *S. tothur* and *S. woodfordii*), an outlier species in New Caledonia (*S. jeanneneyi*) and one species widespread in Malesia (*S. rotundifolius*) (Fig. 2). The removal of *Saribus* reveals a new disjunction in the distribution of true *Livistona* between Australia and southern New Guinea (*L. alfredii*, *L. australis*, *L. benthamii*, *L. concinna*, *L. decora*, *L. drudei*, *L. eastonii*, *L. fulva*, *L. humilis*, *L. inermis*, *L. lanuginosa*, *L. lorophylla*, *L. mariae*, *L. muelleri*, *L. nasmophila*, *L. nitida*, *L. rigida* and *L. victoriae*) and tropical Asia west of Wallace's Line (*L.*

boninensis, *L. chinensis*, *L. endauensis*, *L. exigua*, *L. halongensis*, *L. jenkinsiana*, *L. saribus*, *L. speciosa* and *L. tahanensis*), in addition to the known disjunction in Arabia and the Horn of Africa (*L. carinensis*).

The occurrence of *Livistona carinensis* in Djibouti, northern Somalia, and southern Yemen, so distant from remaining species of the genus, has fascinated many palm biologists. First recognized as a species of *Hyphaene*, it was placed by Burret in the monotypic genus *Wissmannia* in 1943. However, on grounds of close morphological and anatomical similarities, Dransfield and Uhl (1983) reduced *W. carinensis* into synonymy with *Livistona* (see also Tomlinson 1961a, Monod 1955). The placement of *L. carinensis* within *Livistona sensu stricto* is strongly supported by our DNA data. Our

biogeographical results are consistent with Dransfield and Uhl's (1983) hypothesis that the distribution of *Livistona* was once much more widespread during the time of the northern boreotropical forests (Miocene; about 5–24 million years ago) and that, due to geological and climate changes, *L. carinensis* became isolated in the African-Arabian region in a relict forest fragment. In our phylogenetic analysis, *L. carinensis* is resolved on a long branch as sister to all the remaining *Livistona* species, which suggests that there have been high levels of extinction within this lineage. Nevertheless, there is no current phylogenetic justification for recognizing *Wissmannia*, and given its high morphological similarity to *Livistona*, it is most appropriate to retain it within the revised circumscription of this genus.

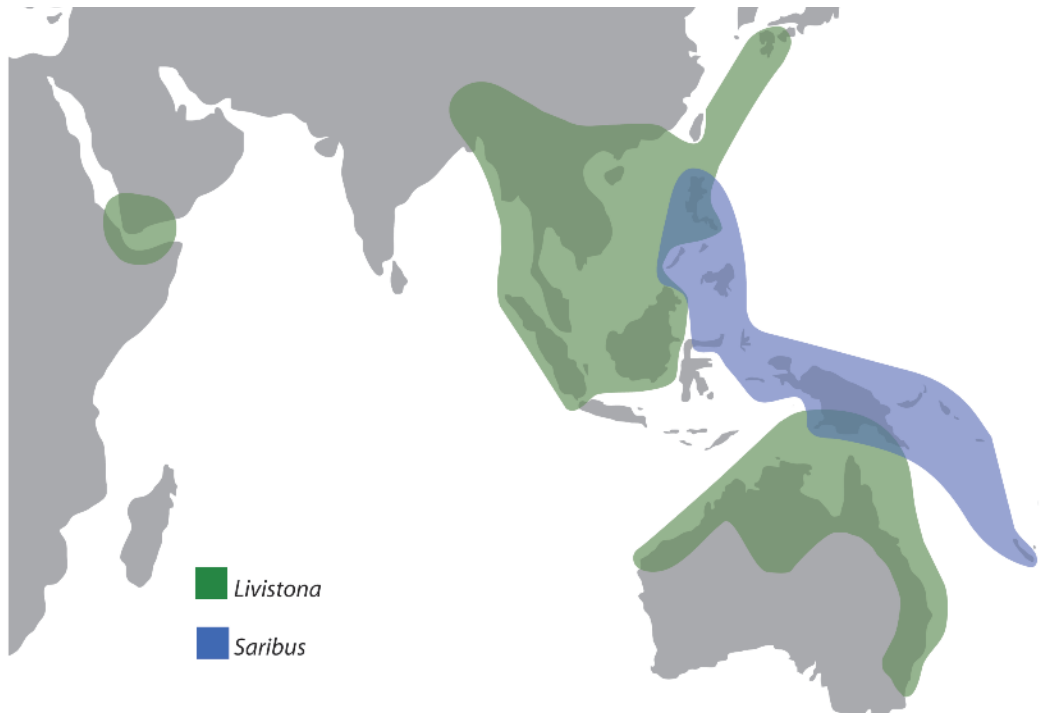
Saribus is readily distinguished from *Livistona* in the field, in cultivation and in the herbarium. The morphological characters that enable identification of *Saribus* include trifurcate inflorescences, consisting of three main axes (sometimes two) that join at their base within a single prophyll (Fig. 3), whereas *Livistona* produces inflorescences comprising a single main axis only (Dowe 2009). *Saribus* has orange, orange-brown, or red mature fruit color (Fig. 4), whereas the fruits of *Livistona* are

green, blue, purple, brown or black (Dowe 2009, Dransfield et al. 2008). It should be noted that this group had already been highlighted by Dowe (2009) as a distinctive element within *Livistona* in its former sense. Because of these clear, consistent characters, we have been able to place several species in *Saribus* that we were not able to sample for our phylogenetic research.

From an anatomical perspective, *Saribus* and the rest of the Livistoninae excluding *Livistona* have intercostal cells of the adaxial epidermis that are differentiated into long and short cells within the same cell file. *Livistona* has adaxial epidermal cells uniformly of the long cell type, like all genera of Trachycarpeae outside of Livistoninae (Tomlinson 1961b, Tomlinson et al. 2010). A similar character distribution occurs for the presence of fibers that are associated with surface layers and also depart from the sheath of transverse veins of the lamina ramifying in the mesophyll (Tomlinson 1961b, Tomlinson et al., 2011). These character states, though not unique to *Saribus*, further distinguish *Saribus* from *Livistona*.

The reduction of the monotypic *Pritchardopsis* into synonymy as *Saribus jeanneneyi* is a notable outcome of this research, given the rarity and conservation significance of this species, which persists as one adult and a few

2. The global distribution of *Livistona* and *Saribus*.



juveniles in the far south of New Caledonia. This taxonomic change is strongly supported by both the molecular and morphological data described above. *Saribus jeanneneyi* deviates slightly in some respects from other members of the genus. Its fruit are reported to be purplish (Hodel & Pintaud 1998), although a near-ripe fruit figured in this reference is in fact yellow-orange. The fruit are also large (ca. 4 cm diam.; Hodel & Pintaud 1998) with seeds surrounded by a keeled, woody endocarp (Dransfield et al. 2008). However, fruits of similar or larger size are found in some species of *Saribus* (*S. surru*, *S. tothur*) and at least one other has an equally woody, thickened endocarp (*S. papuanus*; Fig. 5). The loss of charismatic genera through nomenclatural change can be controversial, but it in no way reduces the conservation importance of this critically endangered New Caledonian endemic. In fact, by knowing its evolutionary relationships more clearly, we may be better placed to understand its biology and to make appropriate, informed conservation decisions as a result.

Taxonomic treatment of *Saribus*

Saribus Blume, Rumphia 2: 48. 1838.
Lectotype: *S. rotundifolius* (Lam.) Blume
(*Corypha rotundifolia* Lam.)

Pritchardiopsis Becc., Webbia 3: 131. 1910.
synon. nov. Type: *P. jeanneneyi* Becc.

Distribution: Philippines, Borneo (Banggi Island only), Sulawesi, Moluccas, New Guinea, Solomon Islands, New Caledonia.

Saribus brevifolius (Dowe & Mogege) C.D. Bacon & W.J. Baker, comb. nov. *Livistona brevifolia* Dowe & Mogege, Palms 48: 201. 2004. Type: Indonesia, Papua, Raja Ampat Islands, West Waigeo, Kawe Is., Nov. 2002, *Mogege et al. 8171* (holotype BO; isotypes K, L, MAN, NY).

Distribution: New Guinea (Raja Ampat Islands only).

Saribus chocolatinus (Dowe) C.D. Bacon & W.J. Baker, comb. nov. *Livistona chocolatina* Dowe, Palms 48: 199. 2004. Type: Papua New Guinea, Central Province, Kuriva Mission

3. Herbarium specimen of *Saribus chocolatinus* showing trifurcate inflorescence, with three main inflorescence axes arising within a single prophyll. Photo: C.D. Bacon.





4. *Saribus merrillii* in cultivation, showing bright red fruit. Photo: C.E. Lewis.

area, 4 km north of Haritano Highway along forestry road, Mar. 2000, *Barfod et al.* 466 (holotype AAU; isotypes BRI, CANB, K, LAE). (Fig. 3)

Distribution: New Guinea.

Saribus jeanneneyi (Becc.) C.D. Bacon & W.J. Baker, comb. nov. *Pritchardiopsis jeanneneyi* Becc., *Webbia* 3: 132. 1910. Type: New Caledonia, Prony District, *Jeanneney s.n.* (K).

Distribution: New Caledonia.

Saribus merrillii (Becc.) C.D. Bacon & W.J. Baker, comb. nov. *Livistona merrillii* Becc. in J.R. Perkins and al., *Fragm. Fl. Philipp.* 1: 45. 1904. Type: Philippines, Luzon, Tayabas Province, Guinayangan, Jan. 1903, *Merrill 2071* (holotype FI). (Fig. 4)

Corypha minor Blanco *non* Jacq., *Fl. Filip.*: 229. 1837.

Livistona whitfordii Becc., Webbia 1: 341. 1905.

Livistona blancoi Merr., Sp. Blancoan.: 84. 1918.

Distribution: Philippines.

Saribus papuanus (Becc.) Kuntze, Revis. Gen. Pl. 2: 736. 1891. *Livistona papuana* Becc., Malesia 1: 84. 1877. Type: Indonesia, Papua, Miosnom Island, Apr 1875, *Beccari s.n.* (holotype FI). (Fig. 5)

Distribution: New Guinea.

5. *Saribus papuanus* in heath forest at 500 m near Mt. Jaya, Papua, Indonesia. Photo: W.J. Baker, RBG Kew.



Saribus rotundifolius (Lam.) Blume, Rumphia 2: 49. 1838. *Corypha rotundifolia* Lam., Encycl. 2: 131. 1786. *Licuala rotundifolia* (Lam.) Blume in J.J. Roemer and J.A. Schultes, Syst. Veg. 7: 1305. 1830. *Livistona rotundifolia* (Lam.) Mart., Hist. Nat. Palm. 3: 241. 1838. Type: Illustration in Rumphius, Herb. Amboin. 1 (1741) t. 8 (lectotype).

Livistona altissima Zoll., Tijdschr. Ned.-Indië 14: 150. 1857.

Livistona microcarpa Becc., Philipp. J. Sci., C 2: 231. 1907. *Livistona rotundifolia* var. *microcarpa* (Becc.) Becc., Philipp. J. Sci. 14: 341. 1919.

Livistona mindorensis Becc., Philipp. J. Sci., C 4: 615. 1909. *Livistona rotundifolia* var. *mindorensis* (Becc.) Becc., Philipp. J. Sci. 14: 341. 1919.

Livistona robinsoniana Becc., Philipp. J. Sci., C 6: 230. 1919.

Livistona rotundifolia var. *luzonensis* Becc., Philipp. J. Sci. 14: 340. 1919.

Distribution: Philippines, Borneo (Banggi Island only), Sulawesi, Moluccas, New Guinea (Raja Ampat Islands only)

Saribus surru (Dowe & Barfod) C.D. Bacon & W.J. Baker, comb. nov. *Livistona surru* Dowe and Barfod, Austrobaileya 6: 169. 2001. Type: Papua New Guinea, West Sepik Province, Miwaute, Nov. 1996, Barfod et al. 390 (holotyp, AAU; isotypes BRI, K, LAE).

Distribution: New Guinea.

Saribus tothur (Dowe & Barfod) C.D. Bacon & W.J. Baker, comb. nov. *Livistona tothur* Dowe & Barfod, Austrobaileya 6: 171. 2001. Type: Papua New Guinea, West Sepik Province, Oenake Mts, on road to Niau Kono from Vanimo, Nov 1996, Damborg & Barfod 418 (holotyp AAU; isotype BRI, K, LAE).

Distribution: New Guinea.

Saribus woodfordii (Ridl.) C.D. Bacon & W.J. Baker, comb. nov. *Livistona woodfordii* Ridl., Gard. Chron. ser. 3, 23: 177. 1898. Type: Solomon Islands, San Cristobal Island, 1898 (1897?), Micholitz s.n. (lectotype BM; isolectotypes FI, K, SING).

Livistona beccariana Burret, Notizbl. Bot. Gart. Berlin-Dahlem 15: 326. 1941.

Distribution: New Guinea, Solomon Islands.

Note

Full taxonomic accounts of all species of *Saribus* can be found in Dowe's (2009) monograph of *Livistona* under the names previously accepted in that genus, with the exception of *S. jeanneneyi*, which was treated most recently by Hodel and Pintaud (1998).

Excluded names

Saribus chinensis (Jacq.) Blume, Rumphia 2: 49. 1838. = *Livistona chinensis* (Jacq.) R. Br. ex Mart.

Saribus cochinchinensis (Lour.) Blume, Rumphia 2: 49. 1838. = *Livistona saribus* (Lour.) Merr. ex A. Chev.

Saribus hasseltii Hassk., Flora 25 (Beibl. 2): 16. 1842. = *Livistona saribus* (Lour.) Merr. ex A. Chev.

Saribus hoogendorpii (Hort. ex Teijsm. & Binn. ex Miq.) Kuntze, Revis. Gen. Pl. 2: 736. 1891. = *Livistona saribus* (Lour.) Merr. ex A. Chev.

Saribus humilis (R. Br.) Kuntze, Revis. Gen. Pl. 2: 736. 1891. = *Livistona humilis* R. Br.

Saribus inermis (R. Br.) Kuntze, Revis. Gen. Pl. 2: 736. 1891. = *Livistona inermis* R. Br.

Saribus jenkinsii (Griff.) Kuntze, Revis. Gen. Pl. 2: 736. 1891. = *Livistona jenkinsiana* Griff.

Saribus kingianus (Becc.) Kuntze, Revis. Gen. Pl. 2: 736. 1891 = *Pholidocarpus kingianus* (Becc.) Ridl.

Saribus mariae (F.Muell.) Kuntze, Revis. Gen. Pl. 2: 736. 1891 = *Livistona mariae* F. Muell.

Saribus oliviformis Hassk., Tijdschr. Natuurl. Gesch. Physiol. 9: 176. 1842 = *Livistona chinensis* (Jacq.) R. Br. ex Mart.

Saribus speciosus (Kurz) Kuntze, Revis. Gen. Pl. 2: 736. 1891. = *Livistona jenkinsiana* Griff.

Saribus subglobosus Hassk., Tijdschr. Natuurl. Gesch. Physiol. 9: 177. 1842. = *Livistona chinensis* (Jacq.) R. Br. ex Mart.

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