

Three new species of *Danaea* (Marattiaceae) from French Guiana and the Lesser Antilles

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Danaea antillensis Christenhusz, *D. kalevala* Christenhusz and *D. ushana* Christenhusz (Marattiaceae) are described as new species from French Guiana and the Lesser Antilles. They are compared with morphologically similar ones and illustrated with line drawings.

Key words: *Danaea*, Marattiaceae, new species, taxonomy

The fern genus *Danaea* (Marattiaceae) contains about 50 species, confined to the neotropics, occurring from southern Mexico, throughout Central America, the Greater and Lesser Antilles and tropical South America, south to Bolivia, Paraguay and the Atlantic rainforests in Brazil (Tryon & Tryon 1982). The elevational range is from near sea level to 2650 m, but the genus is most common between 100 and 1000 m. Species of *Danaea* occur in rain forests and cloud forests, often on steep slopes and well-drained soils. The generic name commemorates G. P. M. Dana (1736–1801), an Italian professor of botany (Proctor 1989).

I carried out botanical explorations focusing on ferns in French Guiana, Suriname and several of the Lesser Antilles from February to April 2003, and on Guadeloupe during March 2005. As a result I discovered three new species of *Danaea*, which I describe in this report.

Danaea antillensis Christenhusz, *sp. nova* (Figs. 1 and 2A)

Rhizomata erecta, 17–50 cm longa, usque 8 cm

crassa. Stipites articulatae, nodis (2–)3, rachides alatae. Pinnae laterales ellipticae usque ovato-lanceolatae, 14–21.5 × 3.5–5 cm, (4–)5–7(–8)-jugae, apices acuminatae, margines undulatae. Pinnae terminales ovato-lanceolatae, 13–21 × 3–5.6 cm. Frondes fertiles stipibus nodosibus cum 2–4 nodis, et pinnae laterales lineares, (5–)6–7-jugae. Habitat in silvis umbrosis humidis Antillis Minores.

TYPE: Guadeloupe. Basse-Terre, Comm. Sainte-Rose, Source Sulfureuse de Sofaïa, along the trail down to Saut des Trois Cornes, steep slopes with creek gullies, 16°18'N, 61°43'W, 400 m, 2.IV.2003 Christenhusz & Paajanen 2747 (holotype TUR!; isotypes BM!, P!, UC!).

Plants 50–100 cm tall. Rhizomes erect, stout, 17–50 cm tall and 5–8 cm wide when fresh (Fig. 2A), 2–2.5 cm wide when dry, with fronds arranged spirally and roots on all sides. Stipules 1.5 cm long, round, papery, bearing many peltate, brown scales. Sterile fronds 62–83(–93) cm long; stipes articulated with (2–)3 nodes, ridged adaxially, usually not winged; rachises narrowly winged, wing to ca. 0.6 mm wide; blades oblong to ovate, widest at base, 32–43 × 15–28 cm,



Fig. 1. *Danaea antillensis*. — **A:** Habit. — **B:** Sterile frond. — **C:** Apical pinnae of fertile frond. (**A** from Christenhusz 2838, TUR; **B** and **C** from holotype, TUR).



Fig. 2. Photographs of rhizomes preserved in alcohol at TUR. — **A:** *Danaea antillensis* (from holotype). — **B:** *Danaea kalevala* (from holotype). — **C:** *Danaea kalevala* (from Christenhusz 3890).

with (4–)5–7(–8) pairs of pinnae and a conform terminal one; pinnae ovate-elliptic to ovate-lanceolate, widest at or below middle, glossy dark green above, dull green below; bases oblique, acute; margins entire, somewhat undulate; apices (long-) acuminate, entire to somewhat sinuate; largest lateral pinnae $14\text{--}21.5 \times 3.2\text{--}5$ cm, petiolules 1–6 mm; terminal pinnae ovate-lanceolate, widest near base, $13\text{--}21 \times 3\text{--}5.6$ cm, petiolules 1.5–2.8 cm. Veins simple or paired at base, rarely some forked veins, 8–12 veins/cm. Fertile fronds 72–86 cm, often bending downwards in live plants, pendent when plant is on a slope; stipes with 2–4 nodes; blades oblong, $11\text{--}15 \times 24\text{--}34$ cm; pinnae linear, (5–)6–7 pairs plus a terminal one; largest lateral pinnae $7.5\text{--}10.6 \times 1\text{--}2$ cm, petiolules 3–10 mm; terminal pinnae $7.2\text{--}12 \times 1\text{--}2.2$ cm, petiolules 1–2 cm.

ETYMOLOGY: This species occurs in the Lesser Antilles, hence the name.

DISTRIBUTION. Guadeloupe, Dominica, Saint Lucia, Saint Vincent. Perhaps also on Puerto Rico and Grenada, but this has not been confirmed. The species often grows on quite steep slopes in rain forests, up to about 650 m.

Danaea antillensis is part of a complex of

species that have traditionally been called *D. elliptica*. However, the type of *D. elliptica* is a juvenile *D. nodosa*, so *D. elliptica* is synonymous with *D. nodosa*. Because *Danaea antillensis* is morphologically clearly distinguishable from all other species in the complex, including the one growing on Jamaica, from where *D. elliptica* was described, it is described here as new.

Danaea antillensis is recognized by its short and thick, erect rhizomes (Fig. 2A) and large, glossy fronds, which have up to 8 pairs of lateral pinnae. It is most similar to *Danaea polymorpha*, also from the Lesser Antilles, which has fewer pinnae (up to 4 pairs, usually only 2 pairs) that are in general more rounded in shape and broadest at the middle rather than towards the base. The terminal pinna in *D. polymorpha* is clearly larger than the largest lateral pinna on the same frond, and the fronds are dull above, with a waxy appearance. *Danaea polymorpha* sometimes grows with *D. antillensis*, but *D. antillensis* can then easily be recognized by the glossy upper side of the fronds and the larger number of pinnae. Juveniles of *D. polymorpha* are simple or trifoliate up to at least 20 cm long; *D. antillensis* will already have two pairs of pinnae at that length. *Danaea antillensis* differs from *D. bipinnata*, from Amazonian Ecuador

and Peru, in having a much stouter rhizome (5–8 cm vs. 1–2 cm thick), more stipe nodes (2–3 vs. 0–1) and more pinnae (up to 8 vs. up to 6 pairs), that are larger ($14\text{--}21.5 \times 3.2\text{--}5$ cm vs. $8.5\text{--}16.5 \times 2.3\text{--}3.7$ cm) and ovate-elliptic (widest at the base or middle) rather than oblanceolate (widest above the middle). *Danaea leprieurii* from northern South America is a much smaller plant in all respects, with a more slender rhizome (less than 2 cm thick), shorter fronds (18–38 cm long), and shorter and narrower ($6\text{--}10 \times 1.4\text{--}2.8$ cm) pinnae.

ADDITIONAL SPECIMENS EXAMINED (paratypes). — **Guadeloupe.** Basse Terre, 1843, *l'Herminier s.n.* (BM!, F!, K!, P!); Comm. Capesterre-Belle-Eau, Grand-Étang, along D4 road from St. Sauveur to Chutes du Carbet, primary forests on steep slopes around the lake shore, $16^{\circ}2'N$, $61^{\circ}37'W$, 400 m, 13.III.2005 Christenhusz et al. 3888 (GUAD!, TUR!, UC!); 30.III.2003 Christenhusz 2730 (TUR!); 6.IV.2003 Christenhusz et al. 2789 (TUR!); Comm. Petit-Bourg, Vernou, at D1, trail down to Saut de la Lézarde, rainforest on steep slope and sandy soil, $16^{\circ}11'N$, $61^{\circ}39'W$, 150 m, 4.IV.2003 Christenhusz et al. 2787 (TUR!); along D23, Trace de Rivière Quiock, at third river crossing over Ravine Lapin, steep north facing slope in *Sloanea* forest, $16^{\circ}11'N$, $61^{\circ}42'W$, 248 m, 17.III.2005 Christenhusz et al. 3894 (GUAD!, TUR!); at occasionally inundated area along Rivière Quiock, near the twelfth river crossing, $16^{\circ}11'N$, $61^{\circ}42'W$, 300 m Christenhusz et al. 3897 (GUAD!, TUR!); Comm. Pointe-Noire, Forêt des Mamelles, start of Trace des Crêtes, 18.I.1992 Fournet 5028 (GUAD!); Comm. Goyave, Route forestier de Moreau, Chute Moreau in Ravine Racoon, 18.III.2005 Christenhusz et al. 3899 (GUAD!, TUR!). **Dominica.** La Chaudière, Valley of Hampstead River, ca. 2 miles from mouth, 100 m, moist forests in river valley, 1940 W. & B. Hodge 3587 (GH!); NW slopes of Morne Diablotins, 3000 ft., rain forest on ridge, 1984 Whiteford 4240 (BM!). **Saint Lucia.** 1887 Gray 14 (K!). **Saint Vincent.** 1797–1833 Guilding s.n. (BM!, K!).

***Danaea kalevala* Christenhusz, sp. nova**
(Figs. 2B–C and 3)

Rhizomata magna, repentia, usque 30 cm longa, vel longiora, 16 cm crassa in vivo. Frondes steriles usque 160 cm longae. Stipites continui. Pinnae laterales $21\text{--}35 \times 3.1\text{--}4.4$ cm, ca. 16-jugae, (ob-)lanceolatae, integrae, apices denticulatae, acuminatae; pinnae terminales $17\text{--}23 \times 3\text{--}4$ cm, ovato-lanceolatae. Nervillae simplices vel furcatae ad basi. Frondes fertiles 150 cm longae, vel longiora; pinnae laterales $13\text{--}15 \times 1.4\text{--}2$ cm, lineari-lanceolatae.

TYPE: Martinique. Fonds St.-Denis, Trace des Jésuites, Forêt du Morne du Lorrain, Forêt Départementalo-Dominiale des Pitons du Carbet, about 1–1.5 km north of D1, in the valley of the Lorrain River, 6 km east of Fonds-St.-Denis, primary rain forest with ridges and steep slopes, $14^{\circ}44'N$, $61^{\circ}05'W$, 350–450 m, 21.III.2003 Christenhusz & Bollen-dorff 2696 (holotype TUR!; isotypes BM!, P!, NY!, UC!).

Large plants to 2 m tall, fronds arching. Rhizomes creeping, fronds in several rows, arranged almost radially, but with roots emerging only on ventral side, massive, about 30 cm long, 10 cm tall, 10–16 cm wide at apex when fresh (Fig. 2B–C), 6–10 cm when dry; stipules 4 cm, round, fleshy, scaly. Sterile fronds up to 160 cm long, slightly lucent blue-green in young plants, dark green in mature ones; stipes 3 cm in diameter at swollen bases (when fresh), ca. 70 cm long, without nodes; rachises narrowly to not winged, nodes between fronds about 12 mm thick when fresh, not swollen when dry; blades imparipinnate, elliptic-lanceolate, widest towards base, $64\text{--}90 \times 50\text{--}60$ cm, with 13–16 pinna pairs and conform terminal ones; pinnae (ob-) lanceolate, widest at or above middle, bases acute to cuneate, margins finely sinuate to finely serrulate-denticulate at apices, apices gradually long-acuminate; largest lateral pinnae $21\text{--}35 \times 3.1\text{--}4.4$ cm, petiolules to 16 mm long; terminal pinnae ovate-lanceolate, widest at base, $17\text{--}23 \times 3\text{--}4$ cm, petiolules 1.8 cm long, bases acute, apices long-acuminate, sinuate-denticulate. Veins mostly simple or paired at base, also a few forked, about 12–14 veins per cm. Fertile fronds to at least 150 cm long; stipes without nodes, rachises winged; blades imparipinnate, with more than 12 pairs of lateral pinnae; pinnae linear-lanceolate, largest lateral pinnae $13\text{--}15 \times 1.4\text{--}2$ cm, petiolules to 4 mm long; bases oblique cordulate, apices acuminate, sinuate; terminal pinnae 12×1.4 cm, petiolules 6 mm long, base acute, apex acuminate.

ETYMOLOGY: The Kalevala, Finland's national heroic epic, was chosen as species epithet to show gratitude to Finland, the country that hosted me and provided me the opportunity to continue my studies in tropical botany.

DISTRIBUTION: Known only from the more humid islands in the Lesser Antilles (Saint Kitts, Guadeloupe, Dominica, Martinique, Saint Vin-

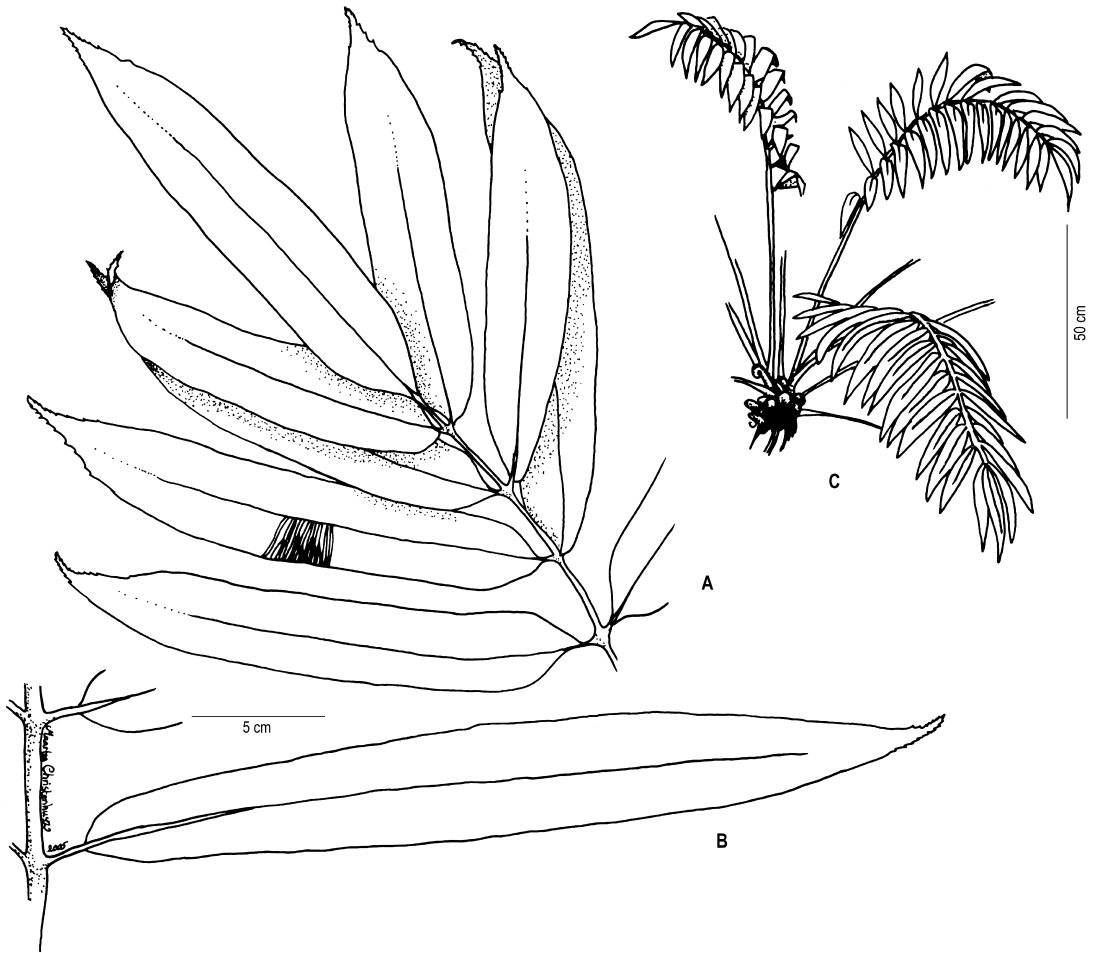


Fig. 3. *Danaea kalevala*. — **A:** Apex of sterile frond. — **B:** Largest sterile pinna. — **C:** Habit. (**A** and **B** from holotype, TUR; **C** drawn from a field sketch).

cent, Grenada), an uncommon species. *Danaea kalevala* can be found in old undisturbed rainforests, on steep slopes on well drained soil, up to about 600 m.

Danaea kalevala belongs to a complex of species that has traditionally been called *D. nodosa*. It can easily be recognized by its enormous rhizomes, which are commonly up to 15 cm wide at the apex and bear several rows (up to 6) of fronds (Fig. 2B–C). The rhizomes of *D. nodosa* differ in being strictly dorsiventral and having only two rows of fronds, and are much more slender, up to 5 cm thick when fresh. The rather long fronds of *D. kalevala* have many lanceolate pinnae (13–16 pairs) that are widest at the middle and have gradually acuminate, sinuate

to finely serrulate-denticulate apices. The pinnae of *D. nodosa* are oblanceolate, not parallel-sided, and have denticulate to dentate apices. *Danaea media* from Central America has sinuate-entire, abruptly tapering and long-acuminate pinna apices, contrasting with the finely serrulate-denticulate apices in *D. kalevala*. *Danaea media* also sometimes has stipes with nodes, especially in juvenile plants. Nodes have not been found on the stipes of *D. kalevala*. *Danaea erecta* from Ecuador differs in having erect, trunk-like rhizomes and entire, non-sinuate pinna apices. *Danaea ushana* has slender rhizomes with only two rows of fronds, entire, non-sinuate pinna apices, and much wider lateral pinnae (5.5–7 cm vs. 3.1–4.4 cm).

One of the proposed synonyms of *D. nodosa*, *D. longifolia*, has lectotype: 'in Antilles', s. coll., ex herb. Desvaux (P!, selected by Proctor 1985). It is possible that *D. kalevala* is *D. longifolia*, but the type material of *D. longifolia* is too incomplete to assign it to either *D. nodosa* or *D. kalevala* with certainty. The type consists only of an apex of a fertile frond and a single sterile pinna, showing none of the features distinguishing between *D. nodosa* and *D. kalevala*. Since the type locality of *D. longifolia* is not exactly known, this does not help in fixing the name's identity. Therefore, I prefer to consider *D. longifolia* a dubious name, and use *D. kalevala* for the species growing on the Lesser Antilles.

ADDITIONAL SPECIMENS EXAMINED (paratypes). — **Saint Kitts & Nevis.** Saint Kitts, outer NW side of The Crater, 2000–2100 ft., 15.III.1980 Proctor 19535 (IJ!). **Guadeloupe.** Basse Terre, Baudouin 831 (P!); Duss 4318 (NY!); Comm. Basse-Terre, St. Claude, Bois de la Souffrière, 1838 l'Herminier 127 (P!); Bains-Jaunes (Ravine Roche), 12.VIII.1942 Questel 2904 (P!); Prise d'Eau (Upper Ravine Roche), near Morne Goyavier, just below Bains-Jaunes, along creek in steep ravine, rainforest with *Sloanea* and *Podocarpus coriaceus*, on the border with the Parc Natural, 16°02'N, 61°40'W, 800–900 m, 10.III.2005 Christenhusz et al. 3884 (GUAD!, TUR!); Cascade Vauchelet, just N of waterfall on W facing slope, in old growth secondary *Sloanea* forest, 16°02'N, 61°41'W, 549 m, 16.III.2005 Christenhusz et al. 3890 (GUAD!, TUR!); Matouba, Rivière St.-Louis, Saut d'Eau du Matouba, northern side of the creek, secondary rain forest, rare, 16°03'N, 61°42'W, 350–400 m, 16.III.2005 Christenhusz et al. 3893 (GUAD!, TUR!). Comm. Capes-terre-Belle-Eau, Plateau Zimbimbe, Deuxième Chute du Carbet, in the ravine of Rivière Crabet, 16°03'N, 61°37'W, 711 m, 16.III.2005 Christenhusz et al. 3892 (GUAD!, TUR!). **Dominica.** 1882 Eggers 963 (K!). **Martinique.** Fonds-St-Denis, Trace des Jésuites, Forêt du Morne du Lorrain, Forêt Départementalo-Dominiale des Pitons du Carbet, Talus et sol de forêt primaire humide, 350 m, Forêt du Morne du Lorrain, le long de la Trace des Jésuites, entre la D1 et le guide la Rivière du Lorrain, à 10 km au SSW de Marigot, 1997 Boudrie 2909 (private herbarium M. Boudrie!). **Saint Vincent.** H. H. & G. Smith 692 (BM!); headwaters of the Cumberland River, 1500 ft, in deep ravines, 1889 H. H. Smith 1129 (E!, S!). **Grenada.** NW slope of Mt. St. Catherine, 30.X.–11.XII.1957 Proctor 17252 (GH!, IJ!). **Trinidad & Tobago.** Trinidad, 1899 Hart 6695 (K!).

***Danaea ushana* Christenhusz, sp. nova**
(Fig. 4)

Rhizomata repentia, ca. 4–4.5 cm crassa. *Fron- des steriles usque 150 cm longae*. *Stipites con-*

tinui, rachides non-alatae. *Pinnae laterales* (23–)24–28 × 5.5–7 cm, 5–6-jugae, *oblongo- ellipticae, apices integrae, acutae; pinnae termi- nales longiora quam pinnae laterales*, 31–33 × 7–8 cm, *lanceolatae*. *Nervillae binatae ad basi, spissae*. *Frondes fertiles usque 92 cm longae; pinnae laterales 17 × 2 cm, 4-jugae*.

TYPE: French Guiana. Matoury, Mont Grand Matoury, Sentier de la Mirande, southern slope of the mountain, forest on fine clay and coarse lateritic gravel. 4°52'N, 52°21'W, 150 m, 24.II.2003 Christenhusz, Bollendorff, Maas & Maas- van de Kamer 2519 (holotype TUR!; isotypes CAY!, P!).

Plants to 140 cm tall, with erect-arching fronds. Rhizomes creeping, dorsiventral, to 20 cm long, about 6–9 cm wide when fresh, 4–5 cm thick and 4.5 cm wide when dry, fronds in two rows on dorsal side, all roots on ventral side. Stipules 2 × 1.5 cm, half-circular. Sterile fronds to about 140 cm long; stipes 47–71 cm, without nodes; rachises not winged; blades stiff, imparipinnate, 53–61 × 48–56 cm, oblong, widest towards base, with 5–6 pinna pairs and a conform terminal one; pinnae oblong-elliptic, widest at or above middle, stiff, with entire, somewhat cartilaginous margins; largest lateral pinnae (23–)24–28 × 5.5–7 cm, bases symmetrical, acute; apices entire, slightly sinuate, acute; petiolules 3–6 mm long; terminal pinnae larger than largest lateral ones in same frond, 31–33 × 7–8 cm, lanceolate, parallel-sided, widest near middle; petiolules 1.5–2 cm long, base and apex acute. Veins mostly paired at base, rarely forked, about 12 veins per cm. Fertile fronds elliptic, to 92 cm long; stipes with reddish brown scales, without nodes, to 58 cm long; blades imparipinnate, to 44 cm long, with 4 pairs of lateral pinnae; pinnae lanceolate, largest lateral pinnae 17 × 2 cm, petiolules to 6 mm long; bases acuminate, apices acuminate, entire, with cartilaginous margins; terminal pinnae 23 × 2.3 cm, petiolules 3 cm long, bases and apices acuminate.

ETYMOLOGY. This species is named after my colleague and friend Usha Raghoenandan (1965–2004), for her friendship, her many contributions to the botany of Suriname, excellent knowledge of the plants in the field, and management of the herbarium collections in Paramaribo (BBS).

DISTRIBUTION. Known from only two localities in French Guiana, the type locality Mont



Fig. 4. *Danaea ushana*. — A: Sterile frond. — B: Fertile frond. (both from holotype, TUR).

Grand Matoury, and Filon Doyle, near Sainte Marie les Mines. Steep slopes on fine laterite-derived clay in rain forest.

Danaea ushana belongs to the complex of species that have traditionally been called *D. nodosa*. *Danaea ushana* can be recognized by its shorter fronds (140 cm vs. 190 cm in *D. nodosa*), broader pinnae, the terminal pinna being larger than the lateral ones (smaller or equal in *D. nodosa*) and entire pinna apices (serrate or serrulate in *D. nodosa*).

Danaea media shares the entire pinna apices, but differs in rhizomes having more than two rows of fronds, stipes sometimes having nodes, and pinnae being much narrower (to 5 cm vs.

5.5–7 cm wide). *Danaea kalevala* differs in rhizomes having more than two rows of fronds and pinnae apices being finely sinuate to serrulate-denticulate rather than entire. *Danaea erecta* differs especially in rhizomes being erect and radial, and in having more pinnae (7–19 vs. 5–6 pairs); often the terminal pinna is replaced by a proliferous bud. *Danaea latipinna*, from Ecuador, shares the rhizome characteristics of *D. ushana* but has pinnae with cuspidate to caudate (rather than acute) apices and a conspicuously whitish margin. In addition, the stipes of *D. latipinna* are sometimes nodose, and the terminal pinna of each blade is usually replaced by a bud.

ADDITIONAL SPECIMEN EXAMINED (paratype). — **French Guiana.** Crique Filon Doyle, Bassin de la Comté, near Ste Marie les Mines, south of Montagne Cacao, south of Cayenne, 14.XII.1980 *De Granville et al.* 4260 (CAY!).

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