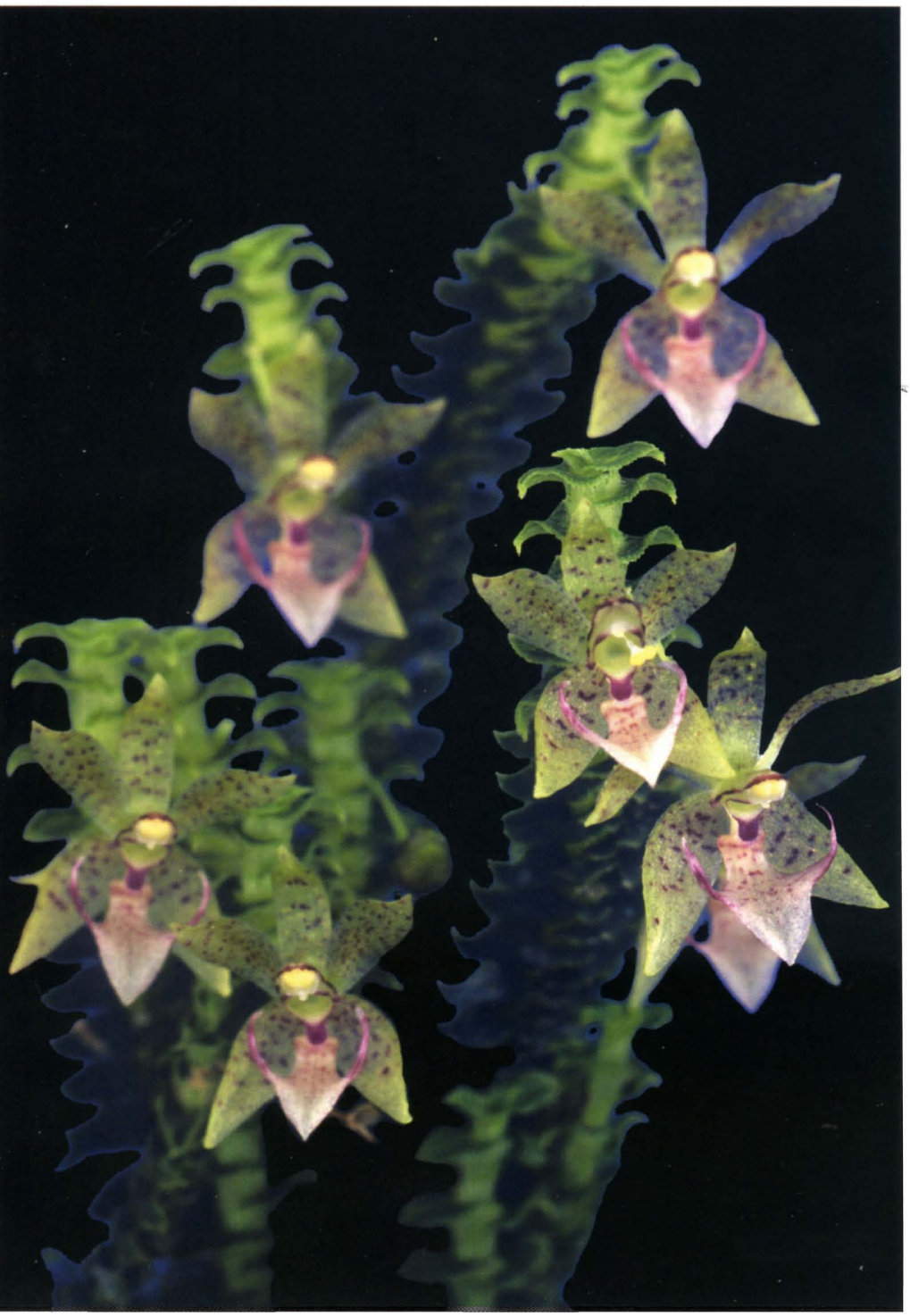
# Ciliate Dichaeas

## Dichaea hystricina and Dichaea ciliolata: Two Species in One and an Interesting Variation

TEXT AND PHOTOGRAPHS BY FRANCO PUPULIN



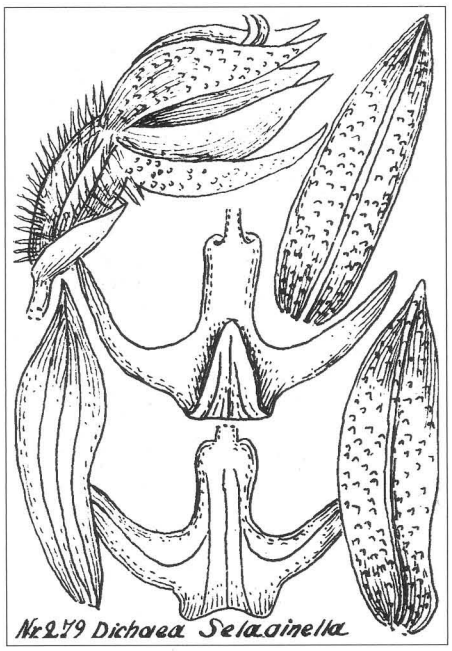
A BOTANICAL GARDEN IS, IN essence, a place where an array of living plants is arranged in scientifically ordered collections. This means that plant specimens, both those exhibited to the public and those serving research purposes, are mostly associated with some kind of data regarding their origin, and these data are maintained in searchable databases. Compatible with the horticultural requirements of the different species, the collections are also usually arranged systematically, i.e., the plants are grouped by families, suprageneric ranks, genera and so on. In this way, maintaining many individuals from different populations in the same *ex situ* conditions of the greenhouses' environment, the living collections of a botanical garden represent an enormous potential to understand better how morphological variations depend on the ecological conditions under which the plants grow in the wild. In a way, minimizing the plant's response to environmental variability, an *ex situ* living collection exposes the expression of genotypes. This is, of course, impossible in plant museums (or herbaria), where dried specimens convey a sort of snapshot of mixed information of variations genetically fixed and environmentally controlled.

Since 2001, as part of the preliminary work aimed to prepare a monograph of the genus *Dichaea* in Costa Rica, and eventually to a general study of the zygopetaline orchids for this country, the staff of Lankester Botanical Garden at the University of Costa Rica has collected and grown tens of specimens of a distinct group of *Dichaea*, which have rather short stems and leaves entirely ciliate along the margins. Four different names (two of them based on Costa Rican types) have been published in this group, and at least two "good" species have been accepted for the flora of Costa Rica

(Kränzlin, 1923; Ames, 1937; Mora-Retana and García, 1992; Pupulin, 2002; Dressler, 2003).

The oldest species of the group is *Dichaea hystricina*, described by Heinrich Gustav Reichenbach (known as Reichenbach the son, *filius*) in 1865 from a collection by C. Wright from Cuba. Although his description was rather concise, as was usual at that time, some of the characteristics that allow recognition of this species are clearly indicated in the protologue (or the text of the original description and the associated specimen data): the linear-ligulate leaves provided with hairs along the margins, the muricate ovary, and the clawed lip, with small lobules at the base and expanded into a sagittate (arrow-shaped) lamina. The type specimen, together with Reichenbach's sketches of the plant habit and details of the flower, is kept at the herbarium of the Natural History Museum in Vienna (W-*Rchb Orch* 17196). An isotype (or part of the original collection on which the author

OPPOSITE In its "ciliolate" form, *Dichaea hystricina* has upcurving, almost erect stems. This specimen was collected at an elevation of 4,265 feet (1,300 m) at Santiago de San Ramón (*F. Pupulin and E. Salas 5095*), and flowered at the Lankester Botanical Garden in June 2004. ABOVE Variations in *Dichaea hystricina* vegetative architecture. From left to right: *D. Bogarín 1464, F. Pupulin 4320, D. Bogarín 4085 and F. Pupulin 3925.* Scale bar = 3/8 inch (1 cm).




based his description) also exists at the Oakes Ames Orchid Herbarium of the Harvard University (AMES 61211).

The presence of trichomes (hairs) along the margins of the leaves is not uncommon in members of the genus *Dichaea*, but these are usually restricted to the apical portion of the leaf. The long hairs that cover the entire leaf margins, as well as the plant's small habit, are useful characters to also recognize plants of the *D. hystricina* group in the field when the plants are not in flower. Specimens of typical *D. hystricina* have freely branching, suberect to pendent stems to 6 inches (15 cm) long, and narrowly ovate leaves up to 3/8 inch (1 cm) long, mucronate at apex and hispid-ciliate on the margins (on the holotype specimen, Reichenbach had annotated for this species the intended name of *Dichaea ciliata*). The leaves are not articulate and they rot in place, a common characteristic in members of *Dichaea* section *Dichaea*. The ovary is echinate (armed with rigid hairs) and produces a densely muricate fruit, from which the specific epithet, from the Latin *hystrix*, porcupine, is derived. The inflorescence is short but exceeds the leaves, and it bears a single flower about 3/8 inch (1 cm) in diameter. Despite its unique features, which do not allow a clear understanding of its phylogenetic affinities within the genus, *D. hystricina* is a widespread species, so far recorded from the West Indies (Cuba, Dominica, Grenada, Guadeloupe, Puerto Rico and Trinidad), Central America (Guatemala, Honduras, Costa Rica and Panama) and South America (Venezuela, Colombia and Ecuador). This wide distribution range is also rather uncommon for the species of *Dichaea*, which in most cases are known from a few adjacent regions and are often recorded as endemic to a single country.

In 1905, Robert Allen Rolfe at the Royal Botanic Gardens, Kew, described his *D. ciliolata*, on the basis of a plant collected by Charles H. Lankester near Cachí, on the eastern side of the Central Valley facing the high chain of the Talamanca range in Costa Rica. The main character used by Rolfe to distinguish the new species from *D. hystricina* was the vegetative habit, characterized by erect, up-curving, rarely branching stems, and short leaves less then 3/16 inch (5 mm) long. Indeed, plants of typical "*D. ciliolata*"

may look different from those of *D. hystricina*. Treating *D. ciliolata* for his monograph in 1923, Kränzlin stressed the distinctiveness of the plant habit, but he also distinguished it from *D. hystricina* by the smaller size of the flower and the presence of a thickening on the column foot, two characters that cannot be reliably observed in fresh flowers.

Around 1880, Reichenbach had received a similar plant at Hamburg, collected in Costa Rica by A.R. Endrés, and he annotated it with the intended name of *Dichaea lycopodioides*, in reference to the resemblance of this species to a small *Lycopodium* (fern relative), but he never published this name. The original material of this collection is conserved in Reichenbach's herbarium in Vienna (W-*Rchb Orch* 14768 and 14769). As well as Lankester's collection, some of the plants collected by Endrés have long, upcurved stems to 10 inches (25 cm), mostly unbranched and with short internodes, covered by small leaves less than 3/16 inch (5 mm) long. When preparing his revision of the genus *Dichaea* for Engler's *Pflanzenreich*, Fritz Kränzlin studied the plants collected by Endrés and, in the paragraph of observations about *D. ciliolata* of his treatment for 1923, he validated the name suggested by Reichenbach.

Meanwhile, in 1920, Rudolf Schlechter described *Dichaea selaginella* from the department of Cauca in Colombia. Once more, the name selected by Schlechter refers to the resemblance of the plant to a fern relative, *Selaginella*. The type specimen in his herbarium was destroyed by fire in 1943, and the original description informs us only of the fact that the stems were 1/32 inch (1.5 mm) in diameter, and the oblong-lanceolate leaves, ciliate on the margins, only 3/16 to 1/4 inch (5–7 mm) long. Luckily, in 1929, professor R. Mansfeld published the tracing of the sketch prepared by Schlechter from a flower of the holotype, and it showed the floral characters of *D. selaginella* are indistinguishable from those of *D. hystricina*. A number of specimens annotated by Kränzlin as type material of *D. selaginella* in Reichenbach's herbarium in Vienna, all of them collected in Costa Rica by Endrés, have nothing to do with Schlechter's species, but represent a name never published by Kränzlin that can be surely assigned to

OPPOSITE TOP LEFT In some plants of *Dichaea hystricina*, the stems have short internodes and the leaves barely reach 1/8 inch (3–4 mm). This form was found at Los Ángeles de San Ramón, at an elevation of 3,675 feet (1,120 m) on the Caribbean slopes of the Cordillera de Tilarán (*F. Pupulin et al. 4319*). It was photographed at Lankester Garden in March 2003.
OPPOSITE TOP RIGHT The shape and the size of flowers in different morphs of *D. hystricina* are indistinguishable. This specimen was originally collected near the top of Cerro Pelón in southern Costa Rica (*F. Pupulin et al. 2362*), at an elevation of about 4,920 feet (1,500 m), and flowered at Lankester Botanical Garden in May 2002.
OPPOSITE MIDDLE LEFT The tracing of Schlecter's diagnostic drawings of the holotype of *Dichaea selaginella* was published by Professor Mansfeld in 1929. The holotype specimen and the original illustration were eventually destroyed in Berlin in 1943.
OPPOSITE MIDDLE RIGHT In typical forms of *D. hystricina*, the slender stems become pendent with age. This specimen was native to low altitudes 2,460 feet (750 m) along the mountains that face the Pacific Ocean in central Costa Rica (*F. Pupulin and D. Castelfranco 1618*). It flowered at Lankester Botanical Garden in June 2001.
OPPOSITE BELOW The oldest plants of *D. hystricina* were satisfactorily grown on tree-fern slabs, maintained horizontally to allow better retention of humidity around the roots. In compliance with legislative dispositions issued by the Costa Rican Ministry of Environment, this medium is no longer in use at Lankester Garden.
ABOVE Plants of *Dichaea hystricina* often form large and intricate mats resembling small epiphytic ferns. This plant of *D. hystricina* was in flower in June 2002, when we collected it for study at Moravia de Chirripó on the Caribbean watershed of the Talamanca mountain chain (*F. Pupulin et al. 3925*).

*Dichaea tuerckheimii*, the smallest of all *Dichaea* species.

Plants of "ciliate" *Dichaea* are widespread in Costa Rica, where they have been recorded from both the Caribbean and the Pacific watersheds of all the main mountain chains of the country. Here they are found from the wet tropical forests along the basal belt of the northern cordilleras to the cloud forests of the Talamanca chain to the border with Panama, at elevations of 1,310 to 5,250 feet (400–1,600 m). The flowers of most *Dichaea* species exhibit a characteristic temporal activity: they open in the first hours of the morning and usually close in the early afternoon, so in the field it is rather difficult to find *Dichaea* plants in flower. During the expeditions aimed to search for material for the revision of *Dichaea*, we carefully attempted to collect plants corresponding, in their vegetative architecture, to both the taxa recorded for the country. However, if a single type of "ciliate" *Dichaea* is found at any specific locality, sometimes we observed both "morphs" growing sympatrically, a point already noted by Dodson in Ecuador (in Mora-Retana and Atwood, 1993). More than 40 specimens of the two morphs (and their variations) are now cultivated in the living collections of the Lankester Garden. As it is perhaps obvious to expect from a species with such a wide distribution range, the ciliate dichaeas from Costa Rica show a great variation in the morphology of the plants, including length of the stems and the internodes, degree of branching and leaf size. However, when the plants began to flower at Lankester Botanical Garden, I was unable to detect any substantial difference among the flowers produced by plants of the *D. hystricina* type and the *D. ciliolata* type, and no correlation seemed to exist between the shape of the plants and the morphology of their flowers, which is largely uniform.

More surprisingly, the plants are able to shift from one morph to the other along a single stem. We noted this phenomenon first in May 2003, when the stems of a *Dichaea "ciliolata,"* collected two years before at Miraflores, in southern Costa Rica, shifted to the morphology typical of *D. hystricina*, with longer internodes and progressively longer and larger leaves. Then we had the opportunity to observe the same condition in another plant of "*D. ciliolata*" originally collected in 2002 at Moravia de Chirripó, on the Caribbean slopes of the Cordillera de Talamanca, and in many other cases. It is now clear that the names *D. ciliolata* and *D. lycopodioides* only represent different variations of the widespread *Dichaea hystricina*, for which I then propose the following taxonomy:

***Dichaea hystricina*** Rchb.f.
*Flora* 48: 279. 1865. Type: Cuba Orientali, prope villam Monte Verdi dicta, Aug. 13, 1859, *C. Wright 1478* (holotype, W-*Rchb Orch* 17196!; isotype, AMES 61211!).

Syn.: *Dichaea ciliolata* Rolfe, *Bull. Misc. Inform. Kew* 1917: 83. 1917. Type: Costa Rica. [Cartago: Orosi,] near Cachí, *C.H. Lankester 12* (holotype, K, not seen).

*Dichaea selaginella* Schltr.
*Repert. Sp. Nov. Regni Veg. Beih.* 7: 202. 1920. Type: Colombia. Cauca, *M. Madero s.n.* (holotype, B. destroyed; drawing of the holotype! published by Mansfeld, 1931).

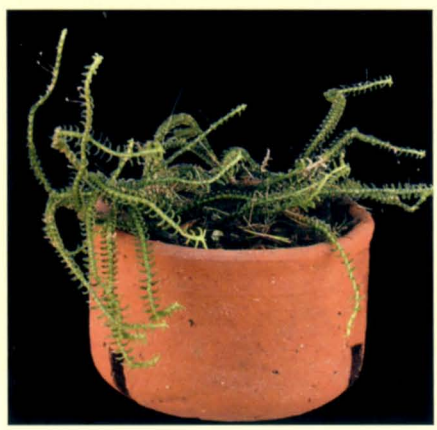
*Dichaea lycopodioides* Rchb.*f. ex* Kraenzl.
*Engl. Pflanzenr. Orchid.-Monandr.-Pseudomonopod.* 35. 1923, *in obs.* Type: Costa Rica. Without locality data, *A.R. Endrés s.n.* (W-*Rchb Orch* 14768! and 14769!).

One might be tempted to consider all of these forms as ecological variations within *D. hystricina* populations, but the observations carried out in the living collection of Lankester Botanical Garden do not confirm such a hypothesis. Many of the plants of

## Growing Dichaea hystricina

PROBABLY the two most important factors found to be considered in the cultivation of *Dichaea hystricina* are light exposure and humidity. The plants of this species are small epiphytes, practically with no organs in which to store water, and their main enemy in cultivation is drying.

At Lankester Botanical Garden, *D. hystricina* is grown in both shade houses (without a solid roof) and in regular greenhouses where watering is strictly controlled. The temperatures range at the garden between 66–77 F (19–25 C) during the day and 55–65 F (13–18 C) during the night, with little variation during the year. Natural humidity is always high, never less than 70 percent.



ABOVE Do not overpot *Dichaea hystricina*. Instead leave the stems so they grow outside the container freely.

To prevent excessive loss of water, plants of *D. hystricina* are grown in greenhouses under 60 percent shade, and the pots and the slabs are maintained in special shallow metal baskets hanging under the main cultivation benches. Here the exposure to light is further reduced, and the proximity to the ground helps to retain high humidity levels around the plants. Most of the specimens are grown in pots, in a medium composed of three parts coconut husk, one part finely chopped sphagnum moss and one part small gravel (¼ inch [5–7 mm]), like that used to cover paths in gardens. A slow-release granular fertilizer is added to the substratum. Clay pots give the best results, retaining enough water around the roots but allowing the medium to breathe, thus avoiding rotting of the basal portion of the stems. We ensure perfect drainage with a thick layer of sterilized gravel or polystyrene on the bottom of the pots. Repotting is usually done every three years after flowering, and we prefer to select a rather small-size new pot to prevent rotting.

Plants grown in shade houses are watered three to four times a week during the dry season and once a week during the rainy season. In greenhouses, under a roof, they are watered twice a week during the rainy season and three times per week in the driest months. All the plants are fertilized every three weeks with a fertilizer derived from seaweed (Agrocosta). — *Reynaldo Gómez, Greenhouses Coordinator, Lankester Botanical Garden, Costa Rica.*

the "*D. ciliolata*" type, with stems composed by short internodes and provided with small leaves, retained their characteristic vegetative architecture also when growing side by side (in the same environmental conditions) with the specimens that eventually shifted to the *D. hystricina* morph. We have enough evidence that the genetic pool of *D. hystricina* has the potential to exhibit a vast array of different characters in plant habit, but the mechanisms that regulate these expressions are still unknown. The architecture of the "*D. ciliolata*" type may perhaps correspond to an indefinite retention of the juvenile habit, somehow more adapted to diminish the loss of water through evaporation, and shifting toward the "*D. hystricina*" type could be correlated to plant age, but long-term observations are needed to test this hypothesis. The actual knowledge gives us a sound basis to our taxonomic understanding of the identity and natural variation of *D. hystricina*, but (as it is often the case in orchidology) many biological questions still wait for research and answers.


## Acknowledgments

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TOP LEFT Plants of *D. hystricina* can be grown epiphytically on plaques of hard wood, but they need to be watered almost daily to prevent desiccation of the fragile stems.

TOP Plants of *Dichaea hystricina* grown in clay pots at Lankester Botanical Garden, University of Costa Rica.

ABOVE Habit transformations in two collections of *Dichaea hystricina*.

A: *F. Pupulin 3925*; B: *F. Pupulin 3466*.

Scale bar = 3/8 inch (1 cm).