A note on the Cuban tree fern hybrid Cyathea ×calolepis (Cyatheaceae) and on its parentage

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Abstract

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Cyathea ×calolepis was first collected by Wright in 1856 or 1857 and after 1859 was not found by any other collector until 1981 when it was rediscovered on the Gran Piedra range in the Sierra Maestra. It has since been collected in several places in the Santiago de Cuba province, twice in the Granma and once in the Guantánamo province, all in E Cuba. It has long been assumed to represent the hybrid between *C. arborea* and another, unknown tree fern species. This assumption is here corroborated, and it is demonstrated that the second parent is the E Cuban endemic *C. strigillosa*.

Introduction

Cyathea ×calolepis (Hook.) Domin was apparently first collected by Charles Wright in 1856 or 1857 in E Cuba, without stated locality. Of this collection (*Wright 891,* GH, NY, according to Tryon 1976) I saw no material – the Kew sheet of *Wright 891* is a mixture of *C. arborea* (L.) Sm. and *C. strigillosa* (Maxon) Domin, and according to Maxon (1922) the same is true for a sheet from the Eaton herbarium (YU). A second gathering of *C. ×calolepis, Wright 950,* was made in the Guantánamo province in 1859. Several specimens with that number bear a printed Wright label of "type 2" (Howard 1988: 86), "prope villam Monte Verde dictam, Jan.-July 1859", and it is not improbable that all are genuine duplicates – although with Wright numbers one may never take this for granted. An exact collecting date, 10 February, is recorded on a handwritten original label in the Gray Herbarium (GH; cited by Howard 1988). Maxon (1914) still considered *Wright 950* as the single known collection of *C. ×calolepis*.

Hooker (in Hooker & Baker 1865-68) described the *Wright 950* specimen in his own herbarium, now at Kew (K), as a new species of *Hemitelia* R. Br., *H. calolepis* Hook. *Hemitelia* as then defined was characterised by sori with a partial, or hemitelioid, indusium. Maxon (1912, 1914), when subdividing the genus, placed *H. calolepis* in *H.* sect. *Hemitelia ('Euhemitelia'),* a heterogeneous assemblage. Domin (1929) transferred *H. calolepis* to *Cyathea* Sm., a placement ac-

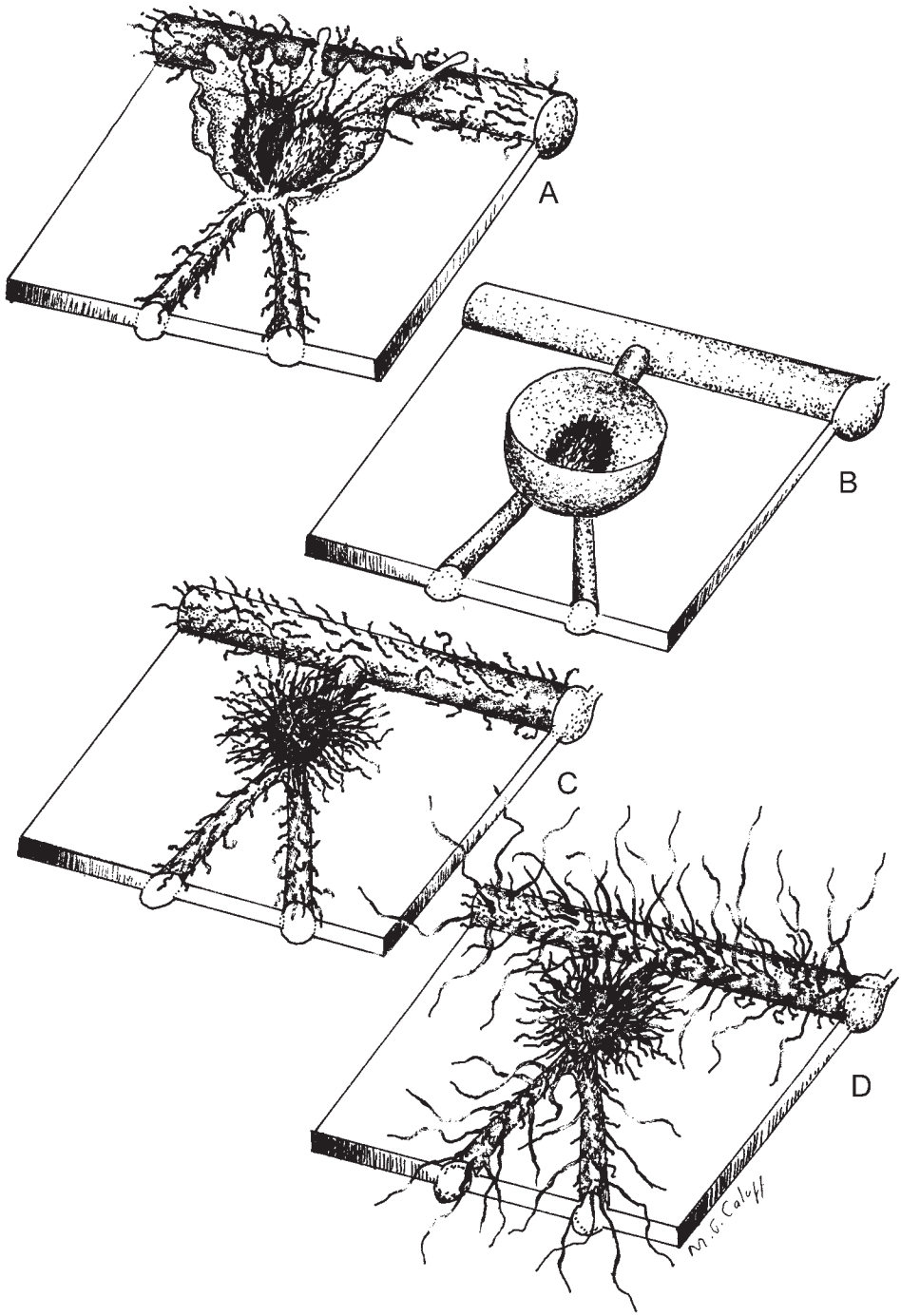

Fig. 1. Portion of abaxial leaf surface of *Cyathea,* showing sori and indumentum – A: *C.* ×*calolepis;* B: *C. arborea;* C: *C. strigillosa;* D: *C. armata*.

cepted by Tryon (1970) in his new classification of *Cyatheaceae,* which was essentially based on the cellular structure of the petiole scales.

In his revision of the genus *Cyathea,* Tryon (1976) mentioned a number of hybrids, among them *C.* ×*calolepis* which he considered to correspond to the cross between *C. arborea* and an unidentified species of *Trichipteris* C. Presl. Specimens from Jamaica that had previously been attributed to *C.* ×*calolepis* he (correctly) assigned to a different parentage, *C. arborea* × *T. armata* (Sw.) Tryon (now *C. armata* (Sw.) Domin), believing (erroneously) that the latter does not grow in Cuba. The Jamaican hybrid was subsequently named *C.* ×*bernardii* by Proctor (1982). Tryon characterised the Jamaican plants by the presence of long, rigid hairs on costae and pinnules abaxially, which is a diagnostic feature of *C. armata,* and he also mentioned the large hemitelioid indusium. For the Cuban hybrid he pointed at similarities with *C. arborea,* such as pinna architecture, the whitish petiole scales, and the bulliform scales found abaxially on the lamina; the indusium he described as relatively small and adhering to the receptacle for 1/4-1/2 of its circumference.

Results

In 1981, more than 120 years after its last known collection by Wright, *Cyathea* ×*calolepis* was rediscovered on the Gran Piedra range in the Sierra Maestra, Santiago de Cuba province, where it has since been collected several times. It has also been collected once on the Loma del Gato in the same province, twice in the Granma and once in the Guantánamo province, all in E Cuba. Details of localities are given in the specimen list.

The vegetative morphology of the plants is characterised in Table 1, where it is compared with that of *Cyathea arborea* and *C. strigillosa*. In the Gran Piedra area some individuals were found in which the petiole varies from tuberculate to aculeate, with up to 6 mm long spines. In fully grown plants spine size gradually decreases from the lowermost to the apical petioles. Young individuals, before the trunk elongates, have aculeate petioles. The veins and costae bear various trichome types abaxially, including some winged hairs (Fig. 3E).

The reproductive structures are quite uniform among the examined specimens, except for the size and curvature of the indusium as well as the degree of its adhesion to the receptacle base, which shows continual variation often on one and the same pinnule. In some indusia, filiform apical projections of uniseriate, chain-like cells were seen, similar to those tipping the bulliform scales found on costules and lateral veins in *Cyathea strigillosa*. In some sori the receptacles,

Table 1. A comparison of *Cyathea arborea, C.* ×*calolepis* and *C. strigillosa.*

Character	*C. arborea*	*C.* ×*calolepis*	*C. strigillosa*
Height of trunk [m]	≤ 13	≤ 5	≤ 5
Petiole bases	deciduous	persistent at least in part	persistent
Leaf length [m]	3-4	3.1-3.7	2.2-2.3
Petiole length [m]	0.36-2	0.8-1.5	0.65-1.15
Petiolar scale margin	lacking dark denticulations	with some light denticulations	with dark denticulations
Petiolar spine length [mm]	0	0-6	≤ 14
Shape of leaf blade in outline	ovate	oblong-ovate to ovate	oblong-ovate
Arrangement of pinnae	alternate	alternate or opposite	opposite or subopposite
Petiolulate pinnae, no. of pairs	8-10	3-8	0-3
Length [cm] of middle pinnae	40-92	37-76	43-68
Bulliform scales, on veins	absent	occasional	present on proximal veins
Winged trichomes, on veins	absent	occasional	occasional

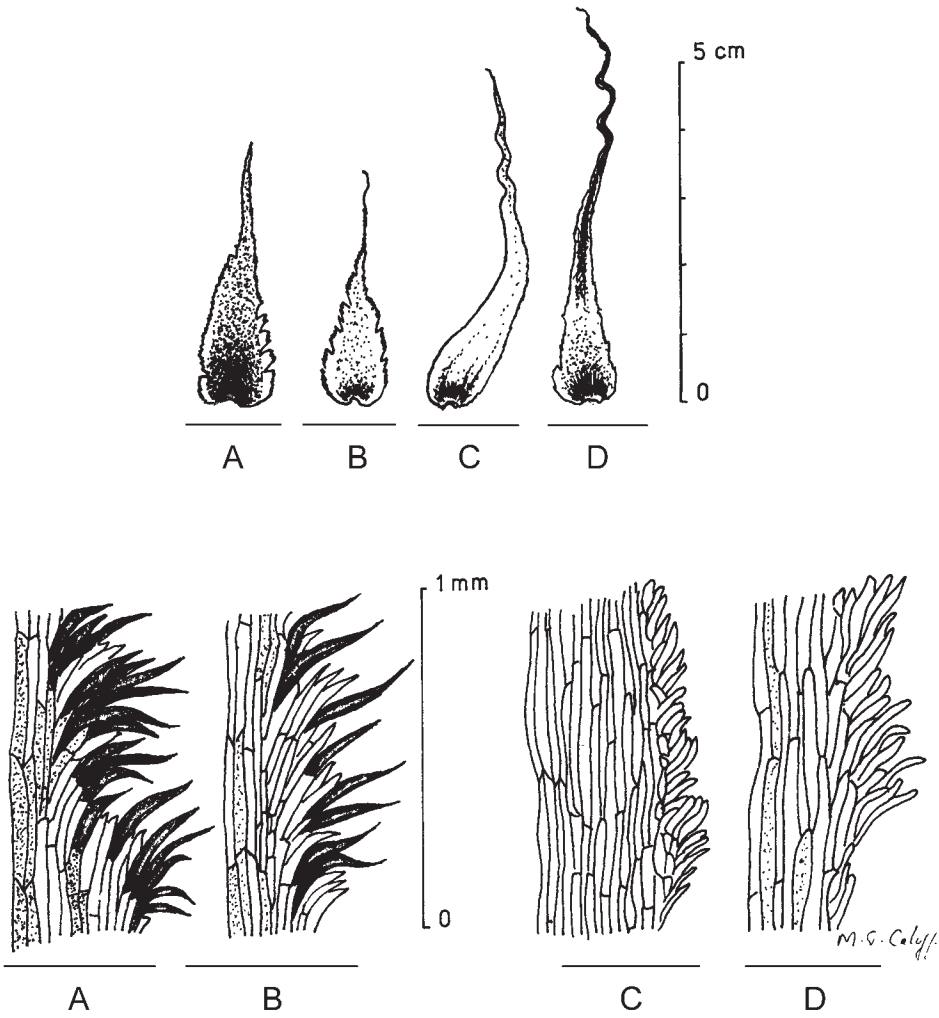

Fig. 2. Petiole scale (above), with enlarged portion of its margin (below), of A: *Cyathea armata;* B: *C. strigillosa;* C: *C. arborea;* D: *C.* ×*calolepis*.

when dry, are longitudinally cleft (Fig. 1A), which phenomenon one may also sometimes observe in *C. arborea*. The paraphyses (Fig. 3A) are of two types: abundant short, persistent ones with pluriseriate, cylindrical cells, somewhat similar to those of *C. arborea* (Fig. 3B); and long, winged ones with an uniseriate, chain-like apical portion, quickly deciduous, resembling the paraphyses of *C. strigillosa* and *C. armata* (Fig. 3C-D). The sporangia appear to develop normally, but the spores show various anomalies (Fig. 4), some being united in pairs by a narrow portion of the cellular wall; others, present in all the examined specimens, are abnormally large, discoid, biconcave. Fresh spores harvested in the wild from several wild individuals all failed to germinate.

Specimens seen. – Granma Prov.: Climb from Buey Arriba to Pino del Agua, 1000 m, trunk 3 m, fronds very long and broad, a single individual, in a gully in pine wood, 16.3.1987, *Caluff 2320 A-B* (BSC); Río Nuevo Mundo, La Bayamesa, 1000 m, trunk 5 m tall and 12 cm thick, fronds very

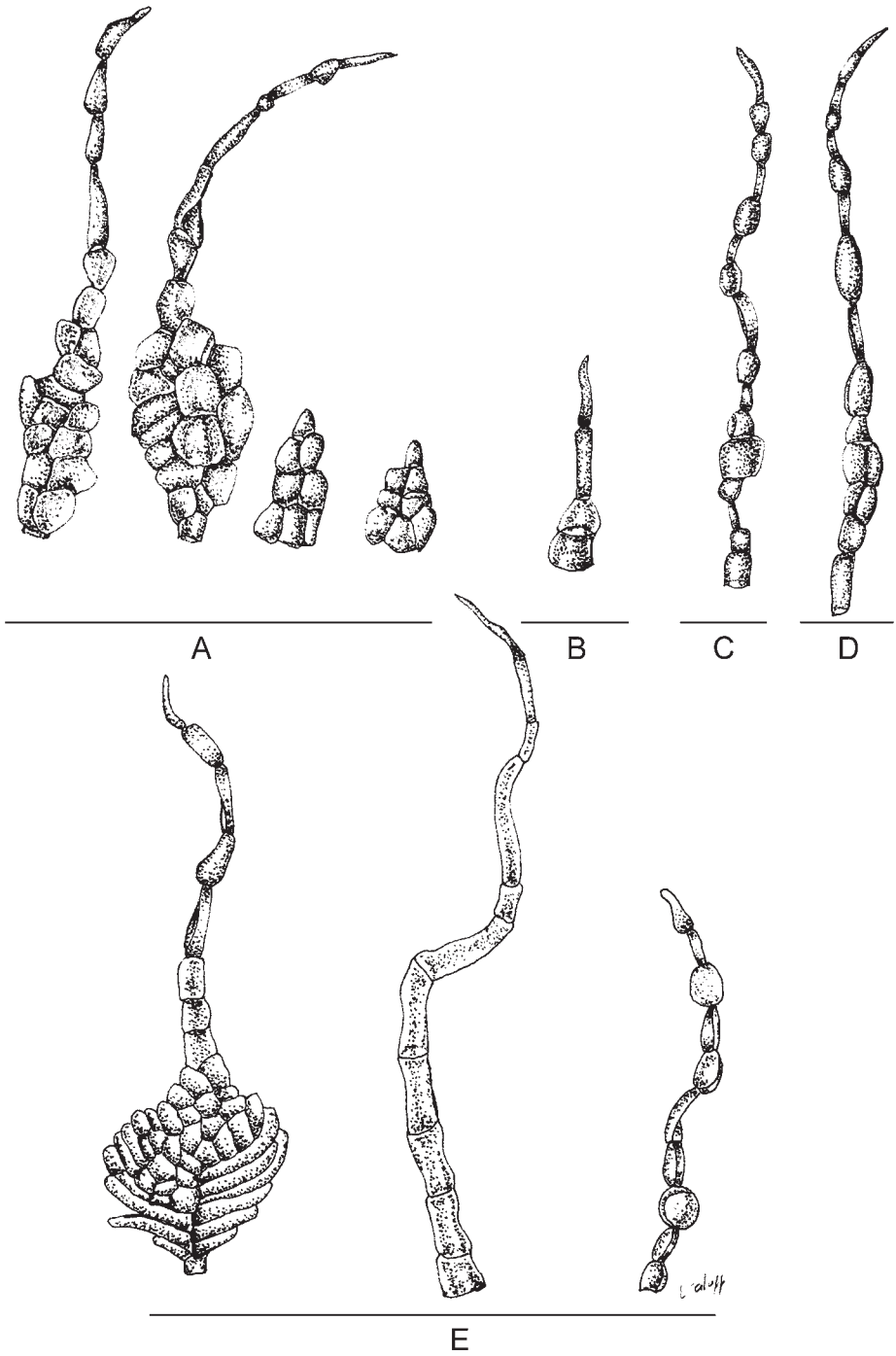

Fig. 3. Paraphyses of *Cyathea* species – A: *C.* ×*calolepis;* B: *C. arborea;* C: *C. strigillosa;* D: *C. armata;* E: trichome types in *C.* ×*calolepis:* winged, rigid and chain-like hair (from left).

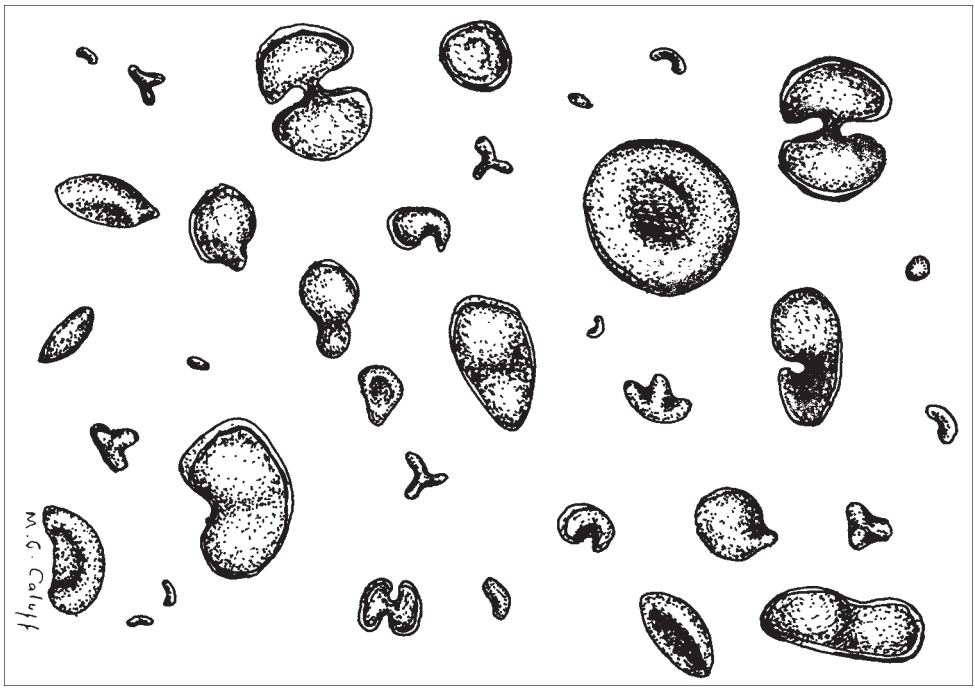

Fig. 4. Sporangium content of *Cyathea* ×*calolepis,* showing malformed and abortive spores.

large, a lone individual in gallery forest, 17.3.1987, *Caluff 2365 A-B* (BSC). — SANTIAGO DE CUBA PROV.: E and SE face of the Loma del Gato, Sierra del Cobre, 800-900 m, 31.8.1985, *Caluff 1613 A-C* (BSC); Gran Piedra, path of the Reserva A.C.C., 1000 m, 25.5.1981, *Caluff & Couso 241 A-B* (BSC); Gran Piedra, path between the tourist centre and La Isabelica, 1000 m, trunk 5 m × 15 cm, leaves 3 × 1.2 m, 19.10.1983, *Caluff & Couso 542 A-C* (BSC); Gran Piedra, path of the Reserva A.C.C., 950 m, trunk 5 m × 12 cm, leaves 3.1 × 1.5 m, 19.10.1983, *Caluff & Couso 543 A-C* (BSC), *Projecto Flora de Cuba 51708* (HAJB); along the path of the Reserva Gran Piedra, 800-1100 m, trunk 5 m tall and 15 cm across, 17.8.1984, *Caluff & Couso 643* (BSC); surroundings of the short-wave radio station of La Gran Piedra, 1000 m, trunk 5 m tall, 0.15 m across, 17.8.1984, *Caluff & Couso 644* (BSC); Gran Piedra Reserve, 900 m, track to the left ahead of La Isabelica, 27.8.1984, *Caluff & Medina 655 A-B* (BSC); path of the Reserva Gran Piedra, 30 m below the big stone and to the right, 800 m, 27.7.1984, *Caluff & Medina 656* (BSC); along the path beyond and N of the summital height of La Gran Piedra, 1050 m, 4 m tall, various individuals, 3.10.1984, *Caluff & Medina 680* (BSC); along the path beyond La Isabelica, toward Kentucky, lefthand side, 959 m, many individuals from trunkless to 5 m tall, 19.11.1984, *Caluff & Medina 689* (BSC). — GUANTÁNAMO PROV.: Sierra de Imías, hill W of the source of the Río Jojo, 1060 m, 19.11.1984, *Proyecto Flora de Cuba 53525* (HAJB); Monte Verde, 1.-7.1859, *Wright 950* (B, BM, GOET, HAC, K).

Discussion

In the Gran Piedra range, *Cyathea* ×*calolepis* coexists with two other tree fern species that had not been collected again since Wright's time: the endemic *C. strigillosa* and *C. armata* of Jamaica and Hispaniola, both rediscovered there in 1981-84 (Caluff 1988). In that area numerous individuals of *C.* ×*calolepis* in different stages of development exist, which in their majority are

located at the margins or in close proximity of pathways, where the natural montane rainforest and pine wood have been altered or replaced by secondary vegetation. This pattern of occurrence confirms the idea of Conant (1975, 1983) that such places offer propitious conditions for hybridisation.

When one observes *Cyathea* ×*calolepis* in the field, the paternity of *C. arborea* springs to the eye, but there are also notable differences between the two taxa: *C. arborea* has a smooth trunk, the lamina is ovate in outline, and the pinnae alternate, whereas *C.* ×*calolepis* retains the old petiole bases on the trunk, has a lamina more yellowish oblong in outline, and pinnae that are opposite to subopposite. Maxon (1914) compared *C.* ×*calolepis* with "certain lax states of *C. arborea*". Among reproductive features, the hybrid retains the curvature, colour and texture of indusia of *C. arborea* (Fig. 1A-B).

As already postulated by Tryon (1976) the second parent of *Cyathea* ×*calolepis* must be sought among the exindusiate *Cyathea* species formerly included in *Trichipteris.* The choice is between *C. strigillosa* and *C. armata.* Both are characterised by petiole scales provided with tiny dark marginal setulae and belong to a natural group of species already recognised, within *Alsophila,* by Maxon (1922) and Riba (1968, 1969), and within *Trichipteris* by Barrington (1978). *C. strigillosa* and *C. armata* are closely related, coinciding in details such as the type of hairiness and its distribution in the different parts of the leaf. In both, the indumentum is basically of two types of hairs: large pluricellular uniseriate, rigid but flexuous hairs, with all the cells cylindrical, translucent to whitish; and tiny chain-like, antrorsely appressed hairs, with the cells uniseriate, alternately flattened, and with reddish transverse walls (Fig. 3E). However, in *C. armata* the petiole and rachis have a characteristic dense coating of rigid hairs, which when shed leave behind their prominent base, so that the surface is harsh to the touch; whereas in *C. strigillosa* the petiole is subglabrous and the rachis barely pubescent with hairs that, when falling off, leave a small dark scar on an almost smooth surface. Also, in *C. armata* the pubescence of the costae and costules, abaxially, consists of abundant large, rigid hairs (Fig. 1D) in addition to the chain-like ones. In *C. strigillosa,* in contrast, typically the pubescence is constituted only by tiny chain-like hairs (Fig. 1C), and only in sterile individuals do some few and scattered rigid hairs occasionally appear on the mid-veins. Finally, a difference in overall size has been reported: *C. strigillosa* grows to 5 m tall at best, whereas for *C. armata* Maxon (1922) gives maximum values of 15 m, and in the Gran Piedra area 11 m were measured (Caluff 1988).

In addition to *Cyathea strigillosa* and *C. armata,* a third exindusiate *Cyathea* grows in the Gran Piedra area: *C. aspera* (L.) Sw. That species, however, is easily discarded as a possible parent of *C.* ×*calolepis* on the basis of its distinctive morphological characteristics, such as the aspect of the trunk (dark, slender, producing stolons and adventitious buds), leaf architecture (petiolate pinnae and petiolulate pinnules), the indumentum of brown scales, and the characteristic soral squamules adhering to the receptacle base, none of which are found in the hybrid.

Conclusion

By its morphology, *Cyathea* ×*calolepis* is intermediate between *C. strigillosa* and *C. arborea* (see Table 1). The pubescence of rachis, costae and costules, abaxially is only composed of reddish cateniform hairs (Fig. 1A), which is the main characteristic of *C. strigillosa*. The abundant rigid hairs of *C. armata,* present in the Jamaican *C.* ×*bernardii,* are found very occasionally on the costae and costules of sterile specimens of *C.* ×*calolepis,* just as in *C. strigillosa*. Also, the maximal size of *C.* ×*calolepis,* 5 m, coincides with that of *C. strigillosa*. It is therefore safe to conclude that *C.* ×*calolepis* is the product of a cross between *C. strigillosa* and *C. arborea*. However, the coexistence, in the Gran Piedra area, of *C. armata* and *C. arborea*, known to hybridise in Jamaica, may result at any time in the production of a further hybrid, *C.* ×*bernardii,* not so far reported from Cuba.

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