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A REVISION OF THE COSTA RICAN SPECIES OF *TRICHOCENTRUM* (ORCHIDACEAE)

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ABSTRACT. Seven *Trichocentrum* species are recognized for Costa Rica, including five of the eight previously reported taxa. Two new species, *T. costaricense* and *T. dianthum,* are described. Taxonomical, ecological and phenological notes are given for each species.

INTRODUCTION

Trichocentrum is a small neotropical genus with about 22 epiphytic species extending from Mexico and central America south to Brazil, Bolivia, and Peru. It was established by E. F. Poeppig and S. L. Endlicher in Nova Genera ac Species Plantarum (1836). Bentham (1881) assigned it to the neotropical subtribe Oncidiinae (as Oncidieae). Later Schlechter (1926) reassigned the genera of this subtribe to twelve other subtribes and included *Trichocentrum* in his subtribe Trichocentrinae on the basis of the spurred lip, excavated stigma, and absence of column foot. In Schlechter's system, this subtribe is placed close to his Comparettiinae from which it can be easily separated by the free lateral sepals and lack of appendages at the base of the lip. Schweinfurth (1959) followed Schlechter's system with few exceptions.

Dressler and Dodson (1960) restored the subtribe Oncidiinae (sensu Bentham), and, in proposing subdivision of this subtribe into three major alliances, assigned *Trichocentrum* to the *Oncidium* complex. More recently, Dressler (1981) restricted only the last group to the Oncidiinae, dividing it into five alliances principally on the basis of chromosome numbers and reproductive features. In Dressler's new system *Trichocentrum* (2n = 24, 28) is considered more distantly related to the *Comparettia* complex, but close to *Lophiaris,* which includes the so called "rat-tail" *Oncidium* of section *Cebolletae* and the section *Plurituberculata* (2n = 28, 30, 32, 34, 36). Also closely related to *Lophiaris* in this system are *Rossioglossum* and *Psychopsis,* the latter also formerly known as *Oncidium* section *Glanduligera* (2n = 38). Chase (1986a, 1986b) proposed a realignment of oncidioid genera on the basis of previously under-utilized floral and vegetative features including chromosome numbers and life history. In his preliminary phyletic scheme, he considered *Trichocentrum* as anomalous among most of the oncidioid orchids. A recent study by Chase and Palmer (1992) of restriction sites in chloroplast genome (cpDNA) in the Oncidiinae assigned *Trichocentrum* to *Lophiaris* complex as suggested by Dressler, but, on the basis of its low chromosome number, the genus occupies now a derived position within the group.

Ames, in Standley (1937), lists four Costa Rican species of *Trichocentrum.* Williams (1956) lists three species native to Costa Rica but also lists four others for 'Central America.' Teuscher (1961) added *T. candidum,* a significant range extension from Guatemala and Mexico. A current updated checklist by Mora-Retana and Garcia-Castro (1992) includes five species known plus the two new species described in this paper.

The Costa Rican species of *Trichocentrum* are distributed at 500–2,000 m in both the Atlantic and Pacific slopes (FIGURE 1). Three species are apparently endemic to Costa Rica while three range south to Panama, Colombia or Venezuela. Only a single species, *T. candidum,* ranges northward. They are native mainly to wet, mountainous regions but may occur at lower elevations along streams with sufficient rainfall. They usually occur on the smaller branches of the canopy or on lianas in thick mats of bryophytes. Although they may become established on twigs, they cannot be considered as obligate twig epiphytes (Chase 1988).

METHODS

Field work was accomplished in Costa Rica from December 1988 to June 1989 (dry season) and October to December 1989 (rainy season). Field collecting was necessary to clarify questions of synonymy and species status. Of particular interest was to note if subtle differences in morphology are continuous (hence representing single, variable species) or discontinuous, representing pairs of similar species. Not only did this enable us to definitively interpret the types but also to map accurate distributions. Logistics did not permit us to visit areas near Turrubares, the Rio Grande de Tárcoles near the Pacific coast, the southern slopes of the Cordillera de Talamanca, nor the Pacific slopes of the Cordillera

de Guanacaste. Species of *Trichocentrum* are probably to be found in some of these regions.

For the application of names, herbarium specimens, especially types, were studied, as well as pertinent literature.

Features useful for differentiating species include (1) shape and position of column wings, (2) indument of the anther cap (operculum), and (3) size and shape of the lip. Some of these features require a hand lens or dissecting microscope. The lip calli and number and shape of partitions in the lobed spur are highly variable, so that these features are not useful in identification.

Other than *T. brenesii* our descriptions are based solely on live Costa Rican collections, and measurements represent the maximum variation observed. Ecological and phenological notes are also based only on Costa Rican plants. The description for *T. brenesii* is based on Schlechter's description and tracing of the type specimen at AMES.

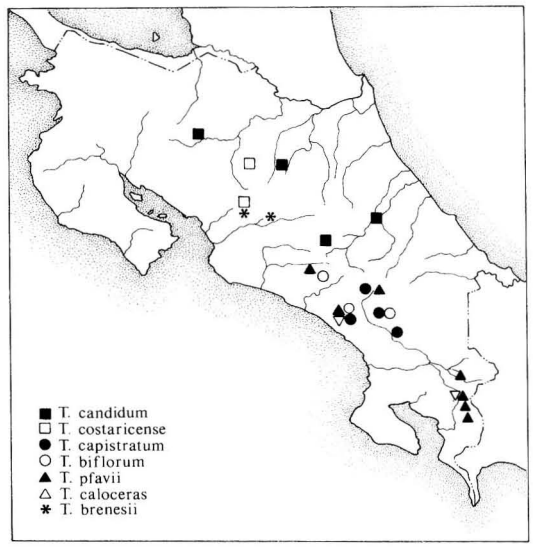

FIGURE 1. Distribution of species of *Trichocentrum* in Costa Rica.

SYSTEMATIC TREATMENT

Key to The Costa Rican Species of *Trichocentrum*

1. Spur conic or cylindric, not lobed
   2. Spur about 3 mm long; column wings white with brown spots at margins ..... *T. pfavii*
   2. Spur 10–12 mm long; column wings with longitudinal brown stripes ..... *T. dianthum*
1. Spur 2- or 4-lobed
   3. Anther cap glabrous, spur always 4-lobed; lip marked with broad purple blotches ..... *T. caloceras*
   3. Anther cap papillose or hirsute
      4. Column wings decurrent, obtuse, introrse apically ..... *T. costaricense*
      4. Column wings ascending or porrect, acute, somewhat revolute apically; lip white
         5. Lip narrowed in the middle; flowers small (sepals and petals 5–6 mm); inflorescence erect or spreading ..... *T. brenesii*
         5. Lip elliptic-ovate or rhombic; flowers large (sepals and petals to 16–18 mm); inflorescence pendent
            6. Lip elliptic, shorter than sepals; column wings entire ..... *T. capistratum*
            6. Lip broadly rhombic, much longer than sepals; column wings erose at apex ..... *T. candidum*

DESCRIPTION OF THE SPECIES

Trichocentrum pfavii Rchb. f., Gard. Chron. n.s. 16: 70, 1881 (FIGURE 2).

TYPE. Panama: Chiriquí, *Pfau 60* (holotype, W!).

SYN. *Trichocentrum pfavii* var. *zonale* Rchb. f., Gard. Chron. n.s. 19: 44, 1883.

TYPE. Costa Rica, *Endres s.n.* (lectotype, here designated W 42180!).

Trichocentrum saundersianum Endres & Rchb. f. in Reichenbach Herb., *Ms.*

Trichocentrum saundersii Endres & Rchb. f. in Reichenbach Herb., *Ms.*

Trichocentrum zonale Rchb. f. in Reichenbach Herb., *Ms.*

Plant epiphytic, cespitose, pendent, with abbreviated rhizome. *Roots* filiform, glabrous, with green apex. *Pseudobulbs* minute, rounded, to 5 mm long, covered by a brown imbricate sheath, unifoliate. *Leaf* oblong-elliptic to oblong-ovate, fleshy, obtuse to retuse, narrowed to a conduplicate, sessile base, light green, 7.2–12.5 cm long, 2.4–3.8 cm wide. *Inflorescences* 2 to 4, pendent to suberect, shorter than leaves, frequently branched at the base, mostly 2-flowered; peduncle terete, up to 5.1 cm long, concealed by 2 or 3 spreading, ovate, concave bracts. *Ovaries* linear-clavate, about 2 cm long including the pedicel. *Flowers* rather large and showy, with sepals and petals free, spreading, white with a large median brown-rose blotch and white lip, marked near the base by one or two rose-purple blotches. *Dorsal sepal* elliptic-ovate, rounded to emarginate at apex and sometimes with a dorsal apicule, rather concave, to 15 mm long, 8 mm wide. *Lateral sepals* obliquely elliptic-lanceolate, obtuse,

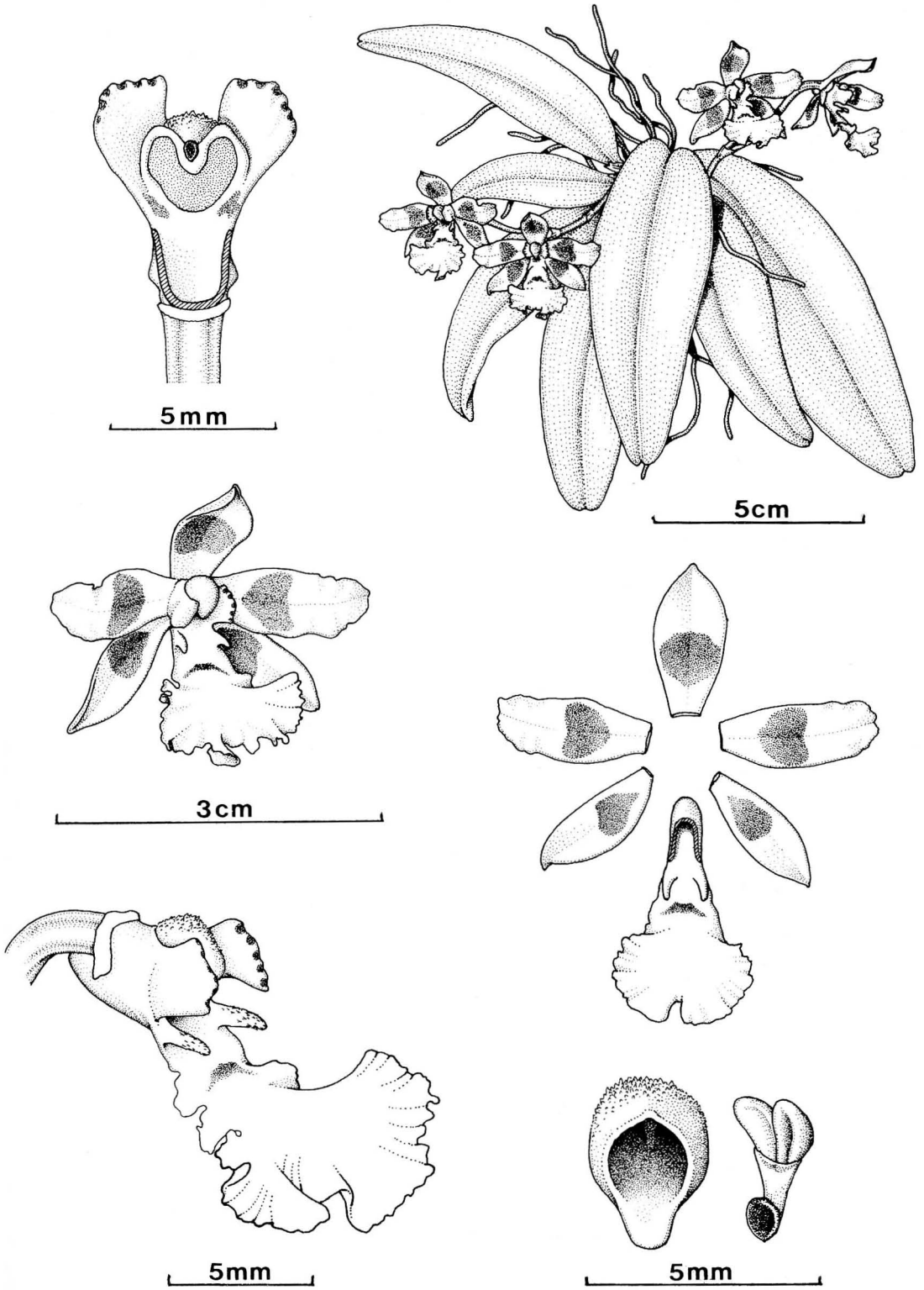

FIGURE 2. *Trichocentrum pfavii*. Illustration voucher: Costa Rica: Prov. of Puntarenas: Coto Brus, Las Cruces, *F. Pupulin & D. Castelfranco 2* (USJ).

minutely apiculate, subcarinate and thickened through the middle, slightly concave, 15 mm long, 6 mm wide. *Petals* spatulate, obtuse, to 14 mm long, 6 mm wide. *Lip* cuneate-flabellate, adnate to the column, 22 mm long, with cuneate claw 5 mm long, with two narrow, erect to falcate, pubescent lateral lobes at the base, expanding abruptly to the suborbicular blade 13 mm long, 16 mm wide, deeply emarginate in front, with undulate to crisped margins, producing with the column base a very short, blunt, saccate spur 3 mm long. *Column* short, stout, footless, about 5 mm long, with a pair of large, erect-spreading, subquadrate, rounded wings spotted with brown along the margins. *Anther* white, hemispherical, papillose. *Pollinia* 2, pyriform, on a short, triangular stipe; viscidium peltate, brown.

ETYMOLOGY. Named in honor of its discoverer, the Swiss collector R. Pfau.

DISTRIBUTION. Costa Rica and Panama.

COSTA RICA. Prov. of San José: Boca de Dota, *Endres s.n.* (W!); San Marcos de Dota, road to San Joaquín, *F. Pupulin & M. Flores 6* (USJ!); Perez Zeledón, Rivas, along the Rio Chirripó Pacifico (1,110 m), *F. Pupulin & J. Cambronero 8* (USJ!); San Juan de San Isidro (980 m), *F. Pupulin & W. Fonseca 21* (USJ!). Prov. of Cartago: Pejivalle, *Endres s.n.* (W!). Prov. of Puntarenas: Coto Brus, Agua Buena (1,000 m), *F. Pupulin 11* (USJ!); Campo Dos (800 m), *F. Pupulin & J. Cambronero 16* (USJ!); Las Cruces (1,280 m), *F. Pupulin & D. Castelfranco 2* (USJ!). Without locality, *Endres s.n.* (W!); *C. H. Lankester s.n.* (K!).

HABITAT. *Trichocentrum pfavii* grows in premontane and lower montane rain forests, 800 to 1,500 m where the average minimum temperature generally exceeds 17°C. Of all the Costa Rican species, *T. pfavii* requires the most constant and high level of moisture, and plants are almost always found in close proximity to water. Located at wet, medium to high elevations of the Valle de Coto Brus and the Valle del General and the Pacific slopes of the Cerro de la Muerte and Cerro Vueltas northward, the species may receive 3 to 5 m of rain a year. High rainfall is particularly marked in the Coto Brus valley, where the species seems to be more abundant. Only in January through March is the rainfall <100 mm. Here, in the San Vito de Java region, plants receive a minimum temperature of 14°C in January. *Trichocentrum pfavii* grows on small branches of *Clusia palmana, Nectandra membranacea, Guarea* sp., *Blakea subpeltata, Hasseltia floribunda, Senna hayesiana* and *Eugenia jambos* trees. All of these hosts have smooth bark and persistent, dense foliage. Occasionally, the orchid grows on moss-covered vines. Adapted to low light zones of its host, *T. pfavii* often grows with other low light requiring orchid species, such as *Lycaste leucantha* and *L. macrophylla, Trichopilia coccinea, Cischweinfia dasyandra, Chondrorhyncha bicolor* and *Xylobium elongatum.* The new growth emerges in June, matures during the rainiest months, and flowers from November to March.

OBSERVATIONS. The species was first discovered in 1880 by the Swiss collector, R. Pfau, who sent Reichenbach a living plant, dried specimens and a sketch. Reichenbach described it in 1881 giving the following comments: "This is a lovely novelty; the flowers stand usually in pairs on a raceme, equalling in size those of Oncidium Gardneri. The sepals and petals are spathulate, blunt, half-brown, half-white . . . I dedicate this species, as well as the fabulous Sobralia Pfavii, to this ardent and enthusiastic orchidist . . . ." A sheet attached to the original drawing Pfau sent to Reichenbach clearly is marked "Chiriquí, 19 Nov. 1880."

Reichenbach received additional material originating from the Costa Rican region of Dota together with a series of detailed drawings from A. R. Endres. Such material was used by him to publish *T. pfavii* var. *zonale* in 1883. No flowers of this concept remain in Reichenbach's herbarium, but the examination of Endres' drawings clearly indicates it should be reduced to synonymy.

Trichocentrum pfavii is the most widespread species within Costa Rica, but it occurs only in a restricted number of suitable environments. Together with intensive deforestation, horticultural demand for the species has noticeably reduced its numbers, especially in the southern end of the Coto Brus region where it should be considered as threatened.

The species could probably be divided into two geographic races: one distributed from Panama to the northern limits of the Valle del General and the other inhabiting the medium intramountain valleys in the region of Dota. This last race has a slightly narrower lip and a darker, brown color on sepals and petals. (On the backcover of the May 1982 issue of *American Orchid Society Bulletin* is illustrated a particular clone of this species.)

Trichocentrum dianthum Pupulin & Mora-Retana, sp. nov. (FIGURE 3).

TYPE. Costa Rica: Prov. of San José, epiphytic in forest near Las Nubes de Quizarrá (1,000 m), 1988, *J. Cambronero s.n.*, flowered in cultivation in March 1989 (holotype, USJ!).

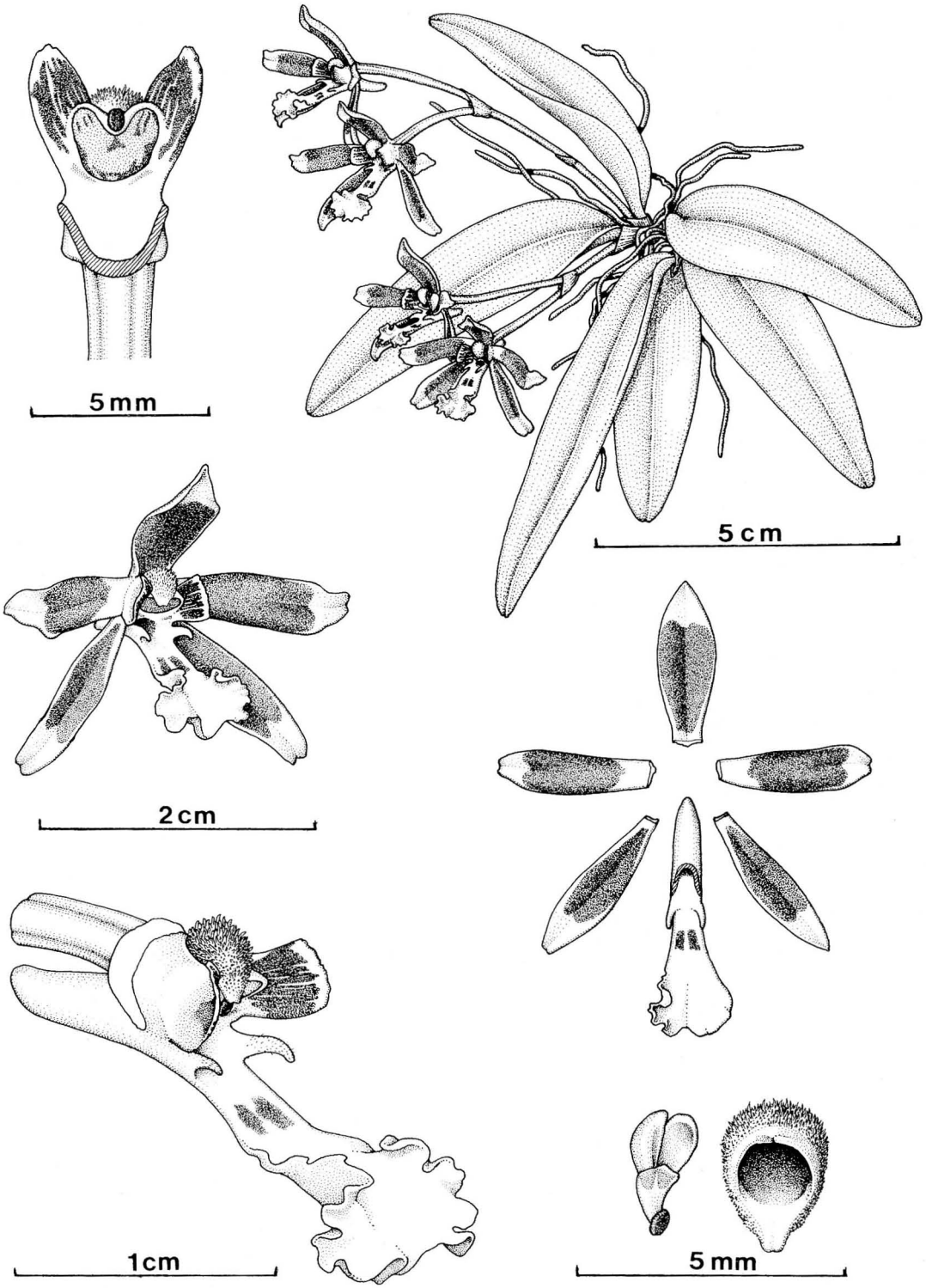

FIGURE 3. *Trichocentrum dianthum.* Illustration voucher: Costa Rica: Prov. of San José: Perez Zeledon, Las Nubes de Quizarrá, *J. Cambronero s.n.* (USJ).

Species *Trichocentrum pfavii* Rchb. f. affinis, sed calcari majore, labello spathulato et alis columnae subquadratis brunneo striatis differt.

Plant epiphytic, pendent; rhizome abbreviated. *Roots* filiform, glabrous, with green apex. *Pseudobulbs* minute, cespitose, rounded, to 5 mm long, unifoliate. *Leaf* light green, oblong-elliptic to obovate-oblong, acute to minutely retuse, sessile, from a conduplicate base, to 9.7 cm long, 3 cm wide. *Inflorescences* up to four, lateral, basal, erect, 2-flowered; peduncle terete, green, 3.5–4 cm long. *Bracts* conspicuous, ovate, concave, spreading, brownish, to 5 mm long. *Ovaries* linear-clavate, 2.3 cm long including the pedicel. *Flowers* spreading, with sepals and petals yellow covered by a very large brown blotch, and white lip, marked near the base by two rose-purple blotches. *Dorsal sepal* erect, elliptic-oblanceolate, obtuse to subacute, carinate, to 16.5 mm long, 6.3 mm wide. *Lateral sepals* spreading, obliquely oblanceolate, carinate, to 17 mm long, 4 mm wide. *Petals* linear-oblong, acute, subcarinate, to 16.5 mm long, 5 mm wide. *Lip* spatulate, adnate to the base of the column, 25 mm long, 9.2 mm wide near the apex, with two narrow, falcate, lateral lobes at the base, the midlobe rounded in front and with crisped margins, producing at the base an elongate, slender, conic spur, 11 mm long. *Column* short, stout, footless, to 5 mm long, with a pair of fleshy, erect, subquadrate wings, brown striped. *Anther* white, cucullate, hirsute. *Pollinia* 2, pyriform, complanate, on a short, triangular stipe; viscidium peltate, brown.

ETYMOLOGY. From the Greek *di-* "two, double" and *anthos* "flower," referring to the two-flowered inflorescences.

DISTRIBUTION. Known only from Costa Rica.

COSTA RICA. Prov. of San José: Perez Zeledón, Las Nubes de Quizarrá, *J. Cambronero s.n.* (USJ!); Alto de San Juan (980 m), on *Citrus aurantium* trees, *F. Pupulin & W. Fonseca 22,* flowered in cultivation, March 1990 (USJ!); slopes of the Cerro Vueltas (about 2,000 m), *A. Herrera s.n.,* flowered in cultivation, November 1989 (USJ!). Without locality, *M. Flores s.n.* (Herb. Pupulin!).

HABITAT. *Trichocentrum dianthum* is extremely rare with few known localities, and is probably extinct in the type locality owing to deforestation. It seems to be restricted between 1,000 to 2,000 m to the northern part of the Rio General valley in the watershed of the Fila Costera and slopes of the Cordillera de Talamanca, and to the high western intramountain valleys of the Cerro Vueltas. At the type locality, which was a patch of primary forest facing a little tributary of the Rio General, it grew with *Lacaena spectabilis, Kefersteinia costaricensis, K. lactea, Restrepia muscifera, Macroclinium* sp., and *Trichocentrum capistratum.* We have collected it at Alto de San Juan growing on short *Citrus* in a pasture, where the plants were established on shady, smaller branches of the host trees with thick layers of moss. *Trichocentrum dianthum* grows sympatrically with *T. caloceras, T. capistratum* and *T. pfavii* which seem to prefer somewhat different microhabitats. *T. caloceras* and *T. capistratum* grow high in the canopy where light is stronger, whereas *T. dianthum* and *T. pfavii* grow lower on the trunks in deeper shade where roots are immersed in moss.

Both the areas, Las Nubes de Quizarrá and San Juan, are characterized by a hot, very moist climate with moderate dry season. The rains are particularly heavy during October and November, when *T. dianthum* matures its new growths. By the end of December, the inflorescences arise and flowers open nearly simultaneously from February until April. Cultivated plants sometimes flower in December.

Trichocentrum caloceras Endres & Rchb. f., Gard. Chron. 1257, 1871, in textu. (FIGURE 4).

TYPE. Costa Rica, without precise locality, *Endres s.n.* (not seen).

Plant epiphytic, pendent, with abbreviated rhizome. *Roots* filiform, glabrous, with green apices. *Pseudobulbs* minute, cespitose, rounded, 2–2.5 mm long, unifoliate. *Leaf* green, more or less spotted with purple, fleshy, oblong to oblong-elliptic, subacute and somewhat minutely mucronate, sessile, to 7 cm long, 1.4 cm wide. *Inflorescences* lateral, basal, racemose; peduncle terete, pendent, brownish, 3–3.5 cm long; rachis short, fractiflex, successively 5–6-flowered. *Bracts* conspicuous, imbricating, ovate, cucullate, acute, 4 mm long. *Ovaries* 8–10 mm long, including the pedicel. *Flowers* small, spreading, with sepals and petals brownish yellow and the lip white, marked with large purple blotches. *Dorsal sepal* erect, elliptic-lanceolate, subacute, slightly concave, to 11 mm long, 4 mm wide. *Lateral sepals* obliquely elliptic-lanceolate, subacute, carinate at apex, 12 mm long, 3 mm wide. *Petals* elliptic-oblong, obtuse, 12 mm long, 4–5 mm wide. *Lip* ovate-subpandurate, adnate to the column, carinate, slightly constricted in middle, emarginate in front, cuneate at the base to produce a short, flattened, subquadrate, 4-lobed spur; disc with a pair of thick, glabrous, converging keels at the base; entire lip 16 mm long, 8 mm wide. *Column* short, without a foot, to 5 mm long, with a pair of fleshy, decurrent, short, rhombic, concave wings with

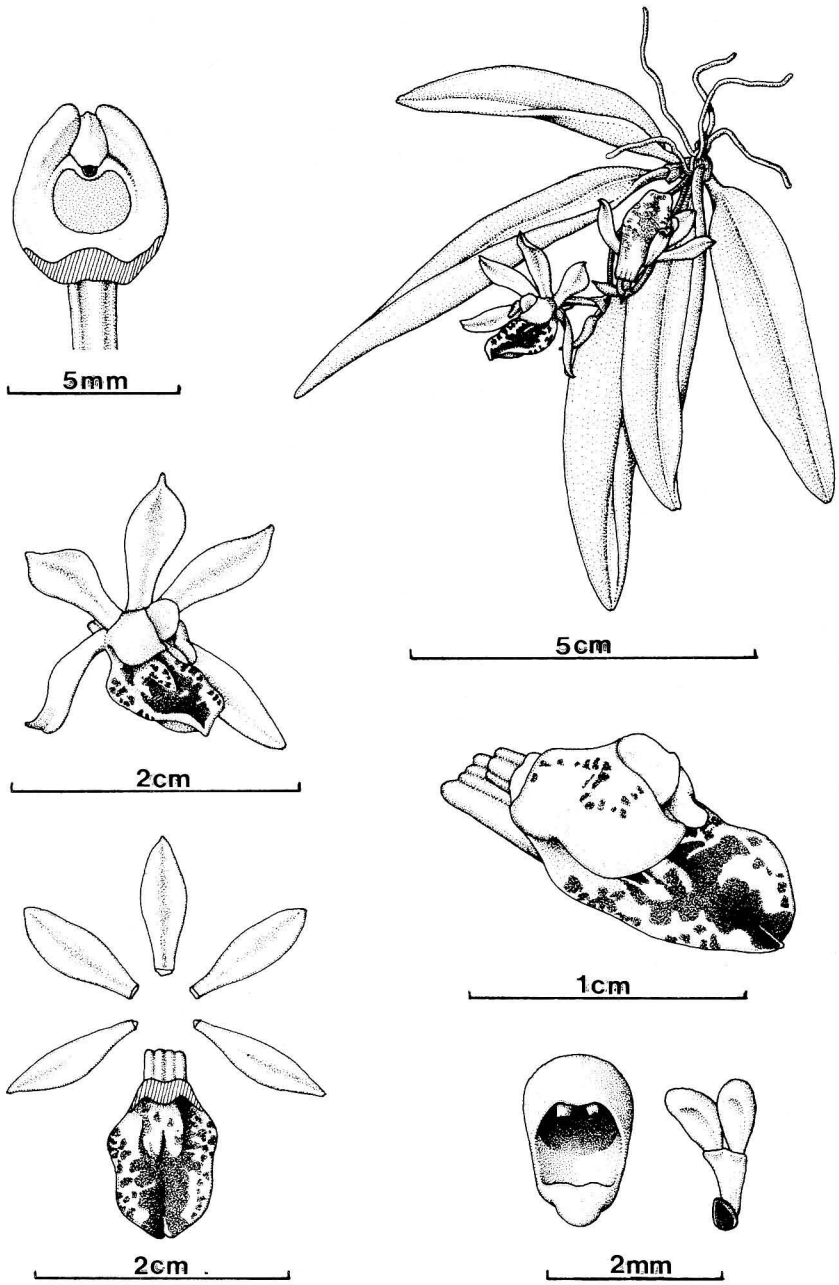

FIGURE 4. *Trichocentrum caloceras.* Illustration voucher: Costa Rica: Prov. of Puntarenas: Coto Brus, Las Cruces, *F. Pupulin & D. Castelfranco 1* (USJ).

revolute margins. *Anther* white, cucullate, carinate, glabrous. *Pollinia* 2, pyriform, complanate, on a triangular-elongate stipe; viscidium peltate, brown.

ETYMOLOGY. From the Greek *kalos* "beautiful" and *ceras* "horn," in allusion to its remarkable spur.

DISTRIBUTION. Costa Rica and Panama.

COSTA RICA. Without locality, *Endres s.n.* Prov.

of San José: Perez Zeledón, San Juan de San Isidro (980 m), on *Citrus aurantium* trees, *F. Pupulin 10,* prepared from cultivated material 12/1989 (USJ!). Prov. of Puntarenas: Coto Brus, Las Cruces (1,300 m), epiphytic in cloud forest, *F. Pupulin & D. Castelfranco 1,* prepared from cultivated material 12/1989 (USJ!); Pacuare, *C. K. Horich s.n.* (photo!).

HABITAT. This species inhabits wet, evergreen forests of southern Costa Rica, growing on shady lower branches and trunks of *Blakea subpeltata* and *Eugenia jambos.* The minimum and maximum temperature of the Coto Brus Region are 14°C and 29°C respectively. Rains are less regular during January and February when plants are often bathed in mist.

Plants are usually found in abundant, moist, live moss, and their roots never dry out completely. In the area of San Vito de Coto Brus *T. caloceras* grows in close proximity to *T. pfavii,* and both species flower at the same time. However, plants of *T. caloceras* often inhabit more exposed places, whereas *T. pfavii* is invariably found in the shadiest spots within the canopy.

Flowering generally occurs by the beginning of the dry season.

OBSERVATIONS. *T. caloceras* was originally discovered in Costa Rica in 1867 by A. R. Endres, a European collector particularly interested in orchids. Endres sent much material to H. G. Reichenbach, and many Costa Rican species were based on Endres' collections (now at Reichenbach's herbarium in Vienna). However, the collecting locality of *T. caloceras* remained unknown, as are most of Endres' itineraries in Costa Rica. The species was described in 1871 with *T. capistratum,* both with similar spurs: "Mr. Endres [. . .] has found since 1867, in Costa Rica, another Trichocentrum, bearing the same most remarkable spurs [as *T. capistratum*], and also broad ovate acute leaves, brown sepals and petals, and a rhomboid white lip, with purplish numerous spots, a shorter column, with rhomboid wings." Preparing the taxonomy of *T. capistratum* in Orquídeas de Colombia nuevas o criticas, Garay (1973) reduced *T. caloceras* to synonymy due to their floral similarities. However, though close relatives, they present consistent morphological differences. We believe they should be kept separate on account of their differently shaped lip and column wings, flower color and surface texture of the anther, which is hirsute in *T. capistratum* and glabrous in *T. caloceras.* Nevertheless, Teuscher (1961) and Beckner (1963) accepted both entities as *T. capistratum.*

This species is adaptable to a wide range of light intensities, and plants can be found in both shaded and bright conditions. However, plants growing in shaded places have darker leaves, and usually attain a larger size (to 7–8 cm) than those found in more exposed positions. Also floral scapes are longer and freely branched, and the flowering period is broader. Plants exposed to higher light levels present smaller and thicker leaves, entirely marked by reddish purple spots. When such plants are cultivated, they lose their spots.

Near San Isidro de Perez Zeledon this species grows in dense colonies on the lower branches of *Citrus aurantium* trees in association with *Oerstedella pinnifera, Stellilabium* sp., *Macroclinium* sp. and *Epidendrum porpax.* It also grows on *Eugenia jambos* associated with *Oncidium cabagrae, Trichocentrum capistratum* and *T. pfavii.*

The flower stalk of the specimen collected at Alto de San Juan produced a plantlet from an internode. Though still unrooted, it had already developed a mature pseudobulb with a fully formed leaf, suggesting the possibility of a propagation technique for *Trichocentrum* similar to that reported by Lim-Ho and Lee (1987) for *Oncidium.*

Trichocentrum costaricense Mora-Retana & Pupulin, sp. nov. (FIGURE 5).

TYPE. Costa Rica: Prov. of Alajuela, epiphytic in forest near Ciudad Quesada (about 700 m), 1988, *C. K. Horich s.n.,* flowered in cultivation 1989 (holotype, USJ!).

Species *T. caloceras* Endres & Rchb. f. affinis, sed labello elliptico, carinis geminis in disco obscuris, alis columnae subfalcatis et anthera papillosa differt.

Plant epiphytic, pendent, with short rhizome. *Roots* filiform, glabrous, with green apex. *Pseudobulbs* short, rounded, cespitose, unifoliate, about 3 mm long. *Leaf* green, fleshy, from a cuneate base obovate-elliptic to elliptic-lanceolate, acute, sessile, 4 cm long, 1.7 cm wide. *Inflorescences* lateral, basal, racemose, with a terete, green peduncle, 2–3 cm long; rachis abbreviated, producing 2–3 flowers consecutively. *Bracts* short, distichous, ovate, cucullate, acute, 2 mm long. *Ovaries* linear-clavate, 8–10 mm long including the pedicel. *Flowers* spreading, with sepals and petals greenish white and a white lip, with lilac spots. *Dorsal sepal* erect, obovate-oblong, acute to acuminate, subcarinate, to 14 mm long, 4 mm wide. *Lateral sepals* spreading, obliquely linear-lanceolate, acute, subcarinate, to 14 mm long, 2–2.5 mm wide. *Petals* obovate-oblong, obtuse to acute, 13 mm long, 4 mm wide. *Lip* elliptic, adnate to the column, concave, obtuse-retuse,

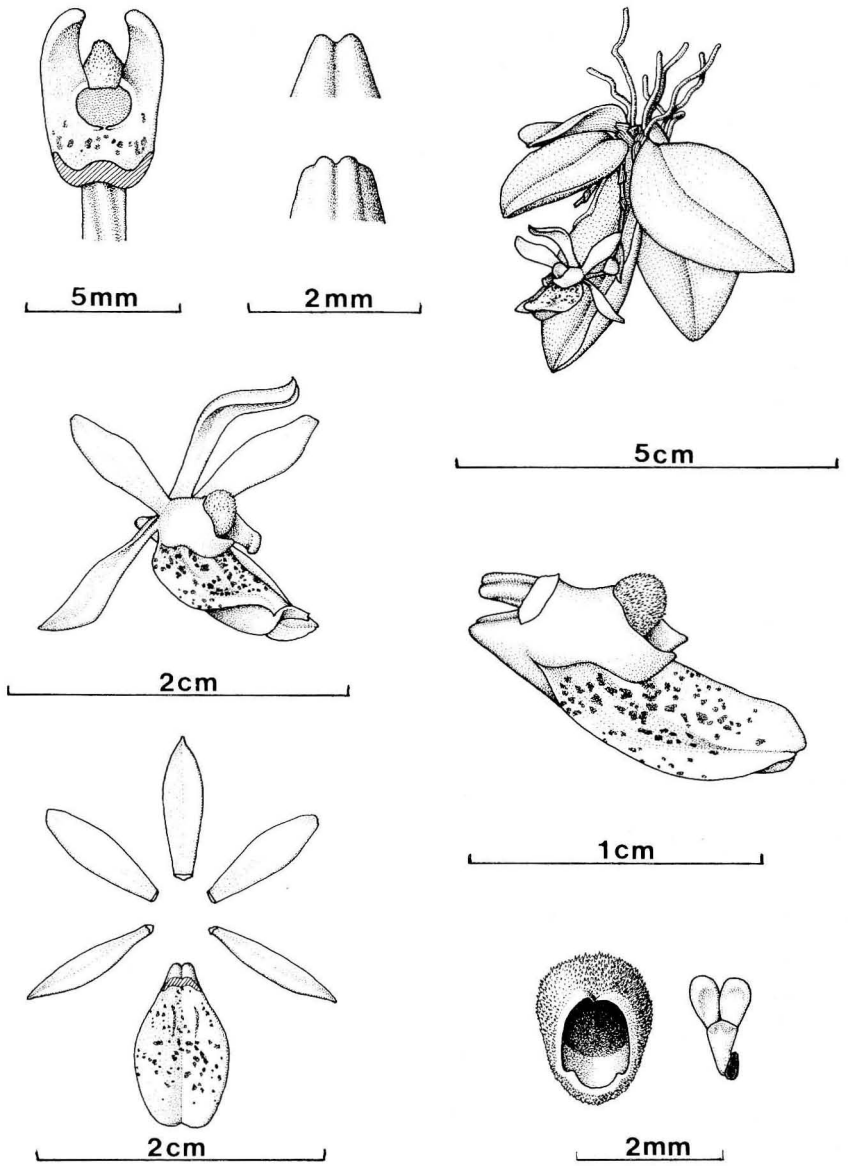

FIGURE 5. *Trichocentrum costaricense.* Illustration voucher: Costa Rica: Prov. of Alajuela: San Carlos, near Ciudad Quesada, *C. K. Horich s.n.* (USJ).

carinate at apex, 16 mm long, 10 mm wide, producing with the column base a short, flattened, truncate, obscurely 2- to 4-lobed spur; disc with a pair of oscure keels toward the base. *Column* short, stout, without a foot, about 5 mm long, with a pair of decurrent, fleshy, subfalcate, obtuse wings. *Anther* white, cucullate, papillose. *Pollinia* 2, pyriform, concave, on an elongate triangular stipe; viscidium peltate, brown.

ETYMOLOGY. Named for the country of origin, Costa Rica.

DISTRIBUTION. Known only from Costa Rica: Province of Alajuela.

COSTA RICA. Prov. of Alajuela: San Carlos, near Ciudad Quesada, *C. K. Horich s.n.* (USJ!); San Ramón, San Juan (1,170 m), 1989, *F. Pupulin & M. Flores 17* (USJ).

FIGURE 6. Different shapes of spurs in *Trichocentrum costaricense.*

HABITAT. *Trichocentrum costaricense* is distributed in the upper and central drainage of the Rio Barranca of the Central Pacific watershed, and the Rio San Carlos drainage. This area, the junction of the Cordillera de Tilarán and the Cordillera Central, forms the upper portion of the valley drained by the San Carlos River, and constitutes a natural pass from the north toward the Meseta de Esparza and the Pacific coast. The constant, strong and moist winds strike the edge of the plateau, where moisture condenses and precipitates as a fine mist. Such precipitation, locally called "pelo de gato," falls year round also on the upper western slopes of the Cordillera. The minimum and maximum average temperatures are about 18–23°C in the Atlantic lowlands and 15–27°C on top of the plateau.

The premontane rain forest and wet forest near San Ramón and the tropical rain forest toward the plain of San Carlos constitute the habitats of this little species, which has been found on shady, constantly moist trunks and branches of *Myrcia splendens.* The plants are usually found facing south or southwest, growing within 2–3 meters of the ground. Other sympatric orchids include *Trichopilia marginata* and *T. suavis, Pleurothallis arietina, Oncidium cabagrae* and *Epidendrum porpax.* The thin roots of *T. costaricense* strongly adhere to the host tree, and are covered by mosses. This impedes the complete drying of the roots during the dry season of February and March. New growth emerges with the rainy season and is completed in August. The flower stem arises from the new pseudobulb in early September and numerous flowers appear from October to January.

OBSERVATIONS. A plant of this species was collected by Clarence K. Horich in 1988 near Ciudad Quesada, in the San Carlos plain. The plant was grown in the Lankester Botanical Garden and identified as *T. capistratum.* A photograph of the flower was deposited at University of Costa Rica, where it was catalogued under the name, *Trichocentrum* aff. *panamense.* However, when all the material in cultivation at Lankester Garden was revised for the present study, the plant collected by Horich proved to be different.

T. costaricense differs from *T. capistratum,* as well as from its closely allied *T. caloceras,* in the diminutive size of the leaves, their rounded shape, the fine purple spotting of the lip and, more clearly, in the decurrent, obtuse, subfalcate wings of the column. *T. capistratum* invariably shows a white lip, with only two to four blotches at the conjunction of the lip with the column base. Further, its column wings are much shorter, porrect and acute to slightly apiculate. The only other Costa Rican species with purple lip color is *T. caloceras,* which has an obovate-subpandurate lip, revolute margins of the column wings and glabrous anther cap.

A natural hybrid origin for *T. costaricense* between *T. caloceras* and *T. capistratum* has been suggested (Chase pers. comm.) as it presents intermediate features such as a slightly hirsute operculum and minute pigmentation of the lip. However, its distribution is exclusively restricted to the northern San Carlos lowlands and the northeastern mountains of the Cordilleras, whereas both *T. caloceras* and *T. capistratum* are southern species and often sympatric without producing hybrids. Many cultivated specimens were studied, from the San Carlos area but without precise locality. They show a great variability in the shape of the spur, which may be 2- to 4-lobed, and in the last case the outer two lobes may be shorter or longer than median ones, or sometimes diverging as little horns (FIGURE 6).

Trichocentrum brenesii Schltr., Fedde Rep. Sp. Nov. Beih. 19: 248, 1923.

TYPE. Costa Rica: Prov. of Alajuela, San Pedro de San Ramón (1,200 m), Sept. 1921, *Brenes 116* (holotype, B, destroyed; drawings, AMES!).

Plant epiphytic, small, to about 10 cm high; rhizome short. *Roots* filiform, flexuous, glabrous. *Pseudobulbs* minute, to 3 mm long, unifoliate. *Leaf* suberect, obliquely ligulate, subacute, abruptly subpetiolate-angustate toward the base, 9 cm long, 1.5 cm wide. *Inflorescence* single, arising from the base of the pseudobulb, with a peduncle slightly vaginulate at the base and the rest bare, producing a solitary flower, erect-spreading to spreading. *Bracts* ovate, acuminate. *Ovary* slightly shorter than two thirds of the pedicel,

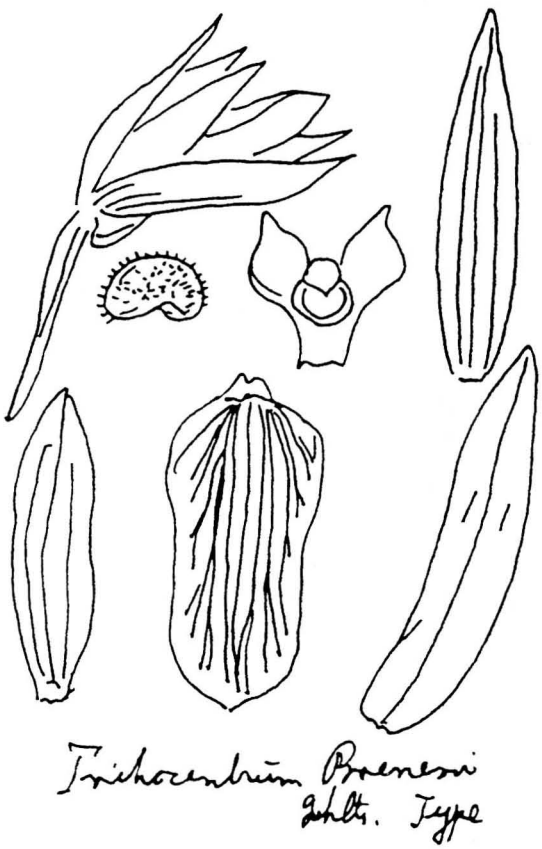

FIGURE 7. *Trichocentrum brenesii,* copy of Schlechter's sketch at AMES.

glabrous, 1.2 cm long including the pedicel. *Flowers* generally small, glabrous, thin. *Sepals* ligulate, acute, 3-nervate, 6 mm long. *Lateral sepals* oblique. *Petals* obliquely ligulate, slightly acute, 3-nervate, 5 mm long. *Lip* oblong, subobtuse, slightly narrowing toward the middle, rounded at the base, smooth, glabrous, with a short spur subtruncate at apex, 6 mm long, 3.25 mm wide, 2.75 mm wide at the base. *Column* short, 2 mm long, with two upward, obliquely subfalcate-elliptic, apiculate, entire wings. *Anther* dorsally densely papillous-verruculose, rounded-cucullate.

This description was taken from the original diagnosis.

ETYMOLOGY. Named in honor of its discoverer, Alberto M. Brenes, a Costa Rican botanist and friend of Rudolf Schlechter.

DISTRIBUTION. Known only from Costa Rica: Prov. of Alajuela.

COSTA RICA. Prov. of Alajuela: San Pedro de San Ramón, *A. M. Brenes 116* (drawing, AMES!); San Jerónimo, 1922, *C. Wercklé 139* (B+). Without locality, 1922, *Nevermann s.n.* (B+).

HABITAT. Epiphytic in the moist premontane forest of San Ramón and San Jerónimo, at altitudes of 1,000–1,200 meters above sea level.

OBSERVATIONS. Unfortunately the type of *T. brenesii* was destroyed during the bombing of Berlin in March 1943 (Ames 1944). Before publication of Schlechter's description, the species was collected twice in 1922 by Wercklé and Nevermann. Wercklé found it at San Jerónimo, less than 20 kilometers from the site of the original collection, Nevermann in an undisclosed locality. Both collections are reported by Schlechter (1923) in the last section of *Orchideae novae et rarae variorum collectorum in Costa Rica collectae.* No additional collections of this species are known.

In the absence of a type, Garay reduced *T. brenesii* to a later synonym of *T. capistratum* Linden & Rchb. f. (Dunsterville & Garay 1965), though he does not include *T. brenesii* among the synonyms of *T. capistratum* in a later work (Garay 1973). Barringer (1986) correctly restored the identity of *T. brenesii* on the basis of a copy of a Schlechter drawing at the Ames Herbarium (FIGURE 7). Though only a copy, the sketch clearly shows the same critical characters emphasized in the original description: the lip slightly narrowed in the middle, not emarginate and not longer than sepals, the narrow sepals, and the apiculate column wings. Lip shape should prevent any confusion with *T. capistratum,* which has an elliptic-ovate, concave, carinate lip with undulate margins, whereas *T. brenesii* shows a perfectly flat lip, lacking any keel or callosity. Furthermore, the column wings are clearly different in the two species, and the inflorescence is erect-spreading in *T. brenesii,* and pendent in *T. capistratum.* Except for an incorrect assignment to Mexico (Soto Arenas 1988), *T. capistratum* was never registered in the countries north of Costa Rica, and even here its presence is restricted to the southern Coto Brus and Rio General valleys, whereas the collecting localities of *T. brenesii* lie to the north, between the Cordillera de Tilarán and Cordillera Central. We have made numerous attempts to relocate plants at the original collecting localities and especially around San Pedro falls, where Brenes collected extensively. Both the San Ramón and San Jerónimo areas have been cleared for coffee, and the search into the last patches of surviving forest has proven unsuccessful. Nevertheless, an unidentified, small *Trichocentrum* plant with little white flowers was collected a few years ago near

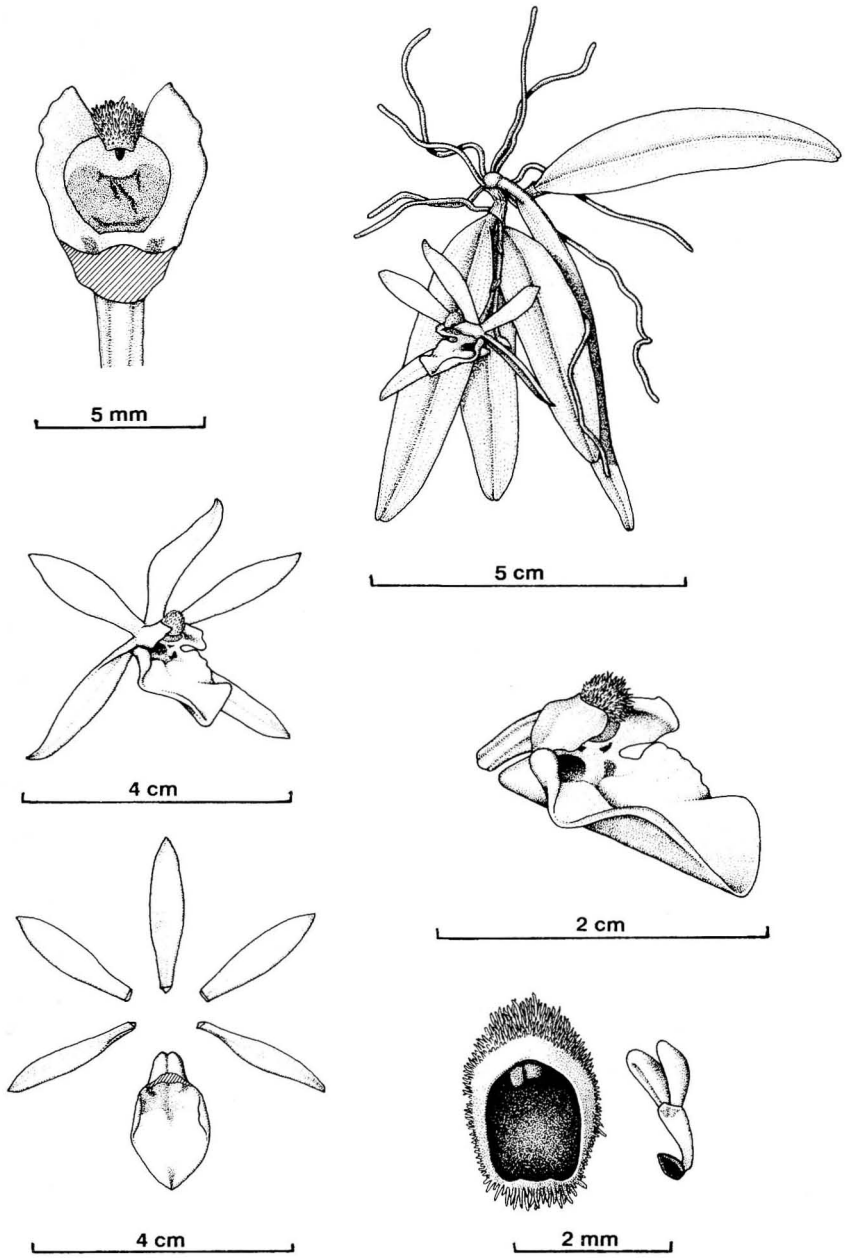

FIGURE 8. *Trichocentrum capistratum*. Illustration voucher: Costa Rica: Prov. of San José: Perez Zeledón, Alto de San Juan, *F. Pupulin, D. Castelfranco & J. Cambronero 3* (USJ).

Catarata de San Ramón, and further searching might reveal this lost species.

Trichocentrum capistratum Linden & Rchb. f., Gard. Chron. 1257, 1871 (FIGURE 8).

TYPE. Costa Rica, without precise locality, *Wallis s.n.* (holotype, W!).

SYN. *Trichocentrum panamense* Rolfe, Kew Bull. 341, 1913.

TYPE. Panama: on bush-covered hills east of the Panama Canal, *L. J. Lipscomb s.n.* (holotype, K!). *Trichocentrum pusillum* Lehmann in Herb. Kew., *Ms.*

Plant epiphytic, pendent, with abbreviated rhizome. *Roots* filiform, glabrous, with green apex. *Pseudobulbs* very short, unifoliate, cespitose. *Leaf* oblong-lanceolate to elliptic-lanceolate, acute, 4–7 cm long, 2 cm wide, more or less gradually narrowed to a conduplicate, sessile base. *Inflorescences* lateral, basal, pendent, racemose, 2–4 cm long; rachis abbreviated, fractiflex, producing consecutively 3 to 5 flowers. *Bracts* imbricate, triangular, concave, acute, 1.5 mm long. *Ovaries* linear-clavate, 5–7 mm long including the pedicel. *Flowers* small, white sepals and petals pale green or greenish-yellow and a white lip marked near the base by two to four reddish-brown blotches. *Sepals* subequal, free, spreading, subcarinate, oblong-elliptic to elliptic, acute, 16–18 mm long, 3–4 mm wide. *Petals* oblong-elliptic, acute, 14–16 mm long, 4–5 mm wide. *Lip* adnate to the column, elliptic-ovate, acute, concave, carinate, with slightly undulate margins in the basal portion, tapering toward the base to produce a short, wide, dorsoventrally flattened, obscurely 4-lobed spur. Length of the lip, spur included, 16 mm. *Column* short, about 5 mm, stout, the base without a foot, with a pair of porrect, fleshy, subquadrate, acute wings. *Anther* cucullate, white, hirsute. *Pollinia* 2, pyriform, complanate-concave, on a flat, triangular, elongate stipe; viscidium peltate, brown.

ETYMOLOGY. From the Latin *capistratum* (from *capistrum,* "capister"), a capister, part of the bird's head about the base of the bill, probably suggesting the form of the lip and spur.

DISTRIBUTION. Costa Rica, Panama, Colombia, and Venezuela.

COSTA RICA. Prov. of San José: Perez Zeledón, Alfombra de San Juan (900 m), *F. Pupulin, D. Castelfranco & J. Cambronero 3* (USJ!); Las Nubes de Quizarrá (1,000 m), *F. Pupulin & J. Cambronero 4* (USJ!); Rivas (1,100 m), *F. Pupulin & J. Cambronero 7* (USJ!). Prov. of Puntarenas: Cañas de Buenos Aires (about 500 m), *J. Cambronero s.n.* (USJ!). Without locality, *Wallis s.n.* (W!).

HABITAT. *T. capistratum* is generally found in warm evergreen tropical forests, where rainfall is regular year round. The dry season is short and moderate, with a water deficit that rarely exceeds 35–50 days a year. The elevational range varies from sea level (Williams and Allen 1946–1949) to 1,000–1,100 meters. Other orchids commonly found growing sympatrically include *Kefersteinia lactea, Restrepia muscifera* and *Macroclinium* sp. As is common for the genus, we have seen this species growing low on the twigs of the hosts, with its root system growing superficially into dense moss. On few occasions we have observed them growing on the branches of *Clusia minor* and *Senna hayesiana* hanging over streams. However, they are often found also in suboptimal natural habitats, such as in bright light and on the very smooth and dry bark of *Psidium guayava.* Nevertheless, when removed from this substrate and cultivated in the greenhouse these plants generally show a notable increase in size (Sanford 1961, 1974).

This species does not seem to have a well defined flowering time. We have seen plants in flower in April, May, June, August, October and November.

OBSERVATIONS. *T. capistratum* was introduced into cultivation in 1868 by Linden who flowered it for the first time in his establishment. In September of the same year Reichenbach saw the plant and was astonished by the unusual spur. Suspecting it to be a monster, Reichenbach did not describe the new species until 1871, when another *Trichocentrum* species with similar spur was introduced by A. R. Endres from Costa Rica. In his original description he wrote: "This little plant is one of the greatest curiosities I have ever seen. There are many Orchids with two spurs—the Satyria, Diplocentra, Comparettias,—there is something comparable to two spurs in Rodriguezias and Scelochilus now and then; but an Orchid enjoying five spurs at once was never seen before . . . Was it not a monster? This suspicion was the reason of my not publishing the plant."

Undoubtedly, this species is the same that was later described in 1913 by Rolfe in Kew Bulletin as *T. panamense.* The characters he pointed out in his diagnosis are quite indistinguishable from those of *T. capistratum.* The only difference Rolfe mentions is the spur divided at the apex into four short lobes instead of the five reported by Reichenbach in his original description. However, the drawing of the type (W) clearly shows the four lobes consistent with most of the plants we have studied in Costa Rica. Moreover, a comparison of the type material of *T. panamense* at Kew with the type of *T. capistratum* confirms the observations of Garay (1973) and reveals no differences by which they could be maintained as separate taxa.

The occurrence of this species in Costa Rica was first reported by Reichenbach (1871). Ames reported it in Standley's Flora of Costa Rica citing the type collection, without locality, made by Wallis. Williams (1951) suggested a Mexican origin of this species owing to Liebmann's name registered as collector. However, Soto Arenas (1988) definitively excludes this possibility indicating that the species has recently been collected only in Costa Rica and Panama. Its pres-

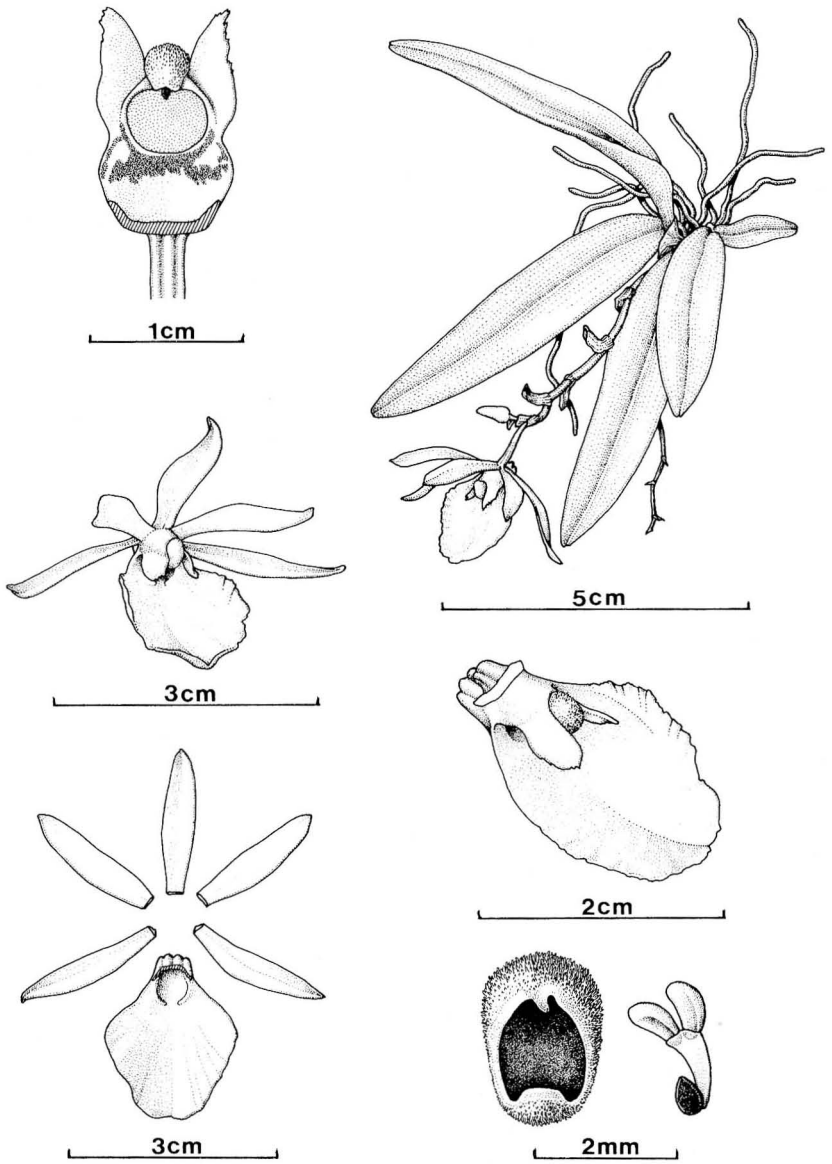

FIGURE 9. *Trichocentrum candidum*. Illustration voucher: Costa Rica: Prov. of Alajuela: San Carlos, Laguna Bosque Alegre, *F. Pupulin 5* (USJ).

ence is also confirmed in Colombia (Garay 1973) and Venezuela (Dunsterville and Garay 1965). In Costa Rica *T. capistratum* occurs locally in the southern slopes of the Cordillera de Talamanca and on the crests of the Fila Costera.

This diminutive species shows great variety of leaf size and shape as well as in length of floral scapes, while floral characters are rather constant aside from the number of spur lobes, easily differentiating it from allied species.

Trichocentrum candidum Lindl.,* Bot. Reg. 29: Misc. 9.9, 1843 (FIGURE 9).

TYPE. Guatemala, without precise locality, *Skinner s.n.* (holotype, K!).

*Editor's note: After this paper was accepted for publication, the Costa Rican population accepted as *T. candidum* was described as a new species, *T. cymbiglossum* Pupulin. See Lindleyana 9(1): 51–53 (1994).

SYN. *Trichocentrum albiflorum* Rolfe, Kew Bull. 336, 1893.

TYPE. Mexico, without precise locality, *Finck s.n.* (holotype, K!).

Plant epiphytic, cespitose, with short rhizome. *Roots* filiform, glabrous, with green apex. *Pseudobulbs* minute, rounded, unifoliate, about 4 mm long. *Leaf* linear-elliptic to elliptic, fleshy, obtuse to acute, sessile, narrowed to a conduplicate base, dark green, 5.3–7.5 cm long, 1.7–2.5 cm wide. *Inflorescences* lateral, basal, pendent, racemose, to 7 cm long; rachis abbreviated, fractiflex, of 1–5 successive flowers. *Bracts* papyraceous, distichous, ovate, cucullate, acute, 6–7 mm long. *Ovaries* 4–7 mm long including the pedicel. *Flowers* rather large, to 4.2 cm in diameter, with sepals and petals greenish white, free, spreading, and with white lip. *Dorsal sepal* elliptic-lanceolate, acute, subcarinate, 15–19.3 mm long, 3–5 mm wide, somewhat slightly recurved at apex. *Lateral sepals* obliquely subfalcate, acute, slightly shorter than dorsal sepal, 13.5–18 mm long, 3 mm wide. *Petals* oblanceolate-oblong, acute, subcarinate at apex, 18.7 mm long, 4.2–5 mm wide. *Lip* adnate to the column, broadly rhombic, concave, retuse, carinate, with undulate margins, cuneate at the base to produce a short, flat, truncate, spur 4-lobed, 20–26 mm in greatest length, 18 mm wide at the middle. *Column* short, about 5 mm, with a pair of erect-spreading, triangular, acute wings, margins erose at apex. *Anther* cucullate, white, papillose. *Pollinia* 2, pyriform, concave, on a short triangular stipe; viscidium peltate, brown.

ETYMOLOGY. From the Latin *candidum* "shining white," in reference to the flower's color.

DISTRIBUTION. Mexico, Guatemala, El Salvador, and Costa Rica.

COSTA RICA. Prov. of Alajuela: San Carlos, Laguna Bosque Alegre (750 m), *F. Pupulin 5* (USJ!); *F. Pupulin 5 bis* (Herb. Pupulin!); Reserva de Juan Castro Blanco, *A. Herrera s.n.* (USJ!). Prov. of Guanacaste: Tilarán, Laguna Arenal, near the Arenal Lodge (700 m). Prov. of Cartago: Turrialba, Tres Equis (750 m), *F. Pupulin & M. Flores 12* (USJ!); Rio Estrella, near San Isidro de Tejar (1,430 m), *F. Pupulin & A. Flores 18* (USJ!).

HABITAT. These rare orchids are usually found in evergreen rain forests (often secondary) at medium-low elevations of the Caribbean slope, where they receive 4–6 m of rain a year. The name, Tilarán, is derived from an Indian word meaning "the place where rain is always falling" (Standley 1937). Plants of *T. candidum* grow in very moist sites in deep shade, generally on smaller branches but sometimes also on trunks of trees within 2.5–3 meters from the ground. The thin roots develop freely and seem to prefer smooth or slightly rough, moss-covered bark. The new growth appears in April to May, maturing by summer. In early summer the inflorescence forms and the flowers are generally borne from September to December.

OBSERVATIONS. Teuscher (1961) first reported *T. candidum* for Costa Rica based on a collection by C. K. Horich. Apparently, this elusive species was not rediscovered in Costa Rica until 1989, when two plants collected by one of the authors (F.P.) in Laguna Bosque Alegre flowered in cultivation in Italy. It was collected twice near Tres Equis and along the Rio Estrella, and in one of these areas, *T. candidum* survived in a patch of virgin forest with *Kefersteinia deflexipetala, Chondrorhyncha bicolor* and the rare *Cryptarrhena guatemalensis.* All the Costa Rican records for this species came from the San Juan watershed.

Ames and Correll (1952–1953) incorrectly stated that *T. candidum* is the only Central American *Trichocentrum* having a blunt, gibbose-saccate spur, all the others showing a tubular spur. In fact, except for *T. pfavii* and *T. dianthum,* all the Costa Rican species possess a lobulate-saccate spur, a peculiarity that seems particularly common for the genus north of the isthmus of Panama.

Plants of *T. candidum* from Costa Rica present some important differences in comparison with those native to Guatemala, Mexico, and El Salvador. In Costa Rican plants the lip is rhombic or rounded, deeply concave, about as wide as long, carinate and only slightly notched at the tip, whereas those from the north are elliptic, about twice as long as wide, somewhat deeply notched at apex, almost flat and curving down in the terminal third.

The Mexican *T. albiflorum* should be considered conspecific with *T. candidum* from Guatemala. Rolfe's description of *T. albiflorum* shows few differences with *T. candidum,* and an examination of both types fails to reveal characters by which they could be maintained as separate. The type of *T. albiflorum* consisting of five flowers shows the lip always oblong-elliptic, and in some cases its length exceeds the width by two thirds. In Costa Rican plants the sepals and petals are generally fairly narrow and invariably yellowish-green or greenish-white in color, whereas the northern forms present rounded, wide sepals and petals. Both Lindley's sketches of *T. candidum* as well as a photograph of a Guatemalan plant (*Amer. Orch. Soc. Bull.* p. 386, 1961) clearly show them of a pure white color.

Although Teuscher (1961) considers the two geographic races to represent the same species, we think more studies are required in order to resolve the status of the Costa Rican plants.

Excluded Species

Trichocentrum orthoplectron Rchb. f. A Costa Rican or 'Central American' distribution was reported by Williams (1956). An examination of the type (W) shows this concept to be conspecific with *T. albococcineum* Linden, a species unknown to Costa Rica.

Trichocentrum porphyrio Rchb. f. This species, reported for 'Central America' by Williams (1956) should be reduced to a variety of *T. albococcineum.*

Trichocentrum tigrinum Rchb. f. This species was reported for Costa Rica by Schlechter (1927), but it is apparently endemic to Ecuador and Peru.

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