THE ORCHID FLORA OF BARRA HONDA NATIONAL PARK, NICOYA, GUANACASTE, COSTA RICA

Diego Bogarín[1,2,3,6] and Franco Pupulin[1,4,5]

Abstract. Barra Honda National Park (BHNP) lies in the Tempisque River Basin of the Península de Nicoya, Guanacaste, Costa Rica. The Park is well known for its limestone caverns, which date from the Upper Paleocene–Lower Eocene and are the main attraction of BHNP. The area shows a marked climatic seasonality with a predominantly semideciduous tropical dry forest. We present a floristic treatment of the orchids of BHNP based on field collections, herbarium sampling, and documentation of living specimens. We discuss the biodiversity, climate, geology, and topography of the Park and provide a novel vegetation zones map with eight floristic associations: bean plantations, disturbed secondary forest, evergreen forest, jaragua fields, mature secondary forests, pastures, rocky areas, karstic limestone pavement, and young secondary forest. For the 36 species belonging to 29 genera recorded, we provide composite line drawings and Lankester composite digital plates, descriptions, distribution, ecology, etymology, synonymy, taxonomy, photographs, and a key to the species for field identification based on morphology. Ten species of orchids (27.8%) are terrestrials and 26 are epiphytes (72.2%). The evergreen forest contains 80% of the orchid species of BHNP. We describe *Pelexia barrahondaensis* and *Sarcoglottis calcicola* as new to science, and we propose a new combination under *Specklinia* for *Pleurothallis panamensis*. Also, we record the terrestrial orchid genus *Tropidia* for the first time in Costa Rica. The present study provides new information on the Nicoya Peninsula's dry forest ecosystems for in situ conservation and research. This work can be useful for other protected areas within the same ecosystem that lack a floristic treatment of the Orchidaceae.

Keywords: Cerros de Jesús, floristics, Orchidaceae, protected areas, taxonomy, tropical dry forest

Resumen. El Parque Nacional Barra Honda (BHNP) se encuentra en la cuenca del río Tempisque de la Península de Nicoya, Guanacaste, Costa Rica. El parque es bien conocido por su sistema de cavernas de piedra caliza que datan del Paleoceno Superior–Eoceno Inferior, el principal atractivo de BHNP. El área muestra una marcada estacionalidad climática con un bosque seco tropical predominantemente semideciduo. Presentamos un tratamiento florístico de las orquídeas de BHNP basado en colecciones de campo, muestreo de herbario y documentación de especímenes vivos y discutimos la biodiversidad, el clima, la geología y la topografía del parque. Además, proporcionamos un mapa de zonas de vegetación novedoso con ocho asociaciones florísticas: plantaciones de frijol, bosque secundario perturbado, bosque siempre verde, campos de jaragua, bosques secundarios maduros, pastizales, áreas rocosas y pavimento de piedra caliza kárstica y bosque secundario joven. Proporcionamos ilustraciones y láminas compuestas digitales de Lankester, descripciones, distribución, ecología, etimología, sinonimia, taxonomía, fotografías y una clave de las especies basada en la morfología para la identificación en el campo de cada una de las 36 especies pertenecientes a 29 géneros registrados. Diez especies de orquídeas (27,8%) son terrestres y 26 son epífitas (72,2%). Aproximadamente el 80% de las especies de orquídeas de BHNP se encontraron en el bosque siempre verde. Describimos *Pelexia barrahondaensis* y *Sarcoglottis calcicola* como nuevas para la ciencia de poblaciones en BHNP y proponemos una nueva combinación bajo *Specklinia* para *Pleurothallis panamensis*. Además, registramos el género de orquídeas terrestres *Tropidia* por primera vez en Costa Rica. El presente estudio proporciona nueva información sobre los ecosistemas de bosque seco de la Península de Nicoya para la conservación in situ e investigación. Esta información se puede extrapolar a otras áreas protegidas dentro del mismo ecosistema que carecen de un tratamiento florístico de las Orchidaceae.

Palabras claves: áreas protegidas, bosque seco tropical, Cerros de Jesús, florística, Orchidaceae, taxonomía

Barra Honda National Park (BHNP) lies in the lower Tempisque River Basin of the Península de Nicoya, Guanacaste, Costa Rica (Fig. 1). The Park was established in 1974 to protect a unique system of limestone caverns present in Costa Rica that dates from the Upper Paleocene–Lower Eocene (Boza, 1986). Geologically, the Península de Nicoya is one of the most diverse and complex areas in southern Central America. Particularly, Barra Honda is a suitable place for understanding the geological evolution of the Central American Isthmus and the sedimentary regions of the Nicoya Complex (Mora, 1978; Aguilar and Denyer, 2001; Jaccard et al., 2001). The establishment of BHNP ensured the protection of water sources and the northern Pacific's dry forest ecosystems. Administratively, BHNP

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[1] Jardín Botánico Lankester, Universidad de Costa Rica, P.O. Box 302-7050 Cartago, Costa Rica, A.C.
[2] Herbario UCH, Universidad Autónoma de Chiriquí, 0427, David, Chiriquí, Panamá.
[3] Naturalis Biodiversity Center, Endless Forms group, P.O. Box 9517, 2300 RA Leiden, The Netherlands.
[4] Harvard University Herbaria, Cambridge, Massachusetts, U.S.A.
[5] Marie Selby Botanical Gardens, Sarasota, Florida, U.S.A.
[6] Corresponding author: diego.bogarin@ucr.ac.cr

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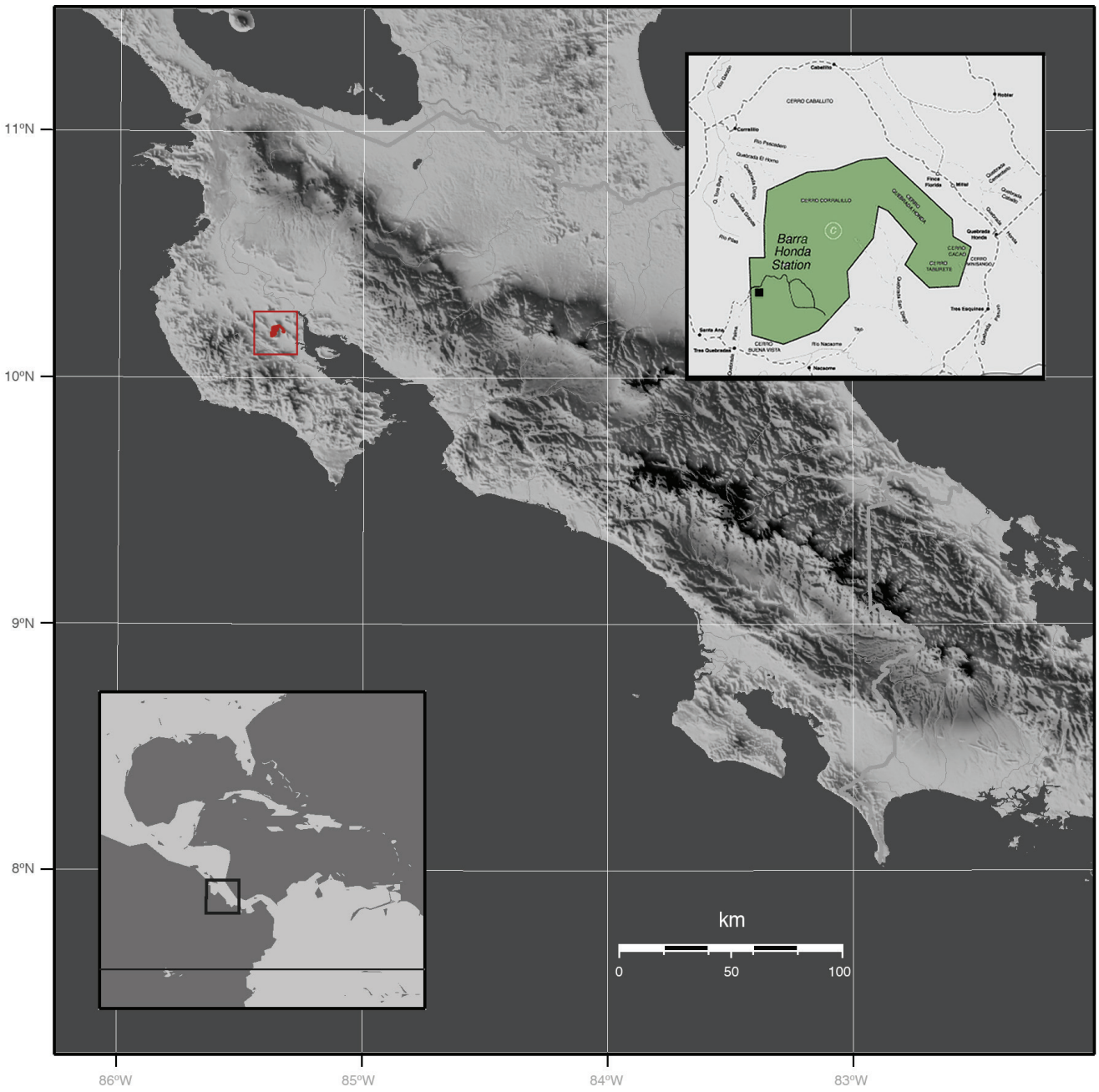

FIGURE 1. Location of BHNP in Costa Rica.

belongs to the Área de Conservación Tempisque (ACT) of the Costa Rican National System of Conservation Areas (SINAC).

The northern Pacific of Costa Rica shows a marked climatic seasonality and a predominantly semideciduous tropical dry forest. This area has suffered massive human intervention by deforestation and agricultural activities (Boza, 1986). The fragility of dry forest ecosystems such as are found in BHNP and the lack of information for understanding the natural resources protected by the SINAC make the development of floristic studies critical. Because of its geological importance, most of the research at BHNP has been published by geologists and speleologists, but little has been published to help understand its biodiversity. On the other hand, seasonally dry forests have been unattractive to orchidologists because of their low diversity as compared with the montane and premontane forests at higher elevations (Bogarín and Pupulin, 2007). Although some unpublished inventories have been undertaken, no scientific treatments on flora and fauna of BHNP are available, except for the two authors' preliminary assessment of the orchid species recorded within the Park (Bogarín and Pupulin, 2007) and a broader essay on the inventory carried out for this study (Pupulin and Bogarín, 2013).

This paper is the first botanical treatment at BHNP, aimed to clarify the Orchidaceae's diversity and provide the basis for a complete systematic revision of the flora at BHNP. This paper is part of a series of floristic studies on the orchids of protected areas in Costa Rica (Pupulin, 1998; Bogarín et al., 2011; Pupulin and Bogarín, 2013; Pupulin and Bogarín, 2018).

Description of the Study Site

BHNP lies in San Antonio, Nicoya, Guanacaste, about 12.5 km northeast of the city of Nicoya (10°12'N, 85°22'W, 10°09'N, 85°18'W) (Fig. 1–4). The Park comprises 2295 ha, with the following limits: to the north Cerro Caballito (a hill), to the south Finca San Diego (a private farm), to the west El Flor (a town), and to the east Quebrada Honda (a village). Other towns surrounding the Park are Barra Honda (Nacaome), Caballito, Corralillo, La Mansión, San Antonio, and Santa Ana. Executive Decree No. 10727-A established the boundaries of BHNP on October 5, 1979, using for reference topographic maps of the Instituto Geográfico Nacional labeled Matambú 3146-III and Talolinga 3146-IV, scale 1:50,000.

Topography

The Park comprises three main slopes: Cerro Barra Honda (423 m); the highest point, Cerro Corralillo (575 m); and Cerro Quebrada Honda (266 m) (Fig. 2), with rocky cliffs and gradients of 60–70 % observed mainly to the south of Cerro Barra Honda and Cerro Corralillo (Fig. 3). The summit of Cerro Barra Honda is a plateau of around 250 ha. The main caves, trails, and viewpoints are located here, making it the most important place for visitors. From the ranger station, a trail of about 1.7 km climbs up to the plateau's top. About 11 km of trails are available for visitors to the Park, including Quebrada Palma (at the ranger station), Ceiba, Los Laureles, Mirador Nacaome (at 423 m), Los Mesones, Bosque de Piedra on Cerro Barra Honda, and Las Cascadas at the south of Cerro Corralillo (Fig. 4). About 42 caves were documented, 19 of which have been explored. The most important are Chorotega, Los Gemelos, Nicoa, Ojoche, Ojos Verdes, Pozo Hediondo, Santa Ana (the deepest, at 180 m), La Trampa, La Cuevita, and Terciopelo (Fig. 5). The latter two are the only caves open to visitors (Barrantes et al., 1999). The slopes rise abruptly from the plains at 30–70 m on the lower Tempisque River Basin near its mouth into the Golfo de Nicoya (Fig. 6A–B).

A depression separates Cerro Barra Honda and Cerro Corralillo, which continues to the south bordering Finca San Diego. This depression is covered by evergreen forest locally known as Las Cascadas (47 ha). To the southeast of Cerro Barra Honda, there is a patch of evergreen forest named Los Mesones (27 ha). The depression between Cerro Barra Honda and Cerro Corralillo and the top of Cerro Corralillo have been disturbed by the action of fire and human activities. This area of about 210 ha comprises grassy lands and bean plantations. A narrow depression separates Cerro Corralillo from Cerros Quebrada Honda, a less explored region without trails for visitors and scientists. Other smaller slopes are Cerro Taburete, Cerro Cacao, and Cerro Misingo, located toward the southeast boundary. Other geologically related slopes in the neighborhood of BHNP are, to the north, Cerro Caballito (448 m) and Cerros del Rosario; to the northeast, Cerros Corral de Piedra and Sonzapote; to the east, Cerros Copal; and to the south, Cerros de Jesús.

Hydrology

The few rivers in BHNP flow mainly between Cerro Corralillo and Cerro Barra Honda in Las Cascadas and Los Mesones, the most humid area of the Park, with gallery forests that run along their edges. The most important rivers and streams are Quebrada San Diego, a system of small creeks from Las Cascadas and Los Mesones that flows into Río Nacaome to the south; Quebrada Horno, Grande, and Río Pescadero to the north of Cerro Corralillo; Quebrada Palma at the main station of the BHNP east of Cerro Barra Honda; and Quebrada Gradas on the slopes of Cerro Taburete, Cacao, and Misingo. Most of the rivers and creeks are intermittent and dry up during the dry season.

Geology

Barra Honda is part of the Barra Honda Limestone Platform of Upper Paleocene–Lower Eocene age (58 to 49 million years ago). Jaccard et al. (2001) studied the age of the structural setting of platform limestones of the Río Tempisque area, recognizing two distinct carbonate platform systems: the El Viejo Platform, represented by Cerros Ballena and Cebollín (Filadelfia, Guanacaste), and the Barra Honda Platform, from the classical outcrops at Cerro Barra Honda in the south to Palo Verde in the north. In the Barra Honda Platform, most facies contain larger benthic and planktonic porcelaneous foraminifera, specially *Morozovella velascoensis* Cushman, rotaliids, crinoids, and abundant red algae such as the Squamariacean *Ethelia alba* (Pfender) Johnson, characteristic of the Paleocene–Eocene (Aguilar and Denyer, 2001; Jaccard et al., 2001). The action of these organisms and the resulting calcium carbonate deposition led to the formation of limestone. According to Jaccard et al. (2001), the docking of the Nicoya Terrane during the Late Paleocene could have caused the uplift initiating the deposition of the Barra Honda Platform. The slopes at BHNP are surrounded by sedimentary plains made up of Cretaceous-Paleogene deep-water sediments and Quaternary alluvial, colluvial sediments (Denyer and Alvarado, 2007).

The water at BHNP contains high calcium carbonate levels, dissolved by rainwater and deposited by rivers and streams on the ground and rocks as travertine. The rivers show carbonate-staggered terraces and travertine columns, produced through slow precipitation and deposition of calcium carbonate. This phenomenon is evident in Las Cascadas, where several streams flow from Cerro Corralillo to Quebrada San Diego (Fig. 7A–B).

Barra Honda is considered a karst characterized by its limestone plateau and underground caverns. The action of

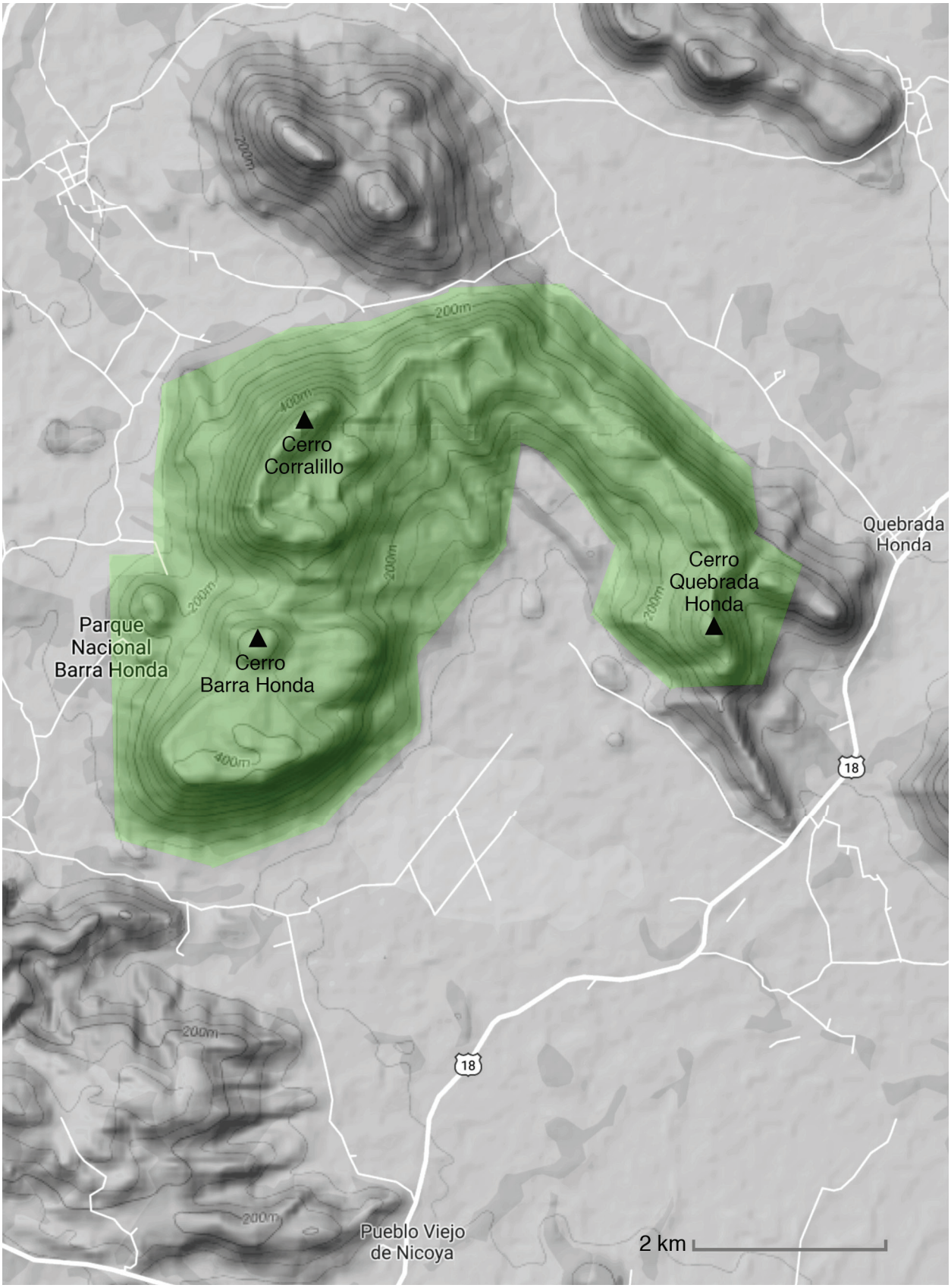

FIGURE 2. The topography of BHNP, showing the position of the highest peaks. Level curves every 20 m.

FIGURE 3. View of the limestone hills of BHNP. Photograph by F. Pupulin.

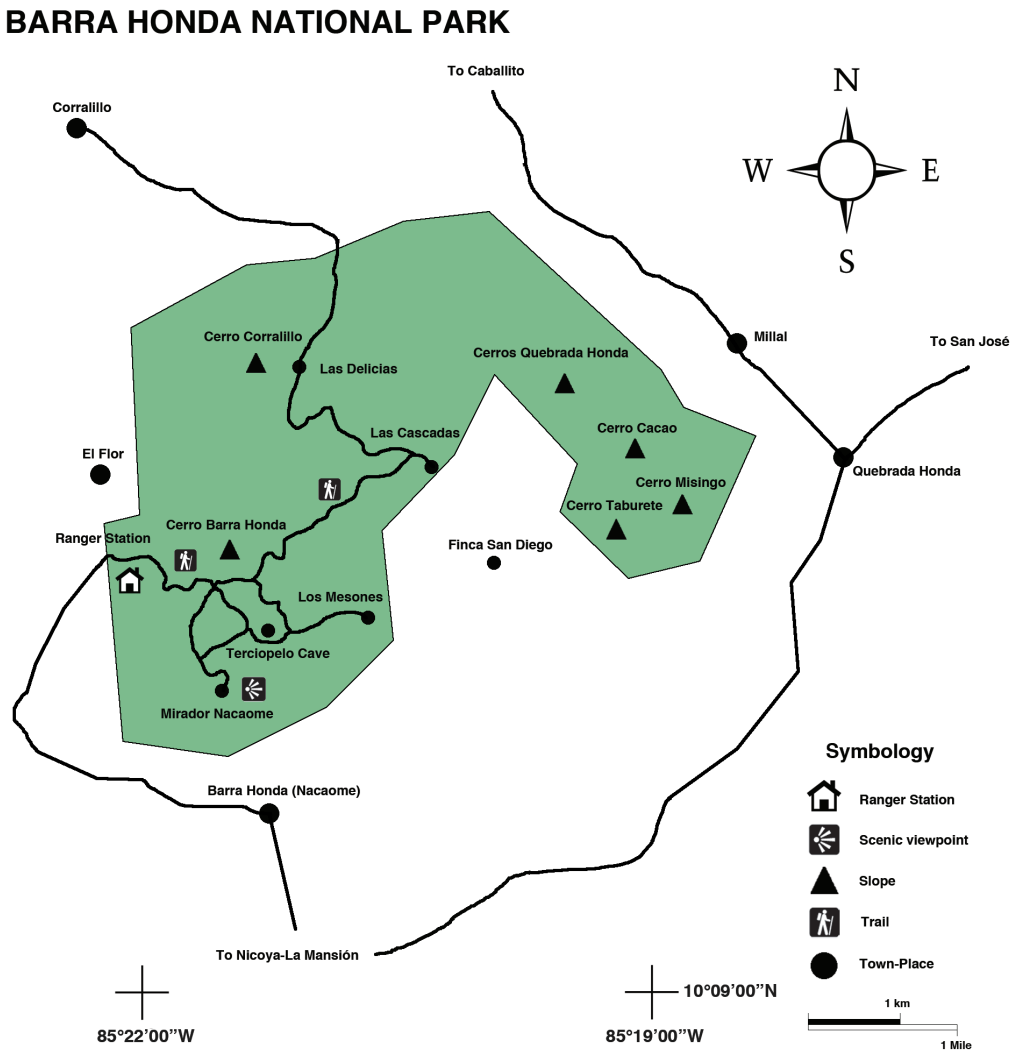

FIGURE 4. Map of Barra Honda National Park showing the main trails and places sampled. Map by D. Bogarín.

FIGURE 5. Calcium stalactites in the Terciopelo cave at BHNP. Photographs by D. Bogarín.

rainwater on soluble limestone also produced the erosion and deposition of calcium carbonate, resulting in the formation of vertical caverns adorned by stalactites and stalagmites, dolines, and sinkholes. Cerro Barra Honda has a stratification of limestone 300 m thick. It is not considered a young karst because of the deep vertical caves such as Santa Ana and La Trampa (170 m deep). However, it lacks the horizontal caverns characteristic of a mature karst (Mora, 1978). Other slopes with similar karstic features are Cerro Corralillo, Quebrada Honda, Corral de Piedra, and El Rosario, all surrounding BHNP.

Climate

The climate has two marked seasons: a dry season from late November to late April and a wet season from May to November (Fig. 6A–B, 7A–B). Precipitation can reach 1500–2000 mm/year, with less than 100 rainy days per year. During the rainy season, the total rainfall is 1800 mm, contrasting with 55 mm during the driest period. Rainfall increases in May (243 mm), slightly diminishes in July–August (191 mm), but later reaches a peak in September–October (up to 372 mm). From November to December, it decreases significantly (11 mm) until March (< 7 mm). The driest month is January, with less than 1 mm of rainfall. The average temperature is > 28 C, with minimum and maximum averages of 23.3 and 33.5 C. The warmest period is from February to April, with an average of 35.8 C.

Trade winds from the north influence the rainfall patterns at BHNP. These winds flow from the Caribbean to the Pacific watershed, but after passing the Cordillera de Guanacaste, they lose moisture and produce the typically dry conditions of the Península de Nicoya. The southwest trade winds and sea breezes from the Golfo de Nicoya interact with the northern trade winds, producing storms and rains from May to November. The intensification of the trade winds from the north during July–August causes a slight decrease in rainfall called *veranillo de San Juan* or *canícula* ("short St. John's summer"). Later in September–October, a stronger influence of southern trade winds increases rainfall levels that diminish in December when the northern trade winds blow again (Kohlmann et al., 2002). According to Bolaños et al. (2005), the life zone is the tropical dry forest, moist province transition with tropical dry forest and premontane moist forest, basal belt transition in the nearby areas.

Biodiversity

The Park lacks a floristic treatment and map of the vegetation types. Plant information is dispersed in unpublished checklists and databases in herbaria. About 200 plant species have been documented, most of them typical of Guanacaste and Puntarenas's seasonally dry forests. Most of the Park comprises secondary forest, and almost 80% of the species are deciduous during the dry season (Barrantes et al., 1999). The fauna includes 18 species of amphibians, 35 species of reptiles, 140 species of birds, and 66 species of mammals, of which about 50% are bats.

Here we propose the subdivision of the vegetation into eight types: pastures, rocky areas and karstic limestone pavement, jaragua fields, bean plantations, and disturbed, young, mature, and evergreen secondary forest (Fig. 8, 9A–H). We established these vegetation types on the basis of field observations and analysis from satellite imagery and aerial photography from 2010 to 2020 provided by Google Earth Pro 7.3.3.©

Vegetation

Evergreen forest (238 ha). Scattered patches of gallery forest cover the edges of rivers and streams, where humidity is constant throughout the year (Fig. 9H). The major areas are located at Las Cascadas and Los Mesones, where several streams flow into Quebrada San Diego. Other sites are located along the base of the western side

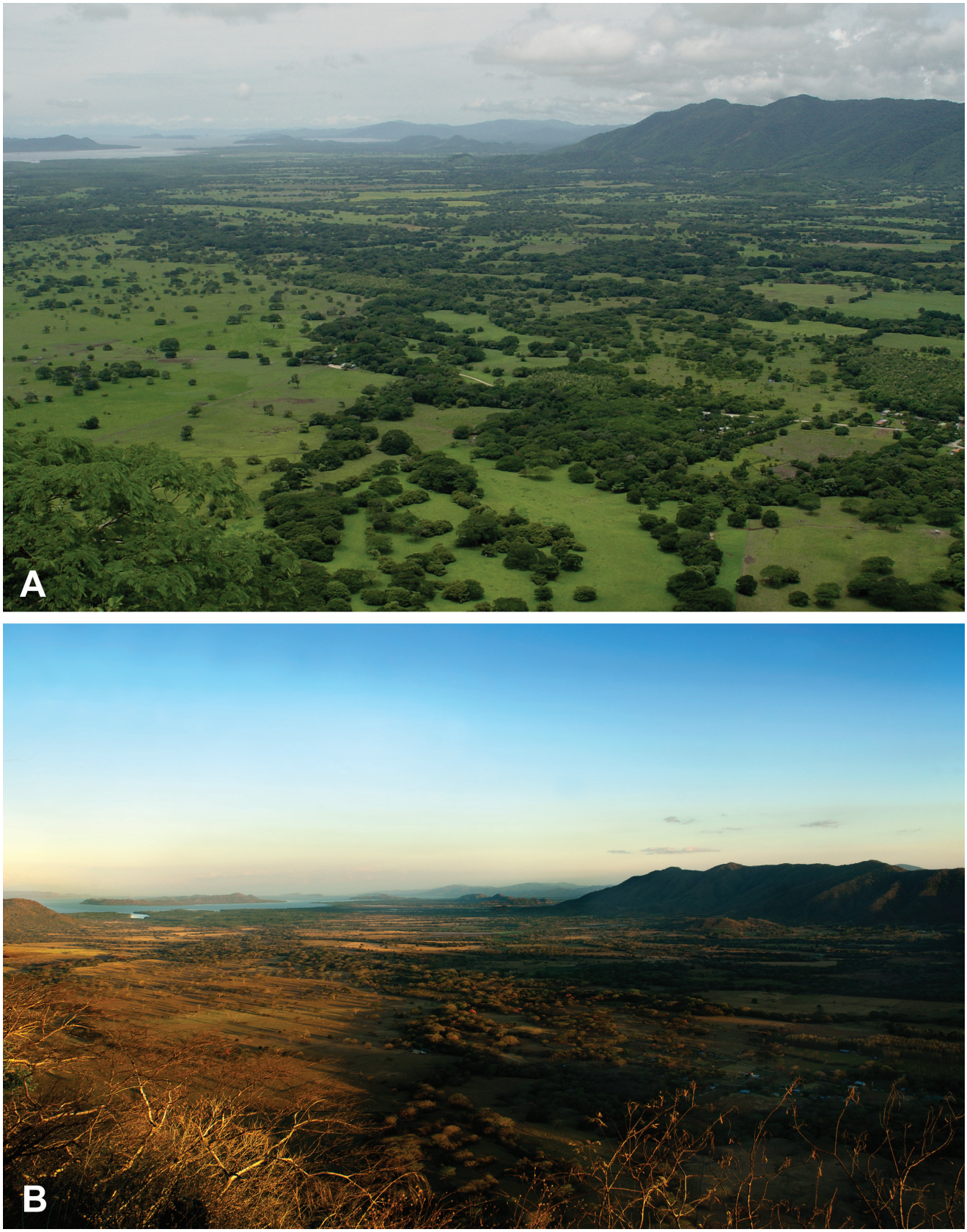

FIGURE 6. The plains of the lower Tempisque River from the top of Cerro Barra Honda, with the Cerros de Jesús on the right and the Nicoya Gulf on the background. **A,** Photo taken during the rainy season by D. Bogarín. **B,** Photo taken during the dry season by F. Pupulin.

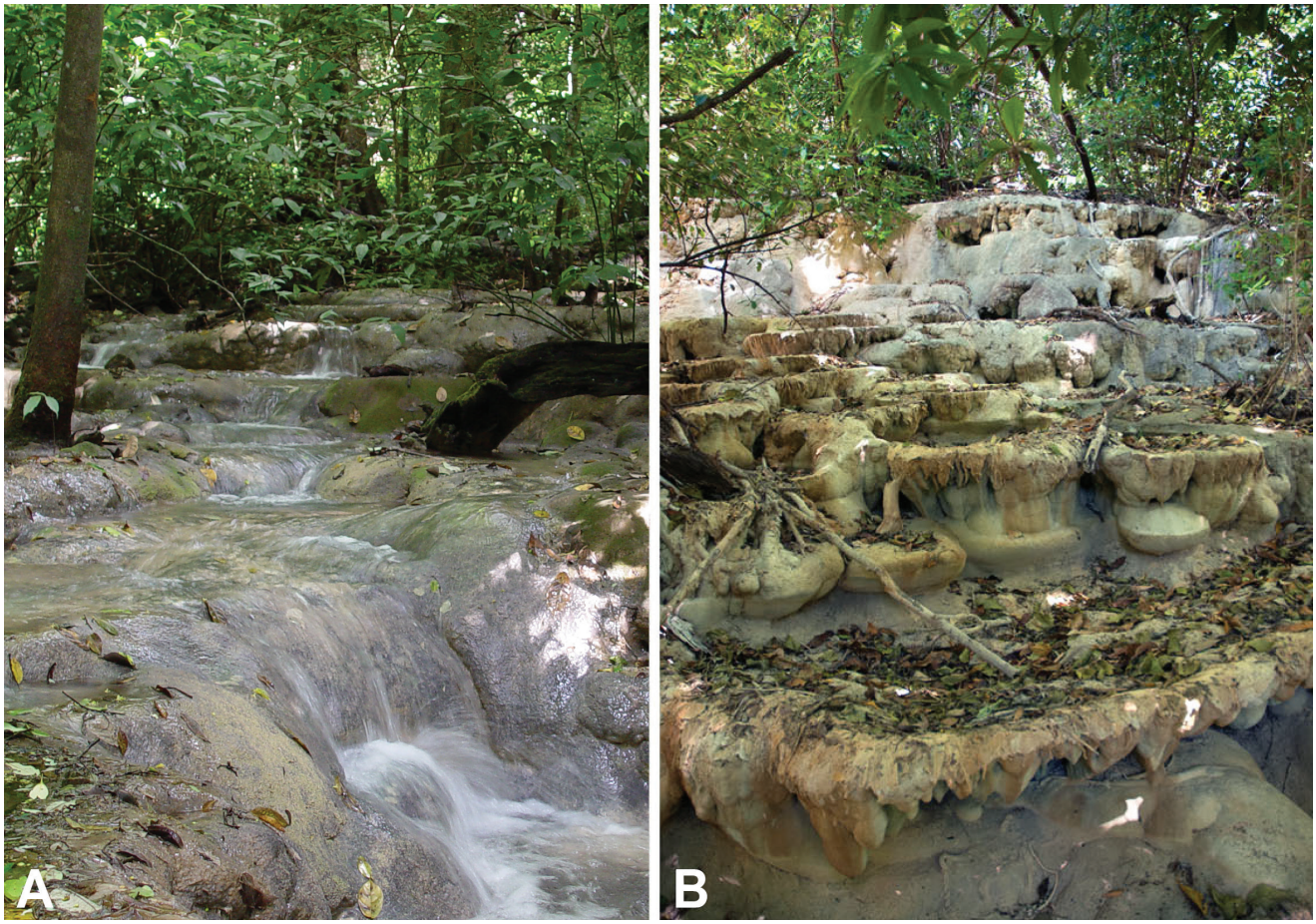

FIGURE 7. Rivulet with carbonate-staggered terraces at Las Cascadas, BHNP. **A,** Photo taken during the rainy season by D. Bogarín. **B,** Photo taken during the dry season by F. Pupulin.

of Cerro Barra Honda and Corralillo. The tallest trees of BHNP (ca. 15–30 m) are mainly found in the evergreen forest: *Anacardium excelsum* (Bertero & Balb. ex Kunth) Skeels, *Aspidosperma megalocarpon* Müll. Arg., *Astronium graveolens* Jacq., *Brosimum alicastrum* L., *Cedrela odorata* L., *Ceiba pentandra* (L.) Gaertn., *Dalbergia retusa* Hemsl., *Enterolobium cyclocarpum* (Jacq.) Griseb., *Ficus goldmanii* Standl., *Genipa americana* L., *Lonchocarpus phaseolifolius* Benth., *Luehea candida* (DC.) Mart., *Luehea semannii* Triana & Planch, *Pachira fendleri* Seem., *Samanea saman* (Jacq.) Merr., *Syderoxilum capiri* (A.DC.) Pittier, and *Tabernaemontana donnell-smithii* Rose. Some of the common shrubs are *Annona reticulata* L., *Ardisia revolute* Kunth, *Cordia* spp., *Garcia nutans* Vahl, *Inga* spp., *Jacquinia nervosa* C. Presl, *Lysiloma divaricatum* Hook. & Jackson, *Pouzolzia guatemalana* (Blume) Wedd., and *Psidium guineense* Sw. Common herbs present are *Dichorisandra hexandra* (Aubl.) Standl., *Dorstenia contrajerva* L., *Olyra latifolia* L., *Psychotria carthagenensis* Jacq., *Rhynchospora nervosa* (Vahl) Boeckeler, and *Selaginella sertata* Spring. Among the species of vines and lianas are *Dalbergia glabra* (Mill.) Standl., *Desmodium infractum* DC., *Heteropterys laurifolia* (L.) A. Juss., *Luffa aegyptiaca* L., *Monstera adansonii* Schott, *Petrea volubilis* L., *Smilax spinosa* Mill., and *Xylophragma seemannianum* (Kuntze) Sandwith.

Mature secondary forests (672 ha). Areas of mature secondary forest are located surrounding evergreen forest and steep areas of BHNP, mostly to the north of Cerro Barra Honda and Cerro Corralillo, and along the depression between Las Delicias and Las Cascadas. The forest is dense and semideciduous (Fig. 9G), with the following representative tree species: *Alvaradoa amorphoides* Liebm., *Annona reticulata, Brosimum aliscastrum, Bursera simaruba* (L.) Sarg., *Casearia corymbosa* Kunth, *Celtis trinervia* Lam., *Coccoloba caracasana* Meisn., *Dalbergia retusa, Ficus* L. spp., *Genipa americana, Hymenaea courbaril* L., *Inga vera* Kunth, *Nectandra martinicensis* Mez, *Phyllanthus acuminatus* Vahl, *Pisonia aculeata* L., *Plumeria rubra* L., *Sapranthus palanga* R.E. Fr., *Semialarium mexicanum* (Miers) Mennega, *Shizolobium parahyba* (Vell.) S.F. Blake, *Sideroxylon capiri*, and *Tamarindus indica* L. Common shrubs are *Aegiphila panamensis* Moldenke, *Allophylus racemosus* Sw., *Bourreria quirosii* Standl., *Bunchosia polystachia* (Andrews) DC., *Calliandra coriacea* (Humb. & Bonpl. ex Willd.) Benth., *Chomelia spinosa* Jacq., *Croton niveus* Jacq., *Erythroxylum havanense* Jacq., *Exostema caribaeum* (Jacq.) Schult., *Jacquinia nervosa*, *Lippia cardiostegia* Benth., *Margaritaria nobilis* L.f., *Vachellia collinsii* (Saff.) Seigler & Ebinger, and *Zanthoxylum setulosum* P. Wilson. Other common plants include the ferns

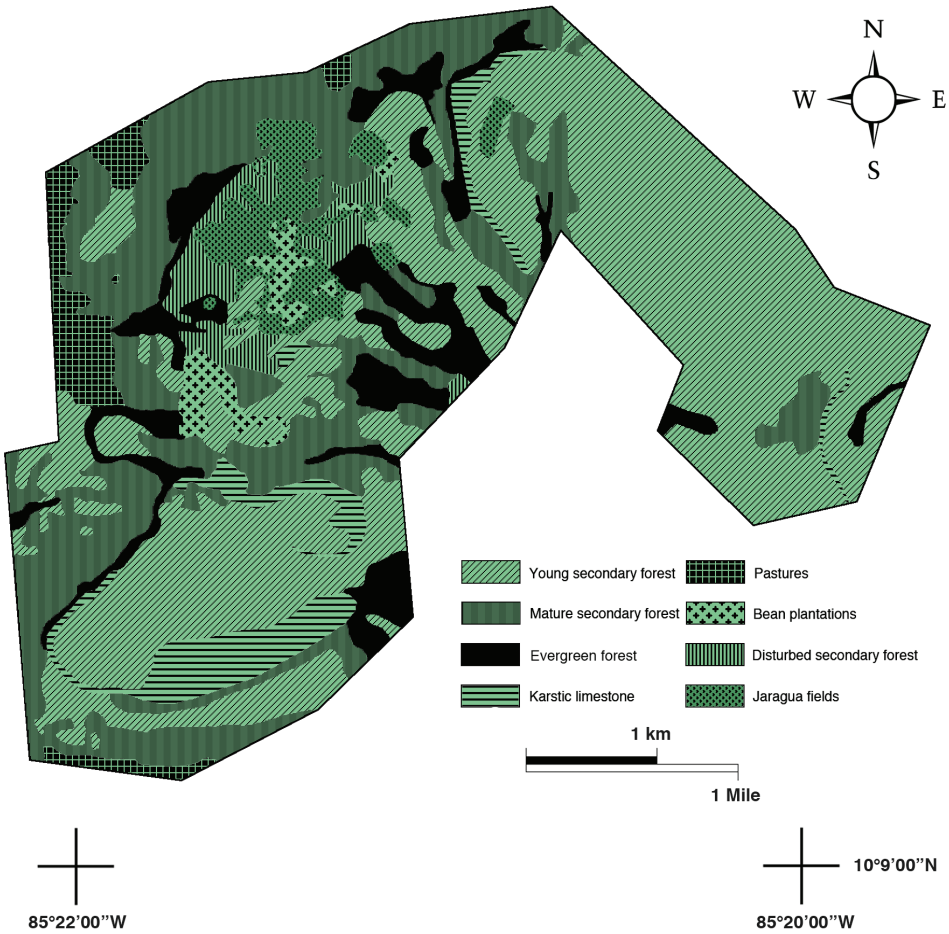

FIGURE 8. Map of vegetation types at Barra Honda National Park, by D. Bogarín.

and herbs *Adianthum* Manetti spp., *Ageratum conyzoides* L., *Coursetia caribea* (Jacq.) Lavin, *Eugenia hiraeifolia* Standl., *Euphorbia* L. spp., *Lasiacis divaricata* (L.) Hitchc., and *Mitreola petiolata* (Walter ex J.F. Gmel.) Torr. & A. Gray; and the vines *Centrosema sagittatum* (Humb. & Bonpl. ex Willd.) Brandegee, *Cydista diversifolia* (Kunth) Miers, *Desmodium infractum* DC., *Mandevilla subsagittata* (Ruiz & Pav.) Woodson, *Melothria trilobata* Cogn., *Passiflora platyloba* Killip, *Pleonotoma variabilis* (Jacq.) Miers, and *Trigonia rugosa* Benth.

Young secondary forest (1017 ha). Extensive secondary deciduous forest areas with scattered trees are located at Cerro Barra Honda, Cerros Quebrada Honda, Taburete, and Misingo (Fig. 9F). Some fine timber trees have been selectively logged in the past, while other areas have suffered the effects of fire, thus changing the areas' floristic composition. The vegetation comprises a mixture of shrubs and trees: *Albizia adinocephala* (Donn.Sm.) Britton & Rose ex Record, *Astronium graveolens, Bursera simarouba*, *Byrsonima crassifolia* (L.) Kunth, *Cedrela* L. spp., *Cecropia peltata* L., *Enterolobium cyclocarpum*, *Guazuma ulmifolia* Lam., *Handroanthus* Mattos spp., *Lonchocarpus phaseolifolius, Luehea seemannii*, *Muntingia clabura* L., *Pisonia aculeata, Plumeria rubra, Sideroxylon capiri*, *Spondias mombin* L., *Tabebuia* Gomes ex DC. *spp*., *Trichilia* P. Browne *spp*., *Sapranthus palanga,* and *Schizolobium parahyba*. On the slopes of Taburete, Cacao, and Misingo, tree species *Cochlospermum vitifolium* (Willd.) Spreng., *Handroanthus chrysanthus* (Jacq.) S.O. Grose, and *Schyzolobium parahyba* produce a conspicuous yellow bloom during the dry season. Understory vegetation comprises mainly *Acacia* Mill. spp., *Aegiphila panamensis, Jacquinia nervosa,* and various *Piper* L. spp.

Bean plantations (42 ha). Occupied lands inside the boundaries of BHNP owned by local farmers have been traditionally used to cultivate beans (*Phaseolus vulgaris* L.) until the present (Fig. 9D). The area is called Las Delicias, and it is located between Cerro Corralillo and Cerro Barra Honda. The land is surrounded by steep slopes of grassy lands and disturbed secondary forest. Scattered palm trees of *Acrocomia aculeata* (Jacq.) Lodd. ex Mart. (Coyol) are observed around the bean plantations and jaragua fields. Local farmers often burn this area before they begin sowing beans.

Jaragua fields (104 ha). Disturbed areas mostly covered by exotic jaragua grass, *Hyparrhenia rufa* (Nees) Stapf, are located on the summit of Cerro Corralillo at Las Delicias (Fig. 9C). The area has suffered severe deforestation, the original vegetation having been destroyed by fire. It is surrounded by bean plantations, which are burned by farmers every year during the dry season.

FIGURE 9. **A–H.** Vegetation types at Barra Honda National Park. **A,** Pastures with scattered trees. **B,** Rocky areas and karstic limestone pavement. **C,** Jaragua fields. **D,** Bean plantations. **E,** Disturbed secondary forest. **F,** Young secondary forest. **G,** Mature secondary forest. **H,** Evergreen secondary forest. Photographs by D. Bogarín (B, E–H) and F. Pupulin (A, C–D).

Disturbed secondary forest (68 ha). Areas surrounding jaragua fields and bean plantations have been severely disturbed by fire and human activities. This vegetation type is located mostly on Cerro Corralillo. The vegetation comprises scattered bushes mixed with grasses on rocky soils (Fig. 9E). Among the species observed are *Acrocomia aculeata, Bursera simarouba, Cecropia peltata, Ceiba pentandra, Chomelia spinosa, Cordia* L. spp., *Crescentia cujete* L., *Tabebuia* spp., *Enterolobium cyclocarpum*, *Ficus* spp., *Gliricidia sepium* (Jacq.) Kunth ex Walp., *Guazuma ulmifolia, Hymenaea courbaril, Luehea* Willd. spp., *Mutingia calabura, Pachira fendleri* Seem., and *Sideroxylum capiri*, among others.

Pastures (56 ha). Disturbed areas and fields, remnants of farms in the Park, are located mainly on the northwest boundary above El Flor (Fig. 9A). The area comprises grassy lands and scattered trees of *Crescentia cujete, Enterolobium cyclocarpum*, *Guazuma ulmifolia, Mutingia calabura*, *Samanea saman*, *Tabebuia rosea*, *Tamarindus indica,* and *Tectona grandis* L.f., among others.

Rocky areas and karstic limestone pavement (98 ha). The area is represented by small trees and bushes interspersed with limestone pavement in exposed sunny conditions (Fig. 9B). They are evident on top of Cerro Barra Honda near Mirador Nacaome. Vegetation includes *Albizia adinocephala, Andira inermis* (Sw.) Kunth, *Ayenia micrantha* Standl., *Bursera simaruba, Casearia corymbosa, Cordia inermis* (Mill.) I.M. Johnst., *Eugenia hiraeifolia* Standl., *Hymenaea courbaril, Lippia cardiostegia, Maclura tinctorial* (L.) D. Don ex Steud., *Mariosousa centralis* (Britton & Rose) Seigler & Ebinger, *Pitcairnia calcicola* J.R. Grant & J.F. Morales, *Plumeria rubra, Senna skinneri* (Benth.) H.S. Irwin & Barneby, *Simarouba glauca* DC., and *Trophis racemosa* (L.) Urb. The cactus *Stenocereus aragonii* (F.A.C. Weber) Buxb. is a common plant observed growing among calcareous rocks. Plants form large populations, mostly in the open, exposed sunny areas on the top of the main slopes of BHNP.

Materials and Methods

We conducted this study at the Barra Honda National Park, Guanacaste (Fig.1–4), Costa Rica, and the Lankester Botanical Garden (JBL, the acronym from its name in Spanish), University of Costa Rica. Living specimens were collected, cultivated, and documented at JBL between 2005 and 2019. We collected along the main trails of BHNP, along the Park boundaries, and in other places not accessible to visitors. Vegetation maps and georeferences were obtained using a Garmin GPSMAP® 64s, Google Earth Pro 7.3.3,© and field observations. Ecological zones were estimated using the Holdridge Life Zone System (Holdridge, 1967) and the ecological map of Costa Rica (Bolaños et al., 2005). Climatic data were taken from the Atlas Climatológico de Costa Rica (2019) and La Ceiba Station N.157 at Nicoya (10°06'N, 85°19'W; 20 m) of the Instituto Meteorológico Nacional de Costa Rica. Phenology data were recorded both in the field and in cultivated specimens, or from herbarium labels. Individual plants were photographed, illustrated, and preserved as herbarium specimens or spirit specimens in FAA (5% formaldehyde:5% glycerol:53% ethanol + 37% water) (including flowers, portions of the stems, or entire plants) for future reference. Herbarium and spirit vouchers may consist of wild-collected specimens or material collected entirely from cultivated plants, and they were deposited at CR, JBL, and USJ. Vouchers were complemented with sketches, photographs, and FAA material deposited at JBL. Drawings and images were prepared with Leica® MZ7.5 and MZ9.5 stereomicroscopes fitted with drawing tubes, Nikon® D5100 and D750 digital cameras with an AF-S VR Micro-NIKKOR 105mm f/2.8G IF-ED lens, and an Epson Perfection Photo Scanner V600. Composite plates were diagramed in Adobe Photoshop.® Ink drawings were prepared on smooth Fabriano® paper of 240 g/m^2 with a Rotring® Rapidograph 0.1 mm using black capillary cartridges and traced on an Artograph LightPad® A920. All taxa were illustrated with composite line drawings from living specimens. Illustrations include a typical plant habit, inflorescences or part of the inflorescences, the flower, and a dissection of the perianth. Descriptions were prepared from living specimens and herbarium material. Materials from AMES, CR, INB, JBL, K, and USJ were studied. Taxonomy of the genera that were recently subject to taxonomic changes, such as *Laelia* Lindl., *Specklinia* Lindl., and *Stelis* Sw., follow Pridgeon et al. (2005).

Results

We documented 36 orchid species at Barra Honda National Park, belonging to 29 genera (Fig. 10–14). Nine species (27.8%) were terrestrials, whereas 26 were epiphytes (72.2%) (Table 1). The most diverse genera were *Epidendrum* L., with 4 species, *Sarcoglottis* C. Presl with 3 species, and *Scaphyglottis* Poepp. & Endl. and *Specklinia*, each with 2 species recorded in the study area. While several elements are typical of the orchid flora of the dry region in northern Pacific Costa Rica or, more generally, of the Pacific lowlands, a surprise was the finding at BHNP of *Malaxis aurea* Ames, whose type is from the basal belt of the Talamanca mountain chain at over 1000 m of elevation. Even though its presence was expected in Costa Rica, the genus *Tropidia* Lindl., with *T. polystachya* (Sw.) Ames, is recorded from the BHNP for the first time for the flora of Costa Rica. *Pelexia barrahondaensis* Bogarín & Pupulin and *Sarcoglottis calcicola* Bogarín & Pupulin are described as new to science on the basis of populations found within BHNP. *Pleurothallis panamensis* Schltr. is recognized as a species distinct from *Specklinia microphylla* (A. Rich. & Galeotti) Pridgeon & M.W. Chase, transferred to the latter genus, and recorded for the first time for the Costa Rican flora from BHNP. With *Trichosalpinx reflexa* Mel. Fernández & Bogarín also described from BHNP (Fernández & Bogarín, 2011), the study of the orchid flora of the Park revealed three new species of Orchidaceae and resulted in the record of a new genus for the flora of Costa Rica.

Orchid Distribution within BHNP

Orchids at BHNP are distributed within the following vegetation types:

TABLE 1. Orchid species recorded at Barra Honda National Park.

SPECIES	EPIPHYTE	TERRESTRIAL	DECIDUOUS	EVERGREEN
1. *Barkeria obovata* (C.Presl) Christenson	x		x	
2. *Beloglottis costaricensis* (Rchb.f.) Schltr.		x	x	
3. *Brassavola nodosa* (L.) Lindl.	x			x
4. *Catasetum maculatum* Kunth	x		x	
5. *Cohniella brachyphylla* (Lindl.) Cetzal-Ix & Carnevali	x			x
6. *Cycnoches warszewiczii* Rchb.f.	x		x	
7. *Cyrtopodium macrobulbon* (La Llave & Lex.) G.A.Romero-Gonzalez & Carnevali		x	x	
8. *Dichaea panamensis* Lindl.	x			x
9. *Dimerandra emarginata* (G.Mey.) Hoehne	x			x
10. *Encyclia macrochila* (Hook.) Neumann	x			x
11. *Epidendrum congestoides* Ames & C.Schweinf.	x			x
12. *Epidendrum coronatum* Ruiz & Pav.	x			x
13. *Epidendrum stamfordianum* Bateman	x			x
14. *Epidendrum vulgoamparoanum* Hágsater & L.Sánchez S.	x			x
15. *Guarianthe skinneri* (Bateman) Dressler & W.E.Higgins	x			x
16. *Habenaria macroceratitis* Willd.		x	x	
17. *Heterotaxis sessilis* (Sw.) F.Barros	x			x
18. *Laelia rubescens* Lindl.	x			x
19. *Lalexia quadrifida* (La Llave & Lex.) Luer	x			x
20. *Leochilus scriptus* (Scheidw.) Rchb.f.	x			x
21. *Lophiaris oerstedii* (Rchb. f.) R.Jiménez, Carnevali & Dressler	x			x
22. *Malaxis aurea* Ames		x	x	
23. *Maxillariella acervata* (Rchb.f.) M.A.Blanco & Carnevali	x			x
24. *Oeceoclades maculata* (Lindl.) Lindl.		x		x
25. *Pelexia barrahondaensis* Bogarín & Pupulin		x	x	
26. *Sarcoglottis acaulis* (Sm.) Schltr.		x	x	
27. *Sarcoglottis calcicola* Bogarín & Pupulin		x	x	
28. *Sarcoglottis sceptrodes* (Rchb.f.) Schltr.		x	x	
29. *Scaphyglottis micrantha* (Lindl.) Ames & Correll	x			x
30. *Scaphyglottis stellata* Lodd. ex Lindl.	x			x
31. *Sobralia fenzliana* Rchb.f.	x			x
32. *Specklinia grobyi* (Bateman ex Lindl.) F.Barros	x			x
33. *Specklinia panamensis* (Schltr.) Bogarín & Pupulin	x			x
34. *Trichosalpinx reflexa* Mel.Fernández & Bogarín	x			x
35. *Trigonidium egertonianum* Bateman ex Lindl.	x			x
36. *Tropidia polystachya* (Sw.) Ames		x		x

Evergreen forest. This vegetation type, located mainly at Las Cascadas, Quebrada San Diego, and Los Mesones, is the most diverse area in terms of orchid species at BHNP (Fig. 9H). We recorded 27 of the 36 (75%) species of orchids of BHNP in the evergreen forest. The only population of *Lophiaris oerstedii* (Rchb.f.) R. Jiménez, Carnevali & Dressler is found at Las Cascadas. Because of their high orchid diversity, these areas are a priority in terms of orchid conservation.

Mature secondary forests. This vegetation zone (Fig. 9G) contains many species of orchids typical of the northern Pacific dry forest ecosystems of Península de Nicoya, such as *Barkeria obovata* (C. Presl) Christenson, *Brassavola nodosa* (L.) Lindl., *Catasetum maculatum* Kunth, *Cohniella brachyphylla* (Lindl.) Cetzal & Carnevali, *Dimerandra emarginata* (G. Mey.) Hoehne, *Epidendrum stamfordianum* Bateman, *Encyclia macrochila* (Hook.) Neumann, *Laelia rubescens* Lindl., *Scaphyglottis micrantha* (Lindl.) Ames & Correll, and *S. stellata* Lodd. ex Lindl. Also, a population of the national flower of Costa Rica, *Guarianthe skinneri* (Bateman) Dressler & W.E. Higgins, was found. Other similar areas are located at Cerro Corralillo, Taburete, and Misingo. A section of mature secondary forest located around Cerro Barra Honda has the only population of fewer than 10 individuals of *Tropidia polystachya*. This species had not been previously recorded in Costa Rica. Together with the cactus forest and rocky areas with scattered trees of Cerro Barra Honda, this area has abundant populations of orchids that are rare or absent in other regions of BHNP, such as *Beloglottis costaricensis* (Rchb.f.) Schltr., *Habenaria macroceratitis* Willd., *Malaxis aurea*, and *Sarcoglottis* spp. The exotic *Oeceoclades maculata* (Lindl.) Lindl. is common in the understory vegetation and even among rocks mixed with *Beloglottis costaricensis* and *Sarcoglottis calcicola*. We recorded 26 of the 36 (66.6%) species of orchids of BHNP in the mature secondary forest.

Young secondary forest. In this vegetation type (Fig. 9F), we observed *Barkeria obovata, Brassavola nodosa, Catasetum maculatum, Cohniella brachyphylla, Dimerandra emarginata, Epidendrum stamfordianum, Encyclia macrochila, Laelia rubescens, Scaphyglottis micrantha,* and *S. stellata*. However, orchids are not common, and they are mostly found on scattered old trees. Common terrestrial orchids are *Beloglottis costaricensis*, *Oeceoclades maculata,* and *Sarcoglottis* spp. We recorded 13 of the 36 (36.1%) species of orchids of BHNP in the young secondary forest.

Disturbed secondary forest, bean plantations, and jaragua fields. These areas (Fig. 9C–E) have very few orchid species because of the massive human intervention. The only orchids observed are growing on scattered trees surrounding the bean plantations and jaragua fields. The trees host mainly *Brassavola nodosa, Catasetum maculatum, Cohniella brachyphylla, Encyclia macrochila, Epidendrum stamfordianum,* and *Laelia rubescens*. Two rare terrestrial orchids were found in a secondary patch neighboring the jaragua fields: *Malaxis aurea* and *Pelexia barrahondaensis*. We recorded 8 of the 36 (22.2%) species of orchids of BHNP in these vegetation types.

Pastures. The scattered trees in pastures, such as large old specimens (Fig. 9A) of *Samanea saman* and *Tabebuia rosea* (Bertol.) DC., host mainly *Brassavola nodosa, Catasetum maculatum, Cohniella brachyphylla, Encyclia macrochila, Epidendrum stamfordianum, E. vulgoamparoanum* Hágsater & L. Sánchez, and *Laelia rubescens*. Isolated trees of *Crescentia cujete* are common in pastures and host *Leochilus scriptus* (Scheidw.) Rchb.f. on twigs. We did not find terrestrial orchids in pastures. We recorded 8 of the 36 (22.2%) species of orchids of BHNP in this vegetation type.

Rocky areas and karstic limestone pavement. Trees of *Cedrela odorata, Plumeria rubra,* and *Tabebuia rosea* are suitable phorophytes for *Barkeria obovata, Brassavola nodosa, Catasetum maculatum, Cohniella brachyphylla, Encyclia macrochila, Epidendrum stamfordianum, Laelia rubescens, Lalexia quadrifida* (La Llave & Lex.) Luer, *Specklinia grobyi* (Bateman ex Lindl.) F. Barros, and *S. panamensis* (Schltr.) Bogarín & Pupulin. Among rocks, we observed *Beloglottis costaricensis*, *Cyrtopodium macrobulbon* (Lex.) G.A. Romero & Carnevali, and *Sarcoglottis calcicola*. We recorded 13 of the 36 (36.1%) species of orchids of BHNP in this vegetation type.

Biogeography and Orchid Floristic Composition at BHNP

The seasonal dry forests of Central America, extending along the Pacific coast from Mexico to northern Costa Rica and then from eastern Panama to the Caribbean coast of Colombia and Venezuela, have the lowest diversity in terms of orchid species among Mesoamerican life zones (Pupulin and Bogarín, 2013). Some species at BHNP have wide distribution ranges and inhabit the entire Pacific coast of Costa Rica to Nicaragua, the humid areas of the central and southern Pacific to Panama, and the seasonal areas of Valle Central. These species are *Epidendrum coronatum*, *E. stamfordianum*, *E. vulgoamparoanum*, *Specklinia panamensis,* and *Scaphyglottis stellata*. Three species, *Lalexia quadrifida*, *Scaphyglottis micrantha,* and *Sobralia decora*, have the same distribution, but they can also be found in the humid areas of the northern Caribbean. Furthermore, *Brassavola nodosa*, *Catasetum maculatum*, *Dimerandra emarginata, Specklinia grobyi,* and *Trigonidium egertonianum* are distributed along the Pacific and the Caribbean slopes.

Within the biogeographic region of the northern Pacific, another group of species is found in the seasonally dry areas of the Northern Río Grande de Tárcoles Basin, reaching the seasonal areas of western Valle Central. Those species have their southern distribution limit in the surrounding regions of Cerro Turrubares and the Tárcoles and Candelaria rivers. Their habitat corresponds to the northern dry seasonal forests (Jiménez and Grayum, 2002). Within this group, we found *Barkeria obovata*, *Cohniella brachyphylla*, *Cyrtopodium macrobulbon*, *Encyclia macrochila*, *Guarianthe skinneri* (now extremely rare in the wild because of overcollection), *Laelia rubescens,* and *Trichosalpinx reflexa*. These observations are supported by floristic studies on the central and southern Pacific coast (Jiménez and Grayum, 2002; Pupulin, 1998; Pupulin and Rakosy, 2013; Weber et al., 2001). The Río Grande de Tárcoles Basin area is also the

biogeographical limit for some species that range from the central and southern Pacific coast to Panama. They are mostly found in humid areas of the southern Pacific to the northern Península de Nicoya but without reaching the seasonal drier regions of the North Pacific. This pattern is observed in the orchid flora of BHNP, where we did not record *Aspasia epidendroides* Lindl., *Ionopsis satyrioides* (Sw.) Rchb.f., *Specklinia corniculata* (Sw.) Steud., *Trizeuxis falcata* Lindl., *Prosthechea abbreviata* (Schltr.) W.E. Higgins, *Campylocentrum multiflorum* Schltr., or *C. micranthum* (Lindl.) Maury, among others (Pupulin, 1998; Jiménez and Grayum, 2002). Other species not recorded in BHNP but commonly found in humid areas of Península de Nicoya are also found in the wet forest of the central and southern Pacific, such as *Anathallis lewisiae* (Ames) R. Solano & Soto Arenas, *Coryanthes kaiseriana* G. Gerlach, *Epidendrum anceps* Jacq., *Prosthechea chacaoensis* (Rchb.f.) W.E. Higgins, and *Stanhopea cirrhata* Lindl., among others. Méndez and Obregón (2019) compiled most of the orchids of the Península de Nicoya. Some of these orchid species might appear at BHNP in the future.

Plants of *Beloglottis* and *Sarcoglottis* are deciduous during the dry season when they bloom. Their habitat is similar to the species found in the dry areas of Mexico toward Nicaragua. They grow mostly among rocks and organic litter. The widespread *Tropidia polystachya* and the exotic *Oeceoclades maculata* retain their leaves throughout the year. *Oeceoclades maculata* is common in some regions of BHNP and form large groups of individuals, mainly in the secondary forest. Its presence is reported for dry areas of the Park Nacional Santa Rosa and has been collected in the central and southern Pacific and the Caribbean lowlands (Dressler, 2003). Plants of *Cyrtopodium macrobulbon* grow in rocky areas with organic matter in secondary forests. The only species of the genus in Costa Rica, it is also found in the seasonal areas of the Candelaria River Basin. Another curious finding is *Malaxis aurea*, a terrestrial species only recorded from the montane rainforest of eastern Cartago.

Among the most apparent elements of the seasonally dry forest ecosystems of the northern Pacific of Costa Rica are *Barkeria obovata, Brassavola nodosa, Catasetum maculatum, Cohniella brachyphylla, Dimerandra emarginata, Epidendrum stamfordianum, Encyclia macrochila, Laelia rubescens,* and *Scaphyglottis micrantha*. In addition to those well-known species, the present study provides new information on the dry forest ecosystems of Península de Nicoya. It attempts to explain the orchid flora of BHNP on the basis of the general distribution of species. This treatment can be useful for other protected areas within the same ecosystem that share several orchid species.

Key to the Orchids of Barra Honda National Park, Costa Rica

1a. Plant terrestrial . . . 2
1b. Plant epiphytic . . . 11
2a. Plant with pseudobulbs . . . 3
2b. Plants without pseudobulbs . . . 5
3a. Plants with several plicate leaves along the pseudobulb . . . *Cyrtopodium macrobulbon*
3b. Plants with one conduplicate leaf at the apex of the pseudobulb . . . 4
4a. Leaf cordate, concolorous green, inflorescence apical . . . *Malaxis aurea*
4b. Leaf oblong-elliptic, maculate, inflorescence lateral . . . *Oeceoclades maculata*
5a. Stems elongated > 3.5 cm long, leaves arranged along the stem, persistent when in flower, roots < 2.5 mm . . . 6
5b. Stems abbreviated < 2 cm, leaves rosulate, deciduous when in flower, roots > 4 mm . . . 7
6a. Plants without tubers, leaves plicate, lip without spur . . . *Tropidia polystachya*
6b. Plants with tubers, leaves conduplicate, lip with a conspicuous spur . . . *Habenaria macroceratitis*
7a. Leaves sessile or subsessile . . . 8
7b. Leaves petiolate . . . 9
8a. Inflorescence congested, floral bracts shorter than the ovary . . . *Sarcoglottis calcicola*
8b. Inflorescence lax, floral bracts longer or as long as the ovary . . . *Sarcoglottis acaulis*
9a. Petiole reddish-pinkish at the base, 13–23 cm long, stem monophyllous, inflorescence up to 8 flowers, brownish-green with white with the mesochile yellow . . . *Pelexia barrahondaensis*
9b. Petiole white-green at base . . . 10
10a. Inflorescence with 5–11 flowers, green or brownish green . . . *Sarcoglottis sceptrodes*
10b. Inflorescence with 15–70 flowers, white with a central green stripe in the perianth parts . . . *Beloglottis costaricensis*
11a. Plants with pseudobulbs . . . 12
11b. Plants without pseudobulbs . . . 27
12a. Leaves terete or semiterete . . . 13
12b. Leaves flattened, plicate or conduplicate, not terete . . . 14
13a. Leaves semiterete, flowers white . . . *Brassavola nodosa*
13b. Leaves terete, flowers yellow . . . *Cohniella brachyphylla*

KEY TO THE ORCHIDS OF BARRA HONDA NATIONAL PARK, COSTA RICA CONT.

14a. Stems prolific, with pseudobulbs arising from the top of old pseudobulbs, forming chains ..... *Scaphyglottis stellata*
14b. Stems not prolific, with pseudobulbs arising from the side of old pseudobulbs, not forming chains 15
15a. Leaves plicate 16
15b. Leaves conduplicate 17
16a. Plants without a mass of secondary roots, inflorescence lateral from near the apex of the pseudobulb, staminate flowers with ovate lip, the column thin, elongated, arcuate without setae ..... *Cycnoches warszewiczii*
16b. Plants with a mass of secondary roots, inflorescence lateral from the base of the pseudobulb, staminate flowers with saccate lip, the column thick, short, erect with two setae ..... *Catasetum maculatum*
17a. Inflorescence apical 18
17b. Inflorescence lateral 22
18a. Leaves (several) arranged along the stem, deciduous ..... *Barkeria obovata*
18b. Leaves (1 or 2) arranged at the apex of the stem, evergreen 19
19a. Leaves < 8 mm wide, flowers < 5 mm in diam. ..... *Scaphyglottis micrantha*
19b. Leaves > 1.5 cm wide, flowers > 2 cm in diam. 20
20a. Pseudobulbs clavate, the inflorescence shortly pedunculate and developed from a conspicuous papyraceous spathe ..... *Guarianthe skinneri*
20b. Pseudobulbs not clavate, the inflorescence pedunculate and not developed from a conspicuous papyraceous spathe 21
21a. Pseudobulbs 1-leaved, laterally flattened, ancipitous, flowers with the lip purple-lavender with the center dark purple ..... *Laelia rubescens*
21b. Pseudobulbs 2-leaved, not laterally flattened, conic-ovoid, flowers with the lip white ..... *Encyclia macrochila*
22a. Inflorescence many-flowered 23
22b. Inflorescence 1-flowered 25
23a. Pseudobulbs > 15 cm long, apically 2-leaved ..... *Epidendrum stamfordianum*
23b. Pseudobulbs < 3 cm long, apically 1-leaved 24
24a. Leaves fleshy-coriaceous, > 30 cm long, > 7 cm wide; flowers white with purple-brown blotches, lip pandurate ..... *Lophiaris oerstedii*
24b. Leaves coriaceous, < 10 long, < 2 cm wide; flowers greenish-yellow, lip obovate ..... *Leochilus scriptus*
25a. Rhizome long, pseudobulbs distant from one another (plant repent) ..... *Maxillariella acervata*
25b. Rhizome short, pseudobulbs close each other (plant caespitose) 26
26a. Pseudobulbs conspicuous, not hidden by the sheaths, bifoliate; leaves subcoriaceous, inflorescence to 20 cm long ..... *Trigonidium egertonianum*
26b. Pseudobulbs inconspicuous, hidden by the foliaceous sheaths, monophyllus; leaves fleshy-coriaceous; inflorescence to 3.5 cm long ..... *Heterotaxis sessilis*
27a. Leaves plicate ..... *Sobralia fenzliana*
27b. Leaves conduplicate, lenticular or cylindrical 28
28a. Plants creeping, leaves granulose-verrucose, superposed ..... *Specklinia panamensis*
28b. Plants erect or subpendent, leaves smooth, not superposed 29
29a. Leaves cylindrical or semiterete 30
29b. Leaves flattened 31
30a. Leaves semiterete, flowers white ..... *Brassavola nodosa*
30b. Leaves terete, flowers yellow ..... *Cohniella brachyphylla*
31a. Plants with one leaf at the apex of the stem 32
31b. Plants with more than one leaf distributed along the stem 34
32a. Stems covered by lepanthiform bracts ..... *Trichosalpinx reflexa*
32b. Stems without lepanthiform bracts 33
33a. Mature plants < 4 cm tall ..... *Specklinia grobyi*
33b. Mature plants > 5 cm tall ..... *Lalexia quadrifida*
34a. Leaves < 1 cm wide 35
34b. Leaves > 1.5 cm wide 37
35a. Inflorescence lateral; leaves subcoriaceous, glaucous on the upper surface ..... *Dichaea panamensis*
35b. Inflorescence apical; leaves coriaceous, not glaucous 36
36a. Stems short, < 6 cm tall; flowers green, suffused brown ..... *Epidendrum congestoides*
36b. Stem long, > 20 cm tall; flowers pink-purple ..... *Dimerandra emarginata*
37a. Inflorescence subumbellate, subsessile, with 3–5 green flowers ..... *Epidendrum vulgoamparoanum*
37b. Inflorescence racemose, pedunculate, with > 6 cream flowers ..... *Epidendrum coronatum*

TAXONOMIC TREATMENT

1. *Barkeria* Knowles & Westc., Floral Cabinet 2: 7–8. 1838. TYPE: *Barkeria elegans* Knowles & Westc.

Plants epiphytic or lithophytic, caespitose, often growing on twigs but not considered obligate twig epiphytes. *Stems* forming slender, ellipsoid, stipitate pseudobulbs bearing tight leaf sheaths. *Leaves* distichous, linear-lanceolate to broadly ovate, conduplicate, arranged along the stem, clustered toward the apex, deciduous during the dry season. *Inflorescence* a terminal raceme, sometimes branched or paniculate. *Flowers* often showy, 1–6 cm in diam., perianth parts reflexed or projected forward, resupinate. *Sepals* and *petals* subequal, or the petals wider than the sepals. *Lip* simple, conspicuous, basally adnate to the column, callus absent or consisting of verrucose keels extending beyond the apex of the column. *Column* appressed against the lip or divergent, often winged. *Anther* terminal. *Pollinia* 4, waxy, sometimes united in loose pairs by the caudicles.

A Neotropical genus of about 17 species ranging in the Pacific of Mesoamerica from Mexico (with 15 species) to Western Panama. Two species occur in Costa Rica, with a single species in BHNP.

Barkeria obovata (C. Presl) Christenson, Lindleyana 3(4): 221. 1988 [1989]. Fig. 10A, 15.

Basionym: *Oncidium obovatum* C. Presl., Reliquiae Haenkeanae 99. 1827. TYPE: MEXICO. *Thaddeus Haenke s.n.* (Holotype: PR).

Heterotypic synonyms: *Broughtonia chinensis* Lindl., London J. Bot. 1: 492. 1842. TYPE: Central America. *Richard B. Hinds s.n.* (Holotype: K).

Laeliopsis chinensis (Lindl.) Lindl., Paxton's Fl. Gard. 3: 156. 1853.

Epidendrum nonchinense Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 324. 1862.

Barkeria nonchinensis (Rchb.f.) Schltr., Orchideen: 206. 1915.

Epidendrum chinense (Lindl.) Ames, Schedul. Orchid. 7: 4. 1924.

Barkeria chinensis (Lindl.) Thien ex Dressler, Taxon 15: 241. 1966.

Plants epiphytic, caespitose, up to 25 cm high. *Roots* thick, coarse, up to 3 mm in diam., white with green tips. *Pseudobulbs* ellipsoid to fusiform, leafy, to 2.5–20 × 0.5–2.3 cm, concealed by green leaf sheaths, scarious when deciduous. *Leaves* 7–8, arranged along the stem, distichous, linear-lanceolate to elliptic-lanceolate, acute, conduplicate, subcoriaceous, articulate, deciduous before flowering and during the dry season, 5–14 × 0.7–1.6 cm. *Inflorescence* terminal, racemose simple or paniculate, 2–14 flowers, peduncle 5–35 cm long, elongated, slender, covered by tubular scarious sheaths, raceme 5–12 cm long, with 1–2 branches in large plants. *Floral bracts* subtending the floral branches, triangular, scarious, up to 10 mm long. *Ovary* pedicellate, cylindrical, up to 23 mm long. *Flowers* rather small and showy, spread, often cleistogamous, up to 1.7 cm long, white to yellowish or cream, the lip yellow, white or pink, often with reddish spots. *Dorsal sepal* lanceolate, acute, 9.5–10.0 × 1.5–2.0 mm. *Lateral sepals* ovate to lanceolate, acute, slightly thickened at apex, 9.5–10.0 × 1.5–2.0 mm. *Petals* lanceolate to elliptic, acute, 9–11 × 1.5–2.0 cm. *Lip* rhombic-ovate or elliptic-obovate, shortly acute, the margins involute around the column, disc sulcate, with 3 longitudinal keels, laterally branched, veins warty, verruculose, 9–11 × 6–7 mm. *Column* short, crenate at the apex, 3.0–3.5 mm. *Pollinia* 4, obovate. *Anther cap* cucullate. *Capsule* ellipsoid, about 2 cm long.

Distribution: from southern Mexico to western Panama.

Distribution in the Park: widespread in the Park. Populations were found near the cactus forest, along Ceiba and Mirador trails, and Cerro Corralillo around Las Delicias.

Etymology: from the Latin *obovatus*, "obovate," in allusion to the lip shape.

Habitat and ecology: plants grow on twigs of *Alophyllus* L. sp. (Sapindaceae), *Bursera* Jacq. ex L. spp. (Burseraceae), *Cedrela* L. spp. (Meliaceae), and *Erythroxylum havanense* (Erythroxylaceae) in rocky areas, rarely growing on thick branches or tree trunks.

Phenology: flowering occurs from December to April.

Discussion: it is distinguished by the fusiform pseudobulbs, with elliptic-lanceolate, subcoriaceous, conduplicate leaves arranged along the stem. The leaves are deciduous during the dry season and just before flowering. The terminal inflorescence is racemose or paniculate, bearing whitish-yellowish flowers. The lip is yellow, immaculate, or often with small red spots with a callus formed by several verrucose veins. The flowers are not as showy as other species of *Barkeria*, and they are often cleistogamous.

Additional specimens examined: BHNP, Bosque de Cactus, 10°10'32.1"N, 85°21'13.3"W, 639 m, bosque húmedo premontano transición a basal, epífitas en lomas rocosas, 28 enero 2009, *D. Bogarín 6149 y F. Pupulin* (JBL, CR). BHNP, San Antonio, Parque Nacional Barra Honda, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario, 26 julio 2005, *D. Bogarín 1756 y F. Paniagua* (CR). Guanacaste: Nicoya, San Antonio, Parque Nacional Barra Honda, Cerro Corralillo, Sector Las Delicias, en bosque al final de las plantaciones de frijol, 10°11'11.82"N, 85°21'09.28"W, 481 m, epífitas en bosque húmedo premontano transición a basal, 5 noviembre 2011, *D. Bogarín 9387 & E. Artavia* (JBL).

2. *Beloglottis* Schltr., Beih. Bot. Centralbl., Abt. 2 37(2, Heft 3): 364–365. 1920.

TYPE: *Beloglottis costaricensis* (Rchb.f.) Schltr.

Plants terrestrial, sometimes epiphytic. *Roots* fasciculate, fleshy, puberulent. *Leaves* arranged in a basal rosette, strongly petiolate, lanceolate or elliptic-lanceolate, acute, deciduous in the seasonally dry forest before flowering. *Inflorescence* slender, erect, exceeding the leaves, covered by several tight sheaths, the rachis with loosely or densely, secund or subsecund flowers. *Flowers* inconspicuous, tubular, usually greenish or white. *Sepals* subsimilar, sometimes glandular outside, free or connate. *Petals* linear to linear-spathulate,

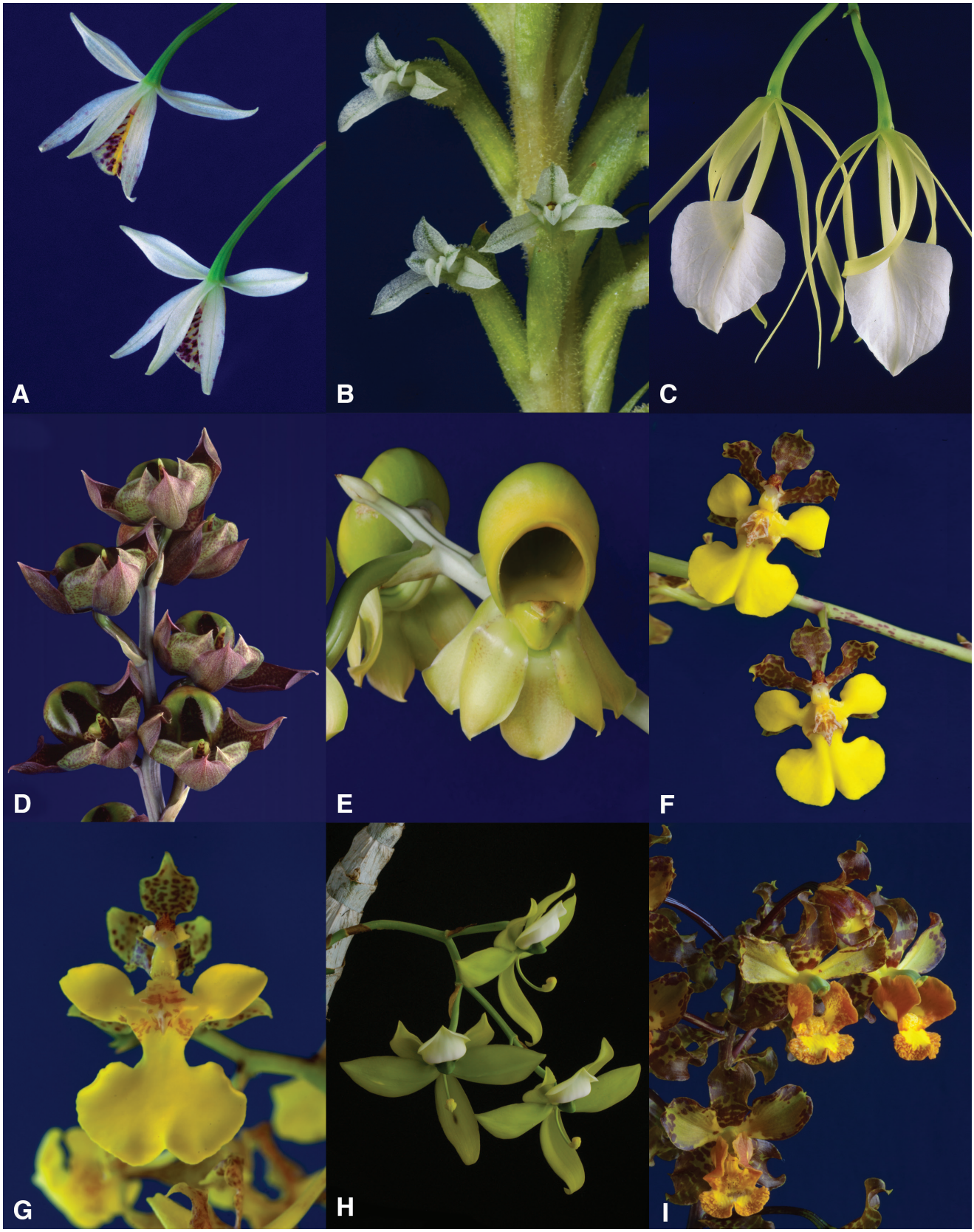

FIGURE 10. **A–I.** Orchid species found at Barra Honda National Park. **A,** *Barkeria obovata* (*Bogarín 6149*, JBL). **B,** *Beloglottis costaricensis* (*Bogarín 9415*, USJ). **C,** *Brassavola nodosa* (*Bogarín 1763*, JBL). **D,** *Catasetum maculatum*, male flowers (*Bogarín 2609*, JBL). **E,** *C. maculatum*, female flowers (*Pupulin 8331*, JBL). **F,** *Cohniella brachyphylla* (*Bogarín 2610*, JBL). **G,** *C. brachyphylla* (*Pupulin 8184*, JBL). **H,** *Cycnoches warszewiczii* (*Pupulin 8895*). **I,** *Cyrtopodium macrobulbon* (*Bogarín 2596*, JBL). Photographs by the authors.

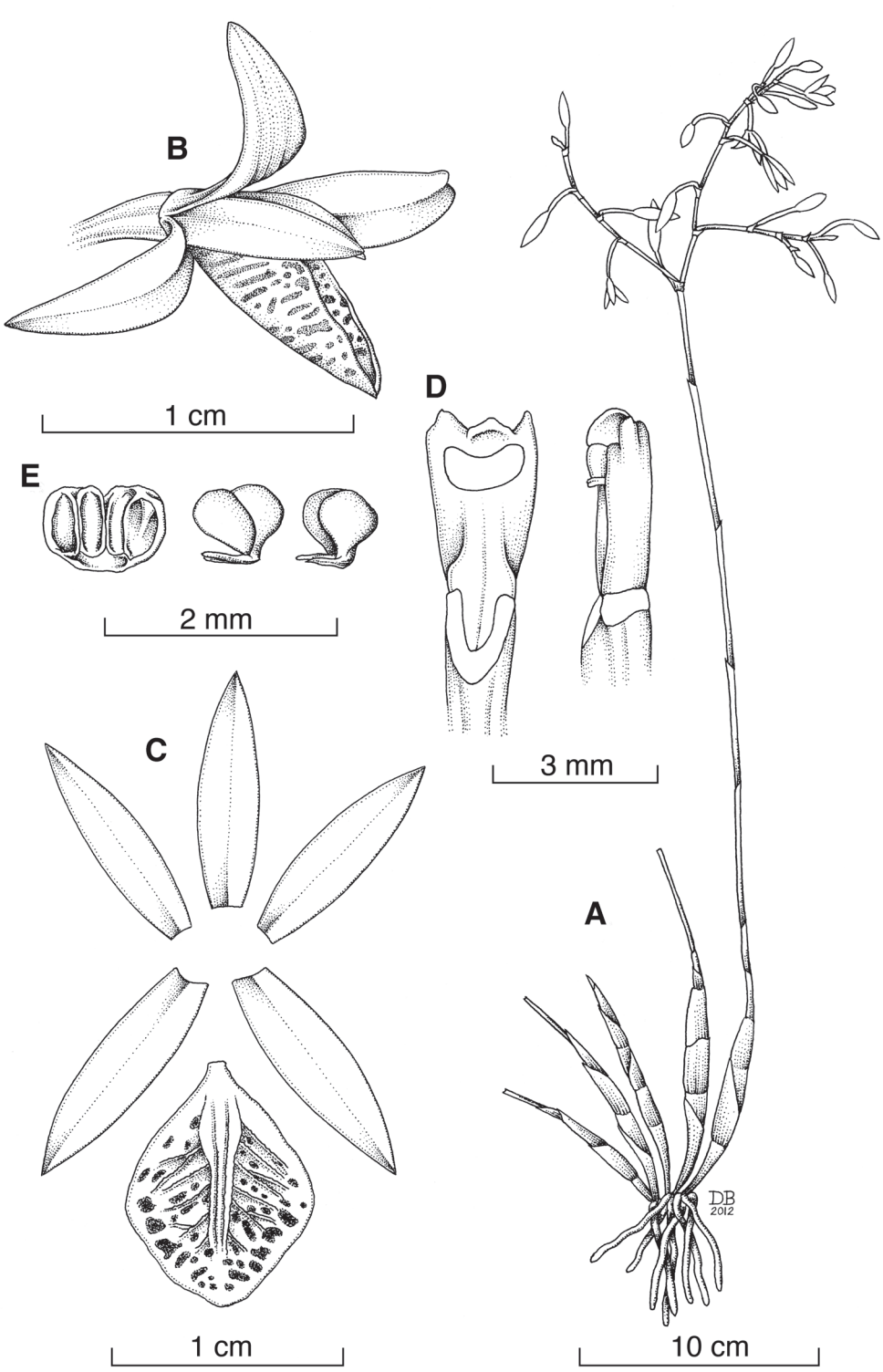

FIGURE 15. *Barkeria obovata* (C.Presl.) Christenson. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column. **E,** Pollinarium and anther cap. Drawn by D. Bogarín from *Bogarín 4041* (JBL).

acute to obtuse. *Lip* clawed, the claw basally connate with the lateral sepals, the lamina constricted near the apex, with basal auricles, the lateral margins agglutinate with the clinandrium. *Column* short, dilated below the stigma and forming a chin structure, footed. *Anther* erect, ovate to oblong-cordate. *Pollinia* 2–4, oblong-ovoid, powdery.

A Neotropical genus of about 10 species ranging from Mexico to Argentina. Four species occur in Costa Rica, with a single species in BHNP.

Beloglottis costaricensis (Rchb.f.) Schltr., Beih. Bot. Centralbl., Abt. 2 37(2, Heft 3): 365. 1920. Fig. 10B, 16, 17.

Basionym: *Spiranthes costaricensis* Rchb.f., Bonplandia 3:214. 1855. TYPE: [COSTA RICA. Alajuela:] Naranjo in Costarica, *A. S. Oersted s.n.* (Holotype: W, Mus. Hafn.).

Homotypic synonyms: *Gyrostachys costaricensis* (Rchb.f.) Kuntze, Rev. Gen. 2:664. 1981.

Plants terrestrial or lithophytic up to 45 cm tall, deciduous when in flower. *Roots* thick, fusiform, puberulent, fasciculate, 5.0–11.3 cm long, 7 mm in diam. *Leaves* 3–6, arranged in a basal rosette, petiolate, 9.5–22.2 × 3.8–6.7, ovate-elliptic to elliptic-lanceolate, acute, petiolate, petiole 2.5–9.0 cm long, the margin wavy. *Inflorescence* terminal, erect, pubescent, 38.5–43.0 cm long, peduncle 20–28 cm long with 6–10 appressed, tubular, ovate, acute bracts 2.8 × 0.6 cm, rachis 13–21 cm, with about 70 helical flowers opening in succession. *Floral bracts*, ovate, acute to acuminate, up to 12 × 3 mm. *Ovary* cylindrical, glandular-pubescent, to 4.3 mm long. *Flowers* inconspicuous, tubular, up to 5 mm long, perianth white with a green stripe in the middle, resupinate. Sepals connate at base, glandular-pubescent adaxially up to the middle, slightly reflexed toward the apex. *Dorsal sepal* oblong, conduplicate, acute, 5.0–6.1 × 1.0–1.6 mm. *Lateral sepals* oblong, conduplicate, acute, 5.8–7.5 × 1.2–1.6 mm. *Petals* narrowly linear-oblong to narrowly spathulate, acute, slightly falcate, 4.5–5.0 × 0.8–1.1 mm. *Lip* clawed, sagittate, with 2 basal filiform, falcate auricles up to 1.2 mm long, the blade oblong, wider near the middle and narrowing toward the acute apex, conduplicate and folded downward apically, glandular-pubescent, 4.6 × 3.5 cm. *Column* oblong, cylindrical, bidentate, rostrate, pubescent abaxially, 2-chambered, 2.0 × 1.1 cm. Anther erect, dorsal. *Anther cap* cucullate, rostrate, with 2 cells. *Pollinia* 2, obovate to elliptic, puberulent.

Distribution: Mexico to Peru and the West Indies.

Distribution in the Park: widespread around Cerro Barra Honda, Cerro Corralillo, Las Cascadas, and Los Mesones.

Etymology: named after Costa Rica, where the type specimen was collected.

Habitat and ecology: plants grow on rocky areas of secondary mature forest and cactus areas. They grow in medium-shaded conditions, terrestrially or in the humus and litter between fissures of rocks. During the dry season, the plants start to bloom while the leaves fall. They grow sympatrically with *Sarcoglottis acaulis* and *S. sceptrodes*.

Phenology: flowering occurs during the dry season from December to March.

Discussion: plants are terrestrial without pseudobulbs, with thickened roots and petiolate leaves with somewhat undulate margins. They are deciduous during the dry season when the plants bloom, developing an elongated scape of several inconspicuous, tubular white flowers. The perianth parts are glandular-pubescent, white with a green stripe along the middle. Within the Park, it can be confused with the other rosulate terrestrial species of the genus *Sarcoglottis*. During the wet season, they bear several leaves arranged in a basal rosette growing in the same habitat (in humus and litter among calcareous or limestone rocks). However, *Beloglottis costaricensis* shows green, petiolate leaves against those of *S. acaulis* and *S. sceptrodes*, which are white spotted. When in bloom, they are easily distinguished, mainly by the shape, size, and color of the flowers (see discussion and description of *Sarcoglottis* spp.).

Additional specimens examined: BHNP, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, terrestres en sitio rocoso con hojarasca, 21 febrero 2006, *D. Bogarín 2591* (JBL-spirit). Same locality, *D. Bogarín 2590* (CR). BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, 22 febrero 2006, *D. Bogarín 2611* (JBL-spirit). Same locality, *D. Bogarín 2612* (CR). BHNP, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestre a orillas del camino, bosque secundario, 7 noviembre 2011, *D. Bogarín 9414 and 9415* (USJ). BHNP, rocky hill in Cactus forest toward La Mantequilla, 10°10'34.48"N, 85°21'19.08"W, 368 m, epiphytic in premontane moist, transition to tropical moist forest, 21 February 2012, *F. Pupulin 8185 & D. Bogarín* (JBL-spirit).

3. *Brassavola* R. Br., Hort. Kew. (ed. 2) 5: 216. 1813.
TYPE: *Brassavola cucullata* (L.) R. Br.

Plants epiphytic or lithophytic, caespitose or shortly creeping, erect or pendent. *Pseudobulbs* short, terete, monophyllous, cylindrical in cross section, covered by tightly fitting, papery sheaths. *Leaves* fleshy, subcylindric or terete, rarely flattened, articulate, conduplicate, channeled on the upper side, erect, stiff, rarely pendent. *Inflorescence* a terminal or lateral 1- to many-flowered raceme shorter than the leaves. *Flowers* generally large and showy, on an elongated peduncle, white, resupinate or pendent, scented during the night. *Sepals* and *petals* subequal, free, narrowly linear or linear-lanceolate, acute. *Lip* unguiculate, trumpet-like, conspicuous, with a tubular claw enfolding the column and a broad acute lamina. Column very short, usually shorter than the claw, footless, winged, straight or recurved, toothed at apex. *Anther* operculate, incumbent. *Pollinia* 8, 4 in each cell of the anther, laterally compressed, hard, waxy.

A Neotropical genus of about 17 species ranging from Mexico to Brazil, northern Argentina, and the West Indies. Two species are found in Costa Rica, 1 species in BHNP.

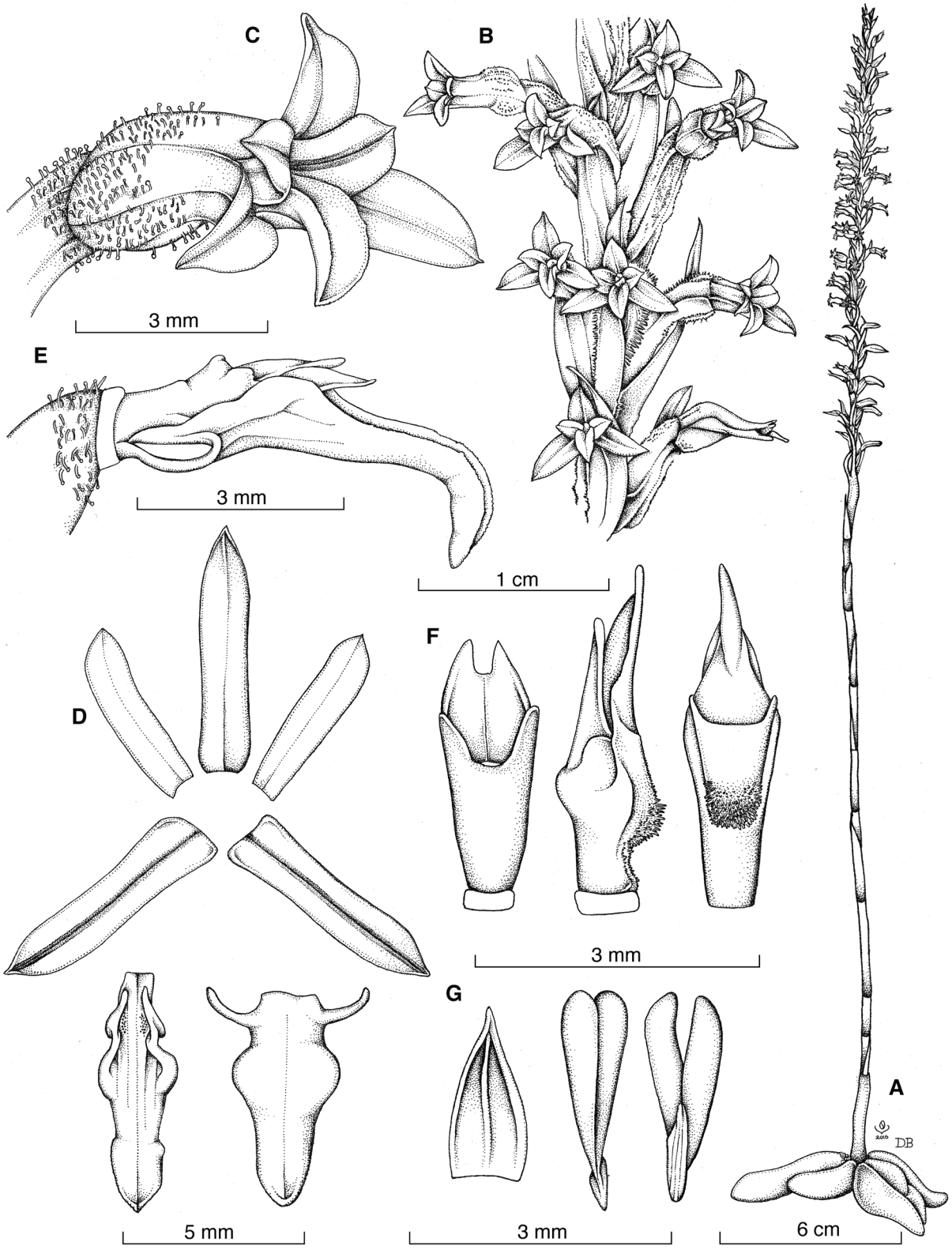

FIGURE 16. *Beloglottis costaricensis* (Rchb.f.) Schltr. **A,** Habit. **B,** Portion of the inflorescence. **C,** Flower. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Column, dorsal, lateral, and ventral view. **G,** Pollinarium and anther cap. Drawn by D. Bogarín & L. Oses from *Bogarín 9415* (JBL).

FIGURE 17. *Beloglottis costaricensis* flowering in situ among arborescent cacti at BHNP. Photograph by F. Pupulin.

Brassavola nodosa (L.) Lindl., Gen. Sp. Orchid. Pl. 114. 1831. Fig. 10C, 18–19.

Basionym: *Epidendrum nodosum* L., Species Plantarum 2: 953. 1753. TYPE: Habitat in America meridionali (Holotype: S).

Homotypic synonyms: *Cymbidium nodosum* (L.) Sw., Nova Acta Regiae Soc. Sci. Upsal. 6: 73. 1799.

Bletia nodosa (L.) Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 437. 1862.

Plants epiphytic or lithophytic, medium sized, up to 50 cm tall, with short, terete rhizome. *Roots* fleshy, with green to brownish vegetative apex, up to 4 mm in diam. *Pseudobulbs* terete to clavate, slender, 2.5–8.5 × 0.4–0.6 cm, covered by 2–3 scarious, tubular sheaths, monophyllous. Leaf linear to linear-elliptic, conduplicate, very fleshy-coriaceous, subcylindrical, rarely flattened, acuminate to slightly mucronate, erect, sulcate on the upper surface, 5–20 × 0.9–1.5 cm. *Inflorescence* terminal, slender, elongated, usually shorter than the leaves, to 15 cm long, 1- to many-flowered (mostly 2- to 3-flowered); peduncle terete; bracts triangular-lanceolate, acute, scarious, 7–10 mm long. *Ovary* pedicellate, slender, smooth, to 4–5 cm long. *Flowers* large and showy, with pale green sepals and petals, and white lip spotted by pale purple on the interior of the tubular claw. Sepals subequal, linear-lanceolate, acute, to 5–9 × 0.3–0.6 cm. *Petals* linear, attenuate above, somewhat falcate, 5.0–8.5 × 0.2–0.5 cm. *Lip* with a tubular-cymbiform claw enfolding the column, abruptly expanding into an ovate-cordate lamina, venose, abruptly apiculate-acuminate at apex and often recurved backward, to 7.8–8.0 × 4.0–4.5 cm at midpoint of the lamina; claw about 3 cm long, 1.2 cm wide, with erose-dentate margins. *Column* short, with a pair of triangular-subfalcate, acute wings, 3-lobed at apex, to 8 mm long. *Pollinia* 8, in 2 subequal groups of 4, on 2 powdery, bilobed caudicles. *Anther cap* hemiglobose, 8-celled. *Capsule* ellipsoidal, conspicuously ridged, up to 5 cm long.

Distribution: from Mexico to Venezuela, Brazil, and the Antilles.

Distribution in the Park: common along the main trails of BHNP, Cerro Barra Honda, Cerro Corralillo, Las Delicias, and the boundaries of the Park with private farms.

Etymology: from the Latin *nodosus*, "knotted" or "knobby."

Habitat and ecology: plants are usually found in exposed to medium-shaded conditions, often forming large specimens on the host tree (Fig. 19). They are found growing on several trees, such as *Lonchocarpus* Kunth sp. (Fabaceae-Papilionaceae), *Pachira fendleri* (Bombacaceae), *Plumeria rubra* (Apocynaceae), and *Tabebuia* spp. (Bignoniaceae). Pollination may be carried out by sphingid moths (Pupulin, 1998).

Phenology: flowering occurs from January to October, but mainly from June to August.

Discussion: it is distinguished by the cylindrical short pseudobulbs bearing 1 semiterete leaf. The terminal inflorescences have 2–3 white, showy flowers that are fragrant in the evenings. The sepals and petals are subequal, linear, and pale green. Variation in the floral fragrances among populations suggests that there could be more than one species under a broad concept of *Brassavola nodosa* (Williams, 1981). However, no morphological differences have been found to allow a proper distinction among the names proposed, such as *B. grandiflora* Lindl. Within the park, *B. nodosa* is vegetatively similar to *Cohniella brachyphylla* because of the terete leaves; however, *C. brachyphylla* has thin roots (< 3 mm in diam.), subglobose pseudobulbs, and a panicle of smaller yellow flowers with brown spots.

Additional specimens examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario, 26 julio 2005, *D. Bogarín 1763 y F. Paniagua* (JBL-spirit). Same locality, *D. Bogarín 1762 and F. Paniagua* (JBL-spirit).

4. *Catasetum* Rich. Ex Kunth, Syn. Pl. 1: 330–331. 1822.
TYPE: *Catasetum macrocarpum* Rich. Ex Kunth.

Plants epiphytic (often on rotten trunks), rarely terrestrial or lithophytic. *Pseudobulbs* slender-ovoid or fusiform with several leaves arranged along the stem, deciduous during the dry season, leaving spines at the apex of the imbricating sheaths when the leaves are dropped. *Leaves* distichous, usually large and plicate, thin, elliptic-lanceolate. *Inflorescence* lateral, arising from the base of the pseudobulb, erect or pendent, few- to many-flowered raceme. *Flowers* usually large and conspicuous, unisexual, dimorphic, nonresupinate. *Sepals* and *petals* subequal, free, fleshy, or membranaceous. *Lip* deeply saccate or rigid to almost flat, sessile, lateral compressed, with entire, dentate, or deeply fimbriate margins. *Column* erect, footless, thickened, elongated with or without a pair of reflexed antennae or tendrils surrounding the stigma and developed at the base in male flowers; shorter and thicker, without antennae in female flowers. *Anther* terminal, operculate, incumbent. *Pollinia* 4, or 2.

A genus of about 130 species extending from Mexico through Central America to Brazil and Argentina. One species in Costa Rica and BHNP.

Catasetum maculatum Kunth, Syn. Pl. 1: 331. 1822. Fig. 10D–E, 20.

TYPE: *Crescit in Regno Novo-Granatensi, prope Turbaco, alt. 180 hex. Floret Majo, A. de Humboldt & A. Bonpland s.n.* (Lectotype designated by Romero and Jenny, 1993).

Heterotypic synonyms: *Catasetum oerstedii* Rchb.f., Bonplandia (Hannover) 3: 218. 1855. TYPE: NICARAGUA. Herr Dr. Oersted sammelte die Art in Nicaragua, *A. Oersted s.n.* (Holotype: W).

Catasetum brenesii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 136, 225 (1923). TYPE: COSTA RICA. Clairiéres des bois aux plaines du Pacifique, pres Guacimal, alt. 100–150 m, *A. M. Brenes no. 294*, VIII. 1922. Fleurs tachetées et lavées de rouge-brun au fond vert (Holotype: B, destroyed; Lectotype designated by Barringer, 1986: NY).

Plants epiphytic, ascending, stout *herb*s with abbreviated rhizome, to 70 cm tall. *Roots* fleshy, glabrous, with many

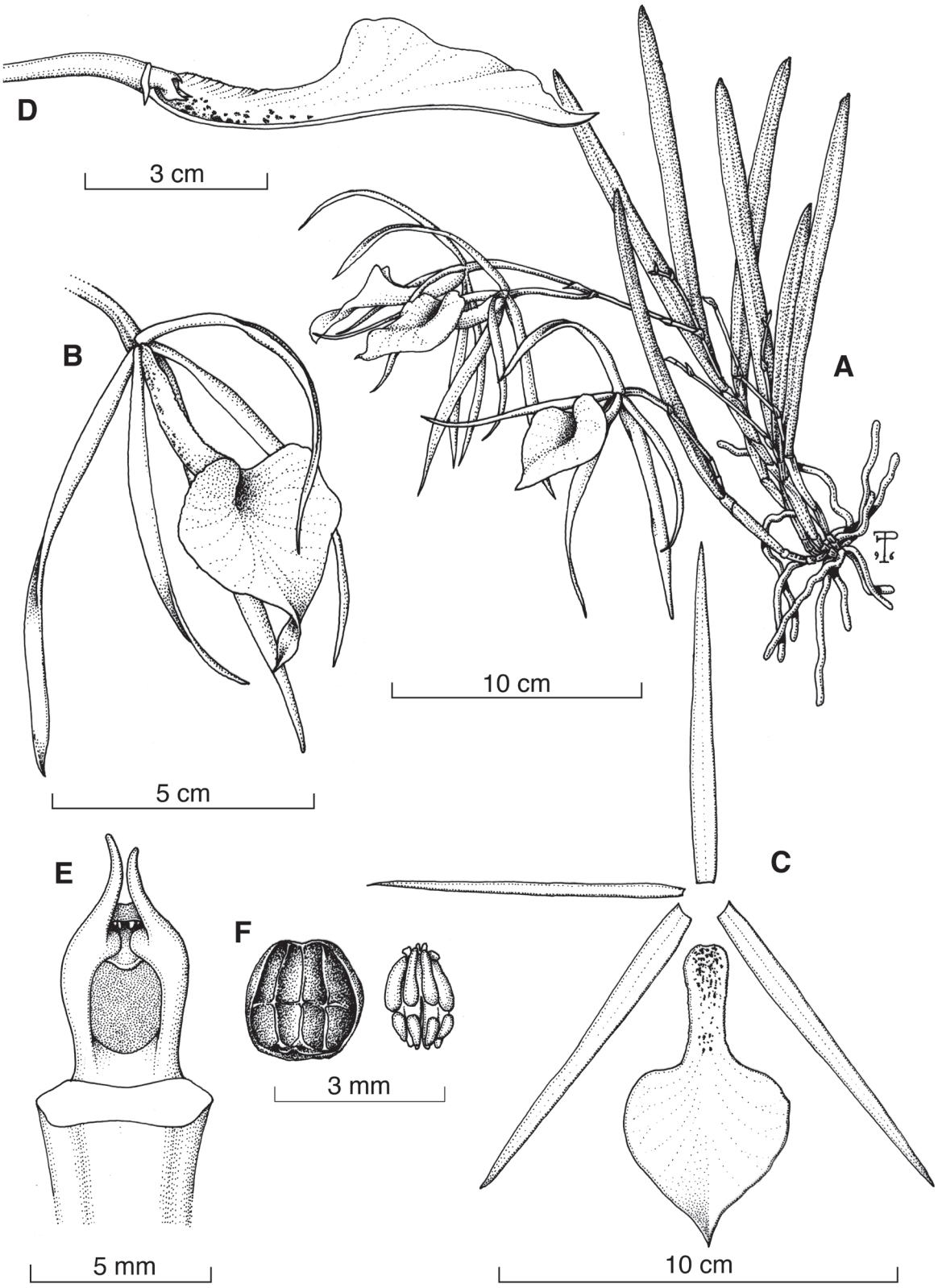

FIGURE 18. *Brassavola nodosa* (L.) Lindl. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 331* (USJ).

FIGURE 19. *Brassavola nodosa* flowering in situ on the trunk of a *Ceiba* sp. at BHNP. Photograph by F. Pupulin.

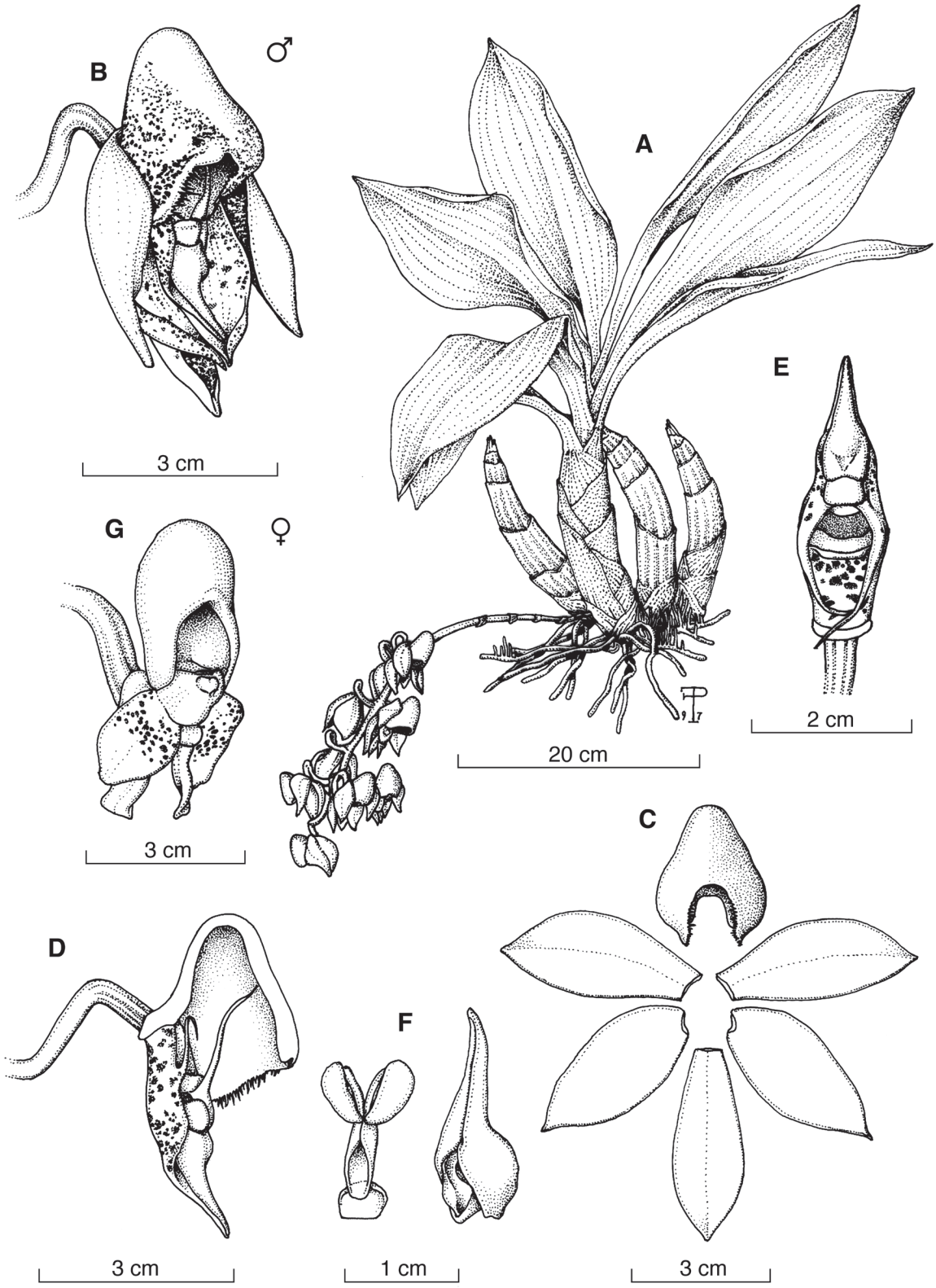

FIGURE 20. *Catasetum maculatum* Kunth. **A,** Habit. **B,** Male flower. **C,** Male column and lip, lateral view (the lip longitudinally sectioned). **D,** Dissected male flower. **E,** Male column, ventral view. **F,** Pollinarium and anther cap. **G,** Female flower. Drawn by F. Pupulin from *Pupulin 323* and *327* (USJ).

slender, erect, secondary rootlets, forming dense mats around the plant base. *Pseudobulbs* subfusiform-conical, to 30 × 5–8 cm, covered by 5–6 scarious, imbricating leaf-sheaths. *Leaves* 6 to 8, distichous, elliptic-lanceolate to oblong-elliptic, acute to acuminate, plicate, strongly nerved, up to 45 × 8–12 cm, the blades deciduous during the dry season, the persistent bracts enveloping the pseudobulbs armed at the apex with sharp spines. *Inflorescence* lateral, basal, erect to arching, racemose, 3- to 14-flowered, up to 40 cm long. Ovaries pedicellate, stout, arcuate, to 3 cm long. *Flowers* relatively large, nonresupinate, unisexual, dimorphic; staminate, and pistillate flowers produced on separate inflorescences. Staminate *flowers* (male), yellowish-green, suffused, and spotted by purple. *Dorsal sepal* membranaceous, oblong-elliptic to lanceolate, acuminate, concave, to 4.2 × 1.6 cm. *Lateral sepals* membranaceous, obliquely lanceolate, acuminate, to 4.4 × 1.9 cm. *Petals* membranaceous, elliptic-lanceolate, acuminate, mucronate at apex, 4.0 × 1.8 cm. *Lip* fleshy, rigid, saccate, obconic, 3.0 × 2.5 cm, margins of the basal portion of the orifice ciliate, the apex of the orifice slightly emarginate. *Column* stout, rostrate, concave, 3.2 × 1.2 cm, with 2 slender, elongate antennae projecting downward, one unciform, the other undulate, extending into the calceolate lip. *Pollinia* 2, obovate, sulcate, on an obtriangular deflexed stipe; viscidium peltate. *Anther cap* cucullate-rostrate, 2-celled. Pistillate *flowers* (female) yellowish-green, spotted by purple at the base of petals. *Sepals* and *petals* reflexed, fleshy. *Sepals* subequal, broadly ligulate, apiculate at apex, to 2.8 × 2.0 cm. *Petals* elliptic-lanceolate, acute, to 2.5 × 1.9 cm. *Lip* fleshy, rigid, saccate, 3.1 cm long, about 2 cm wide, margins of the orifice smooth. *Column* fleshy, very stout, to 1.4 × 1.2 cm, with a short apicule on upper apex.

Distribution: from Mexico to Colombia, Ecuador, and Venezuela.

Distribution in the Park: widespread in open areas and along Sendero Ceiba and Mirador. Large populations were observed at Las Delicias in exposed dead rotten trunks.

Etymology: from the Latin *maculatus*, "spotted" or "speckled," referring to the red-brown spots on the flower.

Habitat and ecology: common in humid coastal lowlands often below 500 m in both Caribbean and Pacific lowlands. They grow mostly on rotten branches or main trunks of *Guazuma ulmifolia* (Sterculiaceae), *Spondias mombin*, *Tabebuia* sp. (Bignoniaceae), and, most frequently, on *Acrocomia aculeata* (Arecaeae), "palma coyol," in disturbed areas fully exposed to sunlight. Flowers are pollinated by the bee *Eulaema cingulata* (Allen, 1952).

Phenology: flowering mainly occurs from July to September. *Catasetum maculatum* shows unisexual flowers and environmental sex determination, in which plants can produce staminate or pistillate flowers under specific ecological conditions (Pérez-Escobar et al., 2016). We observed staminate flowers more often than pistillate flowers.

Discussion: *Catasetum maculatum* is distinguished by the epiphytic plants, with elongated pseudobulbs with distichously arranged plicate leaves. The leaves are deciduous, leaving spiny sheaths during the dry season. The flowers are produced from a basal racemose inflorescence of few unisexual flowers, with a saccate lip. The staminate flowers are greenish with red spots, and the column has 2 antennas projected into the lip. The pistillate flowers are yellow with red dots. Large specimens show dense mats of rootlets around the plant base. In the BHNP, it is vegetatively similar to *Cyrtopodium macrobulbon* because both species have long plicate leaves grouped along the pseudobulbs, becoming spiny when they fall. However, *C. macrobulbon* is mostly terrestrial or lithophytic, with a paniculate inflorescence bearing prominent bracts and several hermaphrodite yellow-brown spotted flowers, without a saccate lip.

Additional specimens examined: BHNP, camino del Sendero Ceiba hacia la Caverna Terciopelo, 10°10'N, 85°21'W, 420 m, epífita en Jobo, *Spondias mombin,* bosque húmedo premontano transición a basal, 21 febrero 2006, *D. Bogarín 2609* (JBL-spirit).

5. *Cohniella* Pfitzer, Nat. Pflanzenfam 2(6): 194. 1889.
TYPE: *Cohniella quekettioides* (Rchb. f.) Pfitzer

Plants epiphytic or lithophytic caespitose herbs. *Pseudobulbs* short, subglobose, 1-leaved. *Leaf* terete, fleshy, sulcate, often spotted with red or purple, erect or pendent. *Inflorescences* lateral from the base of the pseudobulbs, paniculate or racemose. *Flowers* showy, resupinate, spreading, yellow with red or maroon spots or blotches. *Sepals* and *petals* subsimilar, clawed, often spotted with red-brown. *Lip* conspicuously 3-lobed, yellow, rarely white, the midlobe larger than the laterals with the callus made up of small teeth and spotted with red or maroon. *Column* short, cylindrical, the stigmatic surface suborbicular, usually with small horns or wings on each side and a tabula infrastigmatica. *Anther* terminal, operculate. *Pollinarium* 2, yellow, obpyriform, with stipe and viscidium.

A Neotropical genus of about 30 species distributed from northern Mexico to Brazil and northern Argentina. Two species in Costa Rica and one in BHNP.

Cohniella brachyphylla (Lindl.) Cetzal-Ix & Carnevali, Brittonia 62(2): 163. 2010. Fig. 10F–G, 21.
Basionym: *Oncidium brachyphyllum* Lindl., Edwards's Bot. Reg. 28: sub t. 4. 1842. TYPE: This is a Mexican species, with very short stiff leaves, and smaller panicles, not above 18 inches high (Holotype: K).

Plants epiphytic, cespitose, erect, rarely pendent *herb*s up to 50 cm long, with short rhizome. *Roots* up to 1.5 mm in diam., white with reddish tips. *Pseudobulbs* oblate to globose to broadly ovoid, short, 0.7–2.0 × 0.7–1.1 cm, unifoliate, enclosed by imbricate sheaths 3.2–10.0 × 1.0–2.1 cm. *Leaves* terete, subcylindrical, fleshy-coriaceous, 5–50 × 0.5–2.0 cm, dark green, purple-spotted, sulcate dorsally, gradually attenuated apically. *Inflorescence* basal, lateral, racemose or paniculate, green and purple spotted, up to 40 cm long with 1–8 branches, the branches 3- to 7-flowered, erect to arched, peduncle bracts 10–20 × 4–10 mm, oblanceolate, acuminate, tubular; bracts subtending the lateral branches 4–12 × 1.5–3.5 mm, elliptic, acuminate; floral bracts 1.5–7.0 × 1.0–1.5 mm, narrowly elliptic,

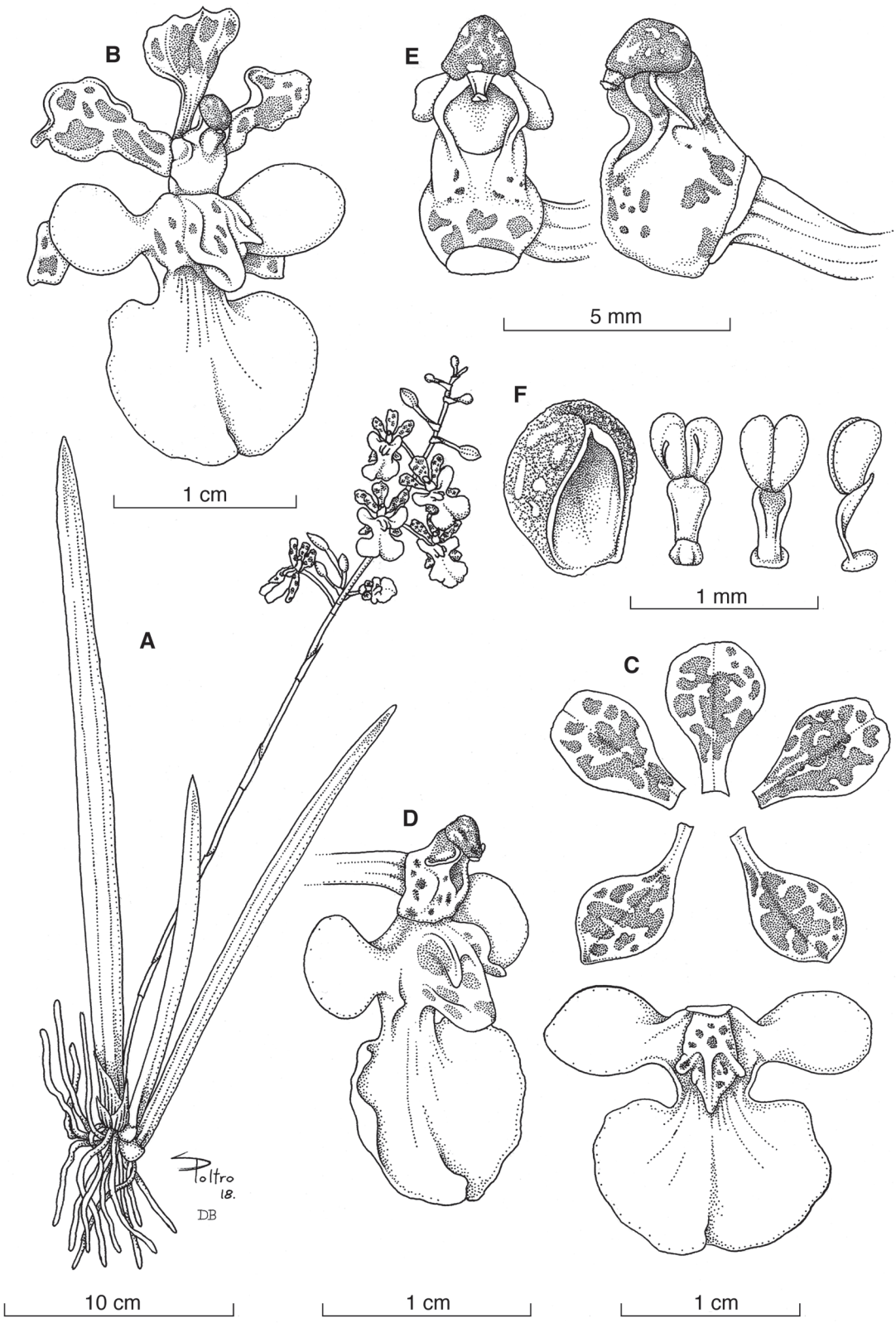

FIGURE 21. *Cohniella brachyphylla* (Lindl.) Cetzal & Carnevali. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by D. Bogarín and S. Poltronieri from *Bogarín 2610* (JBL).

acuminate. *Ovary* pedicellate, cylindric, 2 mm long. *Flowers* showy, resupinate, medium-sized for the genus, spread, the lip yellow, the callus white stained with reddish-brown, sepals and petals greenish-yellow with brown spots. *Dorsal sepal* unguiculate, spathulate, suborbicular to ovate, obtuse, shortly apiculate, apically concave, 8–9 × 5.5–6.0 mm. *Lateral sepals* subsimilar to the dorsal sepal, unguiculate, subfalcate, ovate, acute, apically concave, 9.5–10.0 × 4.5–5.0 mm. *Petals* slightly unguiculate, oblong to oblanceolate, subtruncate, sometimes reflexed, with undulate margins, 8–9 × 4.5–5.0 mm. *Lip* deeply 3-lobed, 1.5 cm long from the base to the apex, 1.9 cm wide across the lateral lobes, the lateral lobes perpendicular to the disc, slightly unguiculate, suborbicular, ovate or obovate, obtuse, the midlobe transversely oblong to reniform, retuse or deeply emarginate, appearing bilobate, slightly undulate, 0.9–1.0 × 1.3–1.6 cm, the isthmus 2.0–3.0 × 4.5–5.0 mm, the disc 4.5–5.0 × 4–5 mm with a callus formed by a central rounded keel and 2 smaller divergent lateral teeth. *Column* short, up to 5.5 mm long, basally thick, with 2 short stigmatic wings, the tabula infrastigmatica sulcate. Pollinarium with 2 obpyriform, cleft pollinia in a narrow spathulate stipe with viscidium. *Anther cap* cucullate, operculate, papillose, ellipsoid, spotted with purple.

Distribution: it ranges from Mexico to Costa Rica.

Distribution in the Park: this species was observed growing on several phorophytes but mainly on *Plumeria rubra* and *Tabebuia rosea* in the forest mixed with cacti at Cerros Barra Honda and on insolated trees in disturbed areas surrounding the park.

Etymology: from the Greek *brachys*, "short," and *phyllo*, "leaf," referring to the very short, stiff leaves and smaller panicles, not above 18 inches high.

Habitat and ecology: plants are found in the lowland tropical dry forest of Península de Nicoya and the drier areas of the Valle Central up to 900 m of elevation. It is the species of *Cohniella* from the driest environments, often found growing under fully exposed conditions (Carnevali et al., 2010).

Phenology: plants were recorded in flower from November to May.

Discussion: it is characterized by the subglobose pseudobulbs bearing one fleshy, succulent, dorsally grooved, cylindrical leaf. The inflorescence is lateral, paniculate with several yellow flowers spotted with brown. *Cohniella ascendens* is similar but differs in the inflorescences usually shorter than the subtending leaves and the erect lateral lobes of the lip that are partially enfolding the column (Carnevali et al., 2010). Within BHNP, it is similar in habit to *Brassavola nodosa*, though the latter has terminal inflorescences, elongated, cylindrical pseudobulbs, and night-scented white flowers. The species is found mostly in tropical rain forest, in warm, humid areas, whereas *C. brachyphylla* is found in the seasonal dry forest. Nevertheless, the variation in flower morphology, both among and within populations of *Cohniella* at BHNP (Fig. 7F–G), is so pronounced as to challenge any attempt at a firm application of the names previously proposed for this group of plants. Here, we tentatively accept *C. brachyphylla* (Carnevali et al., 2010) for the specimens previously treated as *C. cebolleta* (Dressler, 2003).

Additional specimens examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, epífitas en *Plumeria rubra* (Apocynaceae), 22 febrero 2006, *D. Bogarín 2618* (JBL-spirit). Same locality, *D. Bogarín 2610* (JBL-spirit).

6. *Cycnoches* Lindl., Gen. Sp. Orchid. Pl. 154. 1832.
TYPE: *Cycnoches loddigesii* Lindl.

Plants epiphytic (often on rotten trunks). *Pseudobulbs* slender-ovoid or fusiform with several leaves arranged along the stem, deciduous during the dry season. *Leaves* distichous, usually large and plicate, thin, elliptic-lanceolate. *Inflorescence* lateral, arising above the middle or from near the apex of the pseudobulb, pendent, few- to many-flowered raceme. *Flowers* usually large and conspicuous, unisexual, rarely bisexual, dimorphic, nonresupinate. *Sepals* and *petals* subequal, free, fleshy, or membranaceous. *Lip* convex to almost flat, entire with a prominent callus at the base. *Column* deeply arcuate, footless, thin, elongated. *Anther* terminal, operculate, incumbent. *Pollinia* 2 with stipe and viscidium.

A genus of about 30 species extending from Mexico through Central America to Brazil. Two or three species in Costa Rica and one found in BHNP.

Cycnoches warszewiczii Rchb.f., Bot. Zeit. (Berlin) 10: 734. 1882. Fig. 10H, 22–23.

Basionym: *Cycnoches ventricosum* var. *warszewiczii* (Rchb.f.) P.H.Allen, Orchid J. 1: 401. 1952. TYPE: [PANAMA]: Chiriqui, *J. Warszewicz s.n.* (Holotype: W).

Heterotypic synonym: *Cycnoches tonduzii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 298. 1923. TYPE: COSTA RICA: San Ramon, im Mai 1913, *A. Tonduz s.n.* (Holotype: B, destroyed; Neotype, selected by Pupulin et al., 2016, copy of the original drawing of the type made in 1934 by Mansfeld: AMES).

Plants epiphytic, cespitose, tall *herb*s up to 70 cm tall. *Rhizome* stout, with very short internodes. *Roots* thick, numerous, flexuous, to about 3 mm in diam. *Pseudobulbs* homoblastic, cylindrical, tapering at apex, made up of 7–19 internodes, 15–45 cm long, 2.5–5.0 cm wide, leafy at maturity, then deciduous, covered by distichous, thin, tightly adpressed, persistent, papery, fibrous, broadly triangular leaf sheaths, becoming dry, papyraceous, white with age, the apex of the sheaths unarmed. *Leaves* distichous, plicate, lanceolate-elliptic, acute to subacuminate, narrowed at the base into a short, conduplicate petiole, 15–50 × 3–10 cm, ultimately deciduous. *Inflorescence* lateral, produced from the middle to upper portion of the pseudobulb (after the leaves have fallen at BHNP), a stout, arching-pendent raceme, few-flowered (2–4 flowers) raceme to about 20 cm long; the peduncle terete, to 10 cm long, with 3–5 adpressed, triangular-lanceolate, acute, papyraceous, adpressed brown bracts to 15 mm long. *Floral bracts* narrowly triangular-

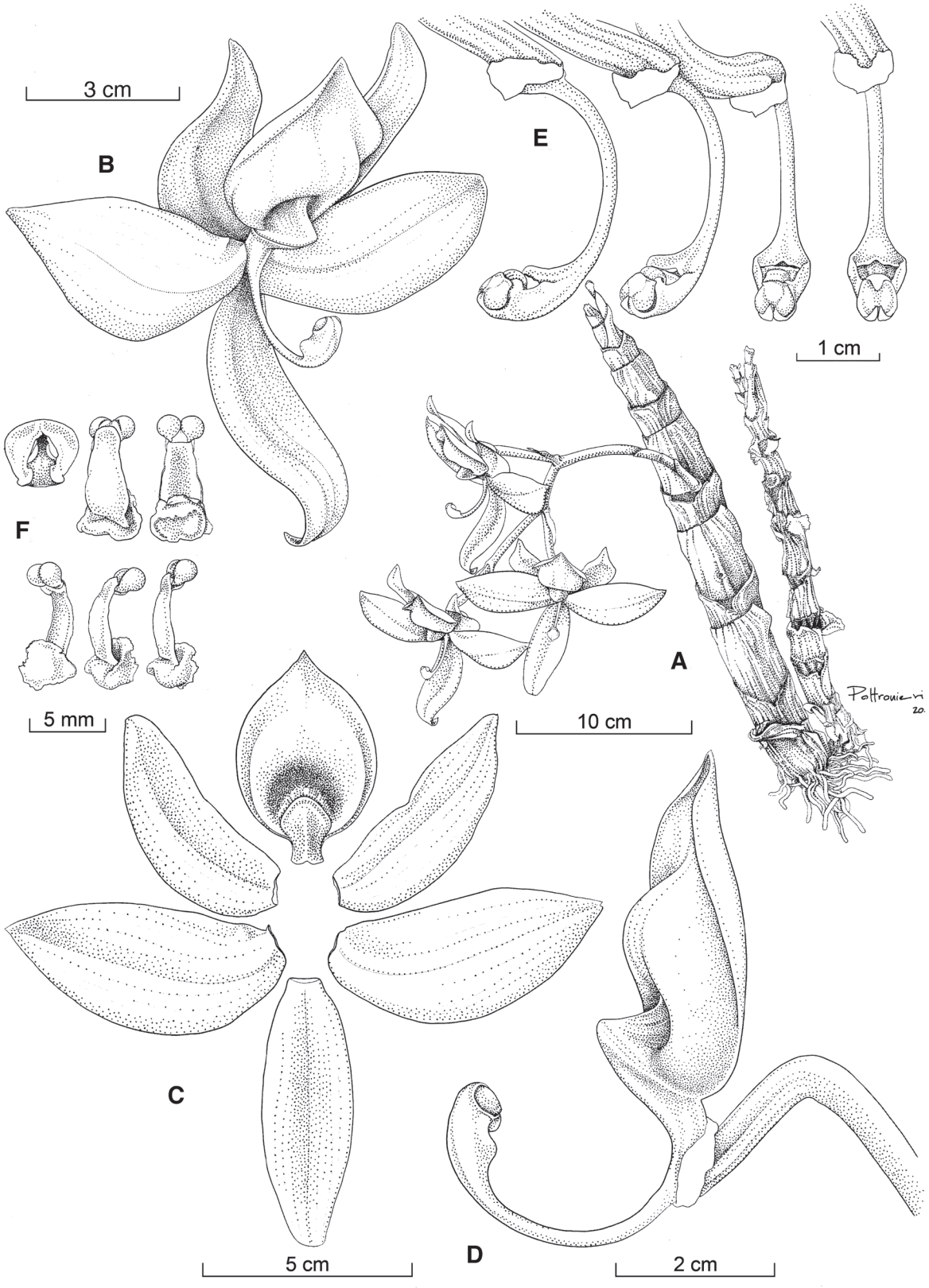

FIGURE 22. *Cycnoches warszewiczii* Rchb.f. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, lateral, three-quarter, and ventral views. **F,** Anther cap and pollinarium, several views. Drawn by S. Poltronieri from *Pupulin 8895* (JBL).

FIGURE 23. *Cycnoches warszewiczii* flowering in situ at BHNP. Photograph by O. Cubero.

lanceolate, acute, scarious, brown, to 25 × 8 mm. Pedicellate *ovary* cylindric, round in section, to 6 cm long including the pedicel. *Flowers* quite variable in size, but usually large, nonresupinate, fleshy, unisexual, staminate and pistillate flowers produced on separate inflorescences, the male and female flowers similar except for the column (see below), the sepals and petals spreading, yellowish-green, the lip white with an emerald green callus, the column pale green, flushing yellow at apex. Dorsal sepal erect, lanceolate to elliptic-lanceolate, acute, concave, the apex gently recurved, 4–7 × 1–2 cm. *Lateral sepals* lanceolate, subfalcate, acute, recurved at apex, 4–6 × 1.3–2.5 cm. *Petals* elliptic-lanceolate, asymmetric-subfalcate, acute, 4.5–7.0 × 1.9–3.7 cm. *Lip* shortly clawed, ovate-elliptic, very fleshy, obtuse, abruptly acute, strongly convex-ventricose, the margins and the apex gently reflexed, 3.5–4.0 × 2.5–3.5 cm; basal callus triangular, acute, fleshy, elevated, projecting, surrounded by a semicircular, lunate, dark depression. *Column* of *staminate flowers* very slender, arcuate, 2.5–3.5 cm long, abruptly dilated at the apex into a subtrigonous, shortly winged, thick clinandrium; in *pistillate flowers*, the column terete, stout, arcuate, 2.0–2.5 cm long, ca. 5 mm thick, provided with auricular, fleshy wings around the stigmatic cavity. *Anther cap* deeply cucullate, flattened, obovate, rounded, 2-celled. *Pollinia* 2, waxy, pyriform, on a ligulate, thick, apically bilobed, green stipe and a massive, transversely elliptic to transversely ovate, brown viscidium.

Distribution: along the Pacific coast from northern Costa Rica to western Panama.

Distribution in the Park: rare, seen only along the calcareous rocky areas mixed with cacti and other scattered trees in Cerro Barra Honda.

Eponymy: named after Józef Warszewicz Ritter von Rawicz, a Polish botanist who collected the type specimen.

Habitat and ecology: rather common in humid coastal lowlands often below 1000 m along the Pacific coast. It grows mostly in exposed full sunlight, usually on dead, rotten branches or main trunks.

Phenology: flowering occurs from January to July.

Discussion: the long, almost cylindrical pseudobulbs with distichous, plicate leaves easily distinguish this species; during the dry season and at flowering, the leaves are deciduous, but the remaining sheaths are unarmed. The inflorescences produced from a node on the central or the upper parts of the pseudobulb are also unmistakable in BHNP. Staminate (more common) and pistillate flowers are similar but essentially distinguished by the morphology of the column, which is longer and filiform in male flowers,

and shorter and thicker in female flowers. The other species with similar (but larger) pseudobulbs at BHNP with which *C. warszewiczii* could be confused when not in flower is *Cyrtopodium macrobulbon*, but the latter is a mostly terrestrial or lithophytic plant, and its pseudobulbs are distinctly spiny after shredding the leaves.

Additional specimen examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, terrestres en sitio rocoso con hojarasca, 3 enero 2016, *O. Cubero s.n.* (digital voucher, JBL).

7. *Cyrtopodium* R.Br., Hort. Kew. (ed. 2) 5: 216. 1813.
TYPE: *Cyrtopodium andersonii* (Lamb. ex Andrews) R. Br.

Plants large, terrestrial or lithophytic, rarely epiphytic, caespitose. *Stems* ovoid, fusiform, or ellipsoid pseudobulbs bearing several leaves. *Leaves* distichous, linear-lanceolate or elliptic-linear, plicate, arranged along the stem, deciduous during the dry season leaving spines at the apex of the imbricating sheaths when the leaves are dropped. *Inflorescence* a large spreading panicle of numerous flowers and bracts developed at the base of the pseudobulb. *Flowers* medium-sized, often showy, with free, spreading parts. *Sepals* and *petals* subequal, the lateral ones slightly oblique and adnate to the column foot, the petals shorter and wider than the sepals, with the margins undulate. *Lip* attached to the column foot, 3-lobed, the lateral lobes incurved over the column, with verrucose margins, the callus warty or tuberculate toward the middle or near the margin. *Column* stout, elongate, semiterete, footed. *Anther* terminal, operculate, incumbent. *Pollinia* 2 or 4, waxy.

A Neotropical genus of about 44 species ranging from Florida (USA), Mexico, and Central America through northern Argentina and the Antilles. One species in Costa Rica and BHNP.

Cyrtopodium macrobulbon (La Llave & Lex.) G.A. Romero-González & Carnevali, Harvard Pap. Bot. 4(1): 331, f. 2–4. 1999. Fig. 10I, 24.
Basionym: *Epidendrum macrobulbon* La Llave & Lex., Nov. Veg. Descr. Orchid. Opusc.: 42. 1825. TYPE: MEXICO. *Habitat supra arbores, prope Turicato in regione calida provinciae Michuacanensis*, *J. J. M. de Lexarza s.n.* (Holotype: not located, presumably lost; Neotype designated by Romero-González and Carnevali Fernández-Concha, 1999: Mexico. Michoacán: Coalcomán, Aguililla, 800 m, *G. B. Hinton 15928*, AMES).

Plants terrestrial or lithophytic, robust, caespitose, up to 1.2 m tall. *Roots* thick, 4–5 mm in diam., white with yellowish-green tips. *Pseudobulbs* fusiform, elongated, rostrate, bearing several leaves during wet season, the old pseudobulbs wrinkled, enclosed by the spiniferous leaf sheaths or naked, 13–55 × 2.2–5.5 cm. *Leaf sheaths* distichously imbricated, papyraceous with age, tightly adpressed to the pseudobulbs, spiniferous, grayish-white when the leaves fall, spines stout, sharp to 3 cm long. *Leaves* several (up to 25), distichously arranged along the pseudobulbs, plicate, with 3 main veins, narrowly elliptic-lanceolate to linear-lanceolate, recurved, acute to acuminate, thin, chartaceous, the blades articulated with the leaf sheaths and deciduous during the dry season and when in bloom, 37–64 × 3.9–8.2 cm. *Inflorescence* lateral, stout, a panicule of several flowers developed from the base of the pseudobulbs, to 90 cm tall; peduncle to 50 cm long erect, basally fusiform, bearing foliaceous, green, ovate-oblong bracts, 4.5 × 4.2 cm; the bracts subtending the branches and flowers ovate-oblong or oblong-lanceolate, undulate, purple-spotted, resembling the sepals in coloration and markings, 5.4–2.1 × 1.3–4.0 cm. *Ovary* pedicellate, arcuate, to 2.3 cm long, including the pedicel. *Flowers* resupinate, showy, yellow, irregularly stained with red-brown, the lip bright yellow with orange margins and spots at the center, the column basally yellow, apically green. *Dorsal sepal* ovate to elliptic, obtuse, truncate, slightly undulate, convex, 1.7 × 1.1 cm. *Lateral sepals* subsimilar to the dorsal sepal, ovate to elliptic, obtuse, slightly reflexed, 1.5 × 1.1 cm. *Petals* obovate to spathulate, obtuse, 1.5 × 1.0 cm. *Lip* basally adnate to the column, deeply 3-lobed, the lateral lobes wider than the midlobe, rounded, reniform, folded, erect and flanking the column in natural position, 0.9 × 2.4 across the lateral lobes, 1.2 from the base to the apex, the midlobe reniform, 0.5 × 1.2 cm, basally verrucose, the margin erose tuberculate, crispate, the disc with a median fleshy oblong, tuberculate callus, running up to the base of the midlobe. *Column* clavellate, arcuate, footed, apically subauriculate, the anther apical, the stigma ventral, 1.2 × 0.4 cm. *Pollinarium* with 2 pollinia, obovate, slightly sulcate, in a triangular stipe. *Anther cap* cucullate, 2-celled.

Distribution: from Mexico (Sinaloa to Yucatán) to Panama and possibly Venezuela.

Distribution in the Park: it is commonly observed in calcareous rocky areas mixed with cacti and other scattered trees in Cerro Barra Honda, Los Mesones, Bosque de Piedra, and Las Delicias.

Etymology: from the Greek *makros,* "long," and *bulbos*, "bulb or fleshy tuber," in reference to the long pseudobulbs.

Habitat and ecology: terrestrial or lithophytic in rocky or sandy soils in tropical dry to seasonal forest up to 800 m. Plants are deciduous and spiniferous when in bloom and during the dry season. They are pollinated by *Centris* bees (Romero-González and Carnevali Fernández-Concha, 1999).

Phenology: plants become deciduous and develop inflorescences in late November and flower from March to May.

Discussion: it is easily recognized by the terrestrial or lithophytic stout plants, the long pseudobulbs with several plicate leaves arranged along the stem and deciduous during the dry season. The inflorescences are basal, paniculate, several to many yellow-brown spotted, hermaphrodite flowers. In habit, they could be confused with *Cyrtopodium maculatum* because of the fusiform pseudobulbs bearing several plicate leaves; however, the latter is mostly epiphytic and somewhat smaller, having racemose inflorescences of few unisexual flowers with saccate lip. Romero-González and Carnevali Fernández-Concha (1999) treated *C. macrobulbon* as a distinct entity ranging from Mexico to Panama, stating that *C. paniculatum* (Ruiz & Pav.) Garay

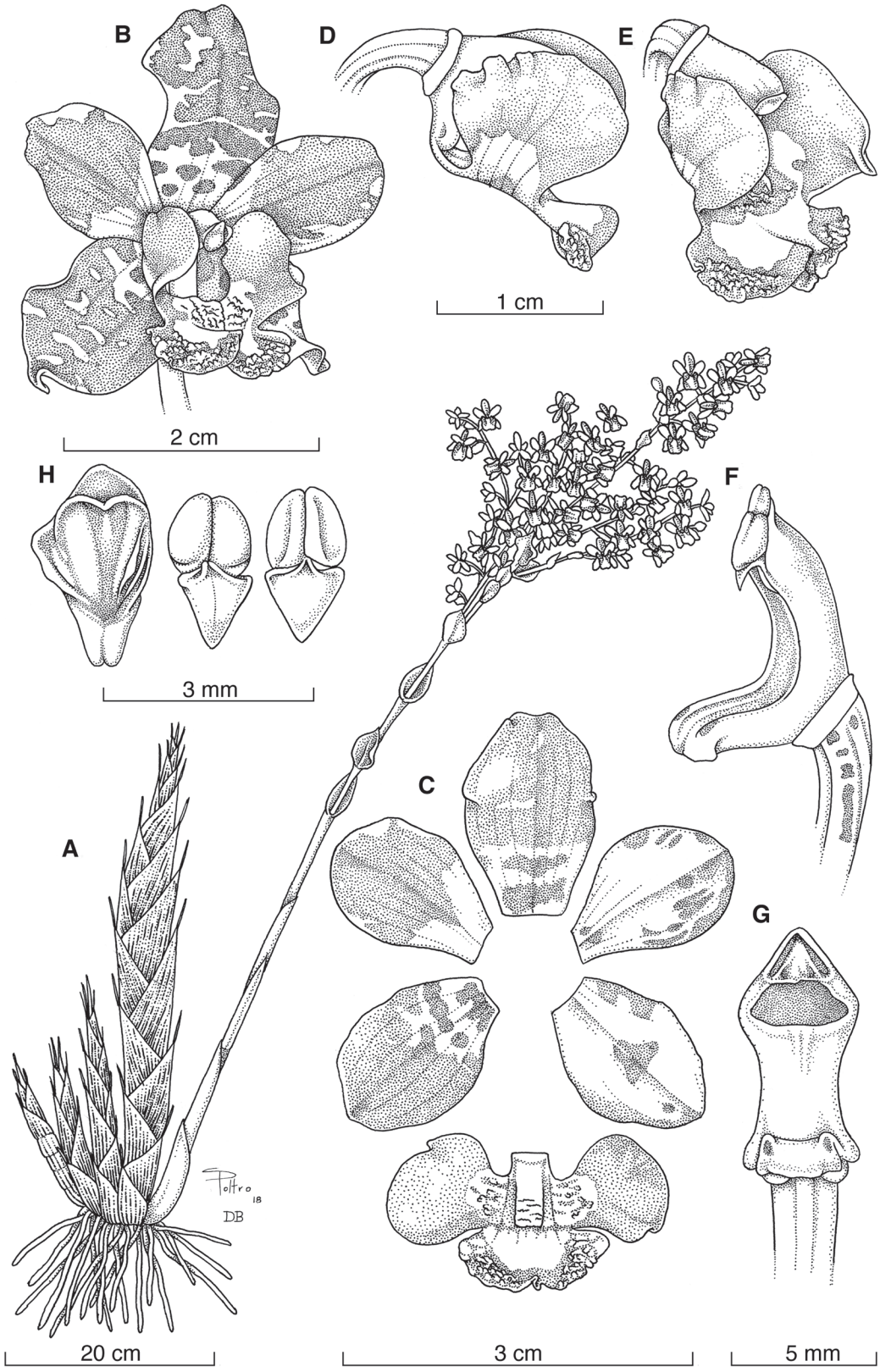

FIGURE 24. *Cyrtopodium macrobulbon* (La Llave & Lex.) G.A. Romero-González & Carnevali. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column and lip, three-quarter view. **F,** Column, lateral view. **G,** Column, ventral view. **H,** Anther cap and pollinarium, two views. Drawn by D. Bogarín from *Bogarín 2596* (JBL).

from Venezuela to Peru, and *C. punctatum* (L.) Lindl. from Florida, the Antilles, and the northwestern Caribbean coast of South America, do not occur in Costa Rica.

Additional specimens examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, terrestres en sitio rocoso con hojarasca, 21 febrero 2006, *D. Bogarín 2596* (JBL-spirit).

8. *Dichaea* Lindl., Gen. Sp. Orchid. Pl. 208. 1833.
TYPE: *Dichaea echinocarpa* (Sw.) Lindl., *nom. illeg.* = *Dichaea pendula* (Aubl.) Cogn.

Plants epiphytic monopodial caespitose, or scandent, pendent or rarely erect, with foliaceous stem, lacking pseudobulbs. *Roots* terete, filiform to fleshy. *Stems* 1 to several, elongate, erect to arching or laxly pendent, terete or dorsiventrally flattened, often freely branching, entirely enclosed by persistent imbricating leaf sheaths. *Leaves* conduplicate, articulate or not, membranaceous or coriaceous. *Inflorescence* lateral from the axils of the leaves, 1-flowered on a short peduncle. *Flowers* small or medium-sized, resupinate, ringent to spreading, the sepals and petals ivory-white to greenish white or orange-grey, the sepals mostly flecked with purple-violet toward the base. *Sepals* and *petals* subequal, free or the laterals sepals slightly connate, spreading; lip clawed, 3-lobed or rarely entire. *Column* short, erect, with a short foot, provided with an infrastigmatic ligule. *Pollinia* 4, in 2 subequal pairs, on a laminar, apically expanding stipe, continuous with the elliptic, sulcate, hyaline viscidium.

A Neotropical genus of about 60 species ranging from Mexico to Brazil and the Antilles. About 30 species in Costa Rica and 1 at BHNP.

***Dichaea panamensis* Lindl.**, Gen. Sp. Orchid. Pl. 209. 1833.
TYPE: Hab. in Panama, et Columbia occidentali, [Taboga Island], 1831, *H. Cuming 1292* (Holotype: K). Fig. 11A, 25.
Homotypic synonyms: *Dichaeopsis panamensis* (Lindl.) Schltr., Beih. Bot. Centralbl., Abt. 2 36(2): 519. 1918. *Epithecia panamensis* (Lindl.) Schltr., Orchis 9: 25. 1915.
Heterotypic synonyms: *Dichaea brachypoda* Rchb. f., Beitr. Orch. Centr.-Amer. 78: 1866. TYPE: COSTA RICA. San Miguel in Costa Rica, 14 May 1857, *H. A. Wendland s.n.* (Holotype: W).
Dichaeopsis brachypoda (Rchb. f.) Schltr., Beih. Bot. Centralbl. 36(2): 519. 1918.
Epithecia brachypoda (Rchb. f.) Schltr., Orchis 9: 25. 1915.

Plants epiphytic, caespitose, to 20 cm long. *Roots* basal, glabrous, flexuous, very thick, wider than the stem, about 2 mm in diam. *Stems* flattened, suberect to spreading or pendent, simple, rarely producing new plantlets with roots at the nodes, 6–21 cm long, 0.15 cm wide across conduplicate sheaths. *Leaves* widely spaced along stem, oblique to spreading, medium to dark green, frequently glaucous on one or both surfaces, subcoriaceous, narrowly linear-elliptic to lanceolate, acute, apiculate, 12–20 × 3–4 mm, usually varying in length along the stem, the blade articulated to the sheath encircling the stem and ultimately deciduous; sheaths tightly clasping, to 4 × 3 mm. *Inflorescence* solitary, 1-flowered, emerging below the foliage, the peduncle straight, to 15 mm long, provided at the base with 2 tubular, acute bracts, about 1.5 mm long. *Floral bract* double, the outer bract suborbicular-funnelform, obtuse, shorter than pedicel, 2 × 2 mm, the inner bract narrowly lanceolate, 2.5 mm long. *Ovary* pedicellate cylindric-subclavate, glabrous, ca. 2.5 mm long, including the pedicel. *Flower* ringent, rarely subspreading, the sepals and petals greenish cream spotted and blotched with purple, sometimes almost solidly purple, the lip cream white, sparsely spotted with purple, mostly toward the apex, rarely solid purple, the column greenish white, flecked violet along the margins of the stigma, anther cap purple-red; no fragrance detected. *Dorsal sepal* elliptic-lanceolate, acute, dorsally carinate, 6–9 × 2.5–3.2 mm. *Lateral sepals* lanceolate-elliptic, asymmetrical, slightly falcate, acute, apiculate, usually upcurved in natural position, 7.5–12.0 × 3.0–4.1 mm. *Petals* obliquely ovate, shortly acute, much wider than sepals, 6.0–8.5 × 4–5 mm. *Lip* 3-lobed, from a fleshy claw, 7–10 × 6–9 mm when spread, the hypochile obcuneate, sometimes provided at the base with a thickened area, 4–5 mm wide apically, the epichile broadly triangular-sagittate, obtuse to subrounded, minutely apiculate, adaxially carinate toward the apex, the lateral lobes narrowly triangular, acute, spreading-retrorse, decurring in the lamina, 1.5 × 1.0 mm. *Column* erect, 5–6 mm long, with a distinct foot about 2 mm long, the reclined clinandrium shallow; ligule small, widely triangular, projecting downward, subacute, glabrous, 0.6 × 1.5 mm. *Anther cap* transversely elliptic-suborbicular, flattened, 2-celled. *Pollinia* 4 in 2 superposed pairs of slightly different size, on a narrowly obtriangular-ligulate, subtruncate stipe with inrolled margins; viscidium elliptic. *Fruit* an elliptic, glabrous capsule.

Distribution: Mexico to Venezuela, Ecuador, and Brazil.

Distribution in the Park: it was observed at Cerros de Jesús. Likely found in the humid evergreen forest of Los Mesones and Las Cascadas at BHNP.

Habitat and ecology: from warm tropical to premontane wet forests on both drainages, at 50–1350 m elevation, but most commonly found between 400 and 900 m. It is a shade-loving epiphyte, occupying many different niches, with a preference for old, moist branches and trunks of the understory vegetation.

Etymology: named after Panama, where the type specimen was found initially.

Phenology: flowering occurs year-round, with a peak between April and June, corresponding to the beginning of the rainy season.

Discussion: *Dichaea panamensis* is vegetatively and florally unmistakable. The plants, rooting only at the base of the stems, have very thick roots wider than the stems. The leaves are distichous, articulate, narrowly linear-elliptic to lanceolate, usually glaucous beneath. The flowers are ringent and vary in color from pale greenish white to almost solid purple, with any combination of purple spotting, blotching, and flushing.

FIGURE 11. **A–I.** Orchid species found at Barra Honda National Park. **A,** *Dichaea panamensis* (*Bogarín s.n.*). **B,** *Dimerandra emarginata* (*Bogarín 9500*, JBL). **C,** *Encyclia macrochila* (*Bogarín 6148*, JBL). **D,** *Epidendrum congestoides* (*Bogarín s.n.*). **E,** *E. coronatum* (*Pupulin 1835*, JBL). **F,** *E. stamfordianum* (*Bogarín 1665*, JBL). **G,** *E. vulgoamparoanum* (*Bogarín 1686*, JBL). **H,** *Guarianthe skinneri* (*Bogarín 2607*, JBL). **I,** *Habenaria macroceratitis* (*Bogarín 1724*, JBL). Photographs by the authors.

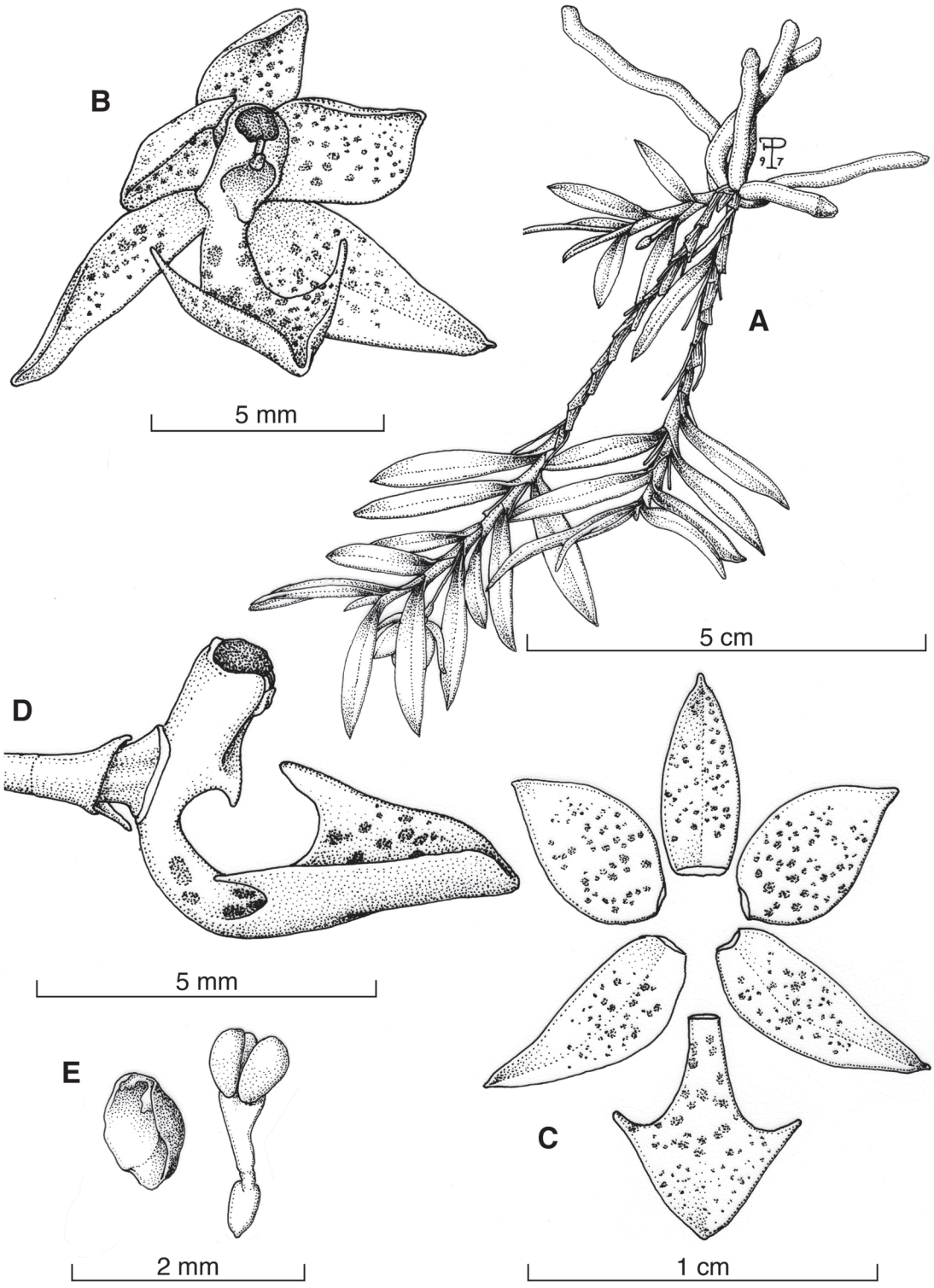

FIGURE 25. *Dichaea panamensis* Lindl. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 304* (JBL).

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, 10°05'41.7"N, 85°18'59.58"W, 370 m, premontane moist, transition to tropical moist forest, epiphytic in secondary mature vegetation along a seasonal stream with high trees, en bosque secundario maduro sobre una quebrada estacional con árboles altos, 23 February 2012, *F. Pupulin 8192 & D. Bogarín* (unvouchered).

9. *Dimerandra* Schltr., Repert. Spec. Nov. Regni Veg. Beih., 17: 43–44. 1922.
TYPE: *Dimerandra rimbachii* (Schltr.) Schltr.

Plants epiphytic, caespitose herbs. *Stems* thickened, narrowly fusiform, foliaceous, covered with thin, imbricating sheaths articulated with the leaves, erect or pendent, the old stems striate and often without leaves. *Leaves* conduplicate, distichous, linear to narrowly elliptic, subcoriaceous, often scattered along the upper part of the stems. *Inflorescence* terminal, a very short, successively and few-flowered raceme. *Flowers* of medium size, showy, resupinated, rose-purple with a white center. *Sepals* linear-lanceolate, acute, spreading. *Petals* wider than sepals, rhombic or elliptic. *Lip* simple with a short claw, obovate or rhombic-obovate, the disc under the column provided with a callus formed by several obscure carinae or imbricating lamellae in rows. *Column* short, apically with 2 prominent rows of the clinandrium. *Anther* small, incumbent. Pollinia 4, waxy, laterally flattened, with caudicles.

A genus probably monotypic, ranging from Mexico to Brazil and Trinidad. One species in Costa Rica and BHNP.

Dimerandra emarginata (G. Mey.) Hoehne, Bol. Agric. (Sao Paulo). 34: 618. 1934. Fig. 11B, 26.
Basionym: *Oncidium emarginatum* G. Mey., Prim. Fl. Esseq. 259. 1818. TYPE: [GUYANA]. In arboribus plantationis Hof. van Holland, floret Sept, *H. van Holland s.n.* (Holotype: GOET).

Plants epiphytic, caespitose, with fleshy, foliaceous stem, up to about 60 cm tall. *Roots* fleshy, glabrous. *Pseudobulbs* cylindrical to fusiform from a narrow stalk, slightly fractiflex, of several nodes, bearing leaves in the upper portion, sometimes purplish and wrinkled. *Leaves* arranged distichously on the stems, narrowly linear-elliptic, subcoriaceous, unequally bilobed at apex, 4.0–9.0 × 0.7–1.0 cm, produced at the nodes of the pseudobulb, articulate with the leaf sheaths. *Inflorescence*s terminal, a short raceme bearing 1 to few flowers produced successively, about 1 cm long. *Ovary* pedicellate, cylindrical, up to 4 cm long. *Flowers* very flat, with spreading parts, often self-pollinating, rose-purple with a white blotch at the base of the lip. *Dorsal sepal* lanceolate to elliptic-lanceolate, acute, conduplicate, 15 × 5 mm. *Lateral sepals* subsimilar, elliptic-lanceolate, acute to acuminate, conduplicate, somewhat oblique, 15 × 5 mm. *Petals* broad-obovate to subrhombic, acute, 17 × 10 mm. *Lip* flabellate, with a fleshy claw partially adnate to the column, the lamina broadly obovate to suborbicular, truncate, slightly apiculate, the disc with a callus made up by obscure lines or rows of imbricating lamellae, the entire lip 16 × 15 mm. *Column* short, slightly arcuate, without a foot, provided at the apex with 2 large, subquadrate, deflexed wings, about 5 mm long. *Pollinia* 4, laterally compressed, in 2 pairs on short, bilobed caudicles. *Anther cap* hemiglobose, 4-celled.

Distribution: from Mexico to South America and the West Indies.

Distribution in the Park: it was observed at Cerro Barra Honda near Sendero Ceiba and around Terciopelo cave.

Habitat and ecology: commonly found in tropical moist lowland forest of both the Caribbean and Pacific at elevations below 1000 m in disturbed forest or open areas. The plants often form big clumps of many stems, usually pendent in mature specimens. Sometimes the flowers are self-pollinating soon after anthesis, and the plants bear several capsules.

Etymology: from the Latin *emarginatus*, "emarginate," in allusion to the emarginate apex of the lip.

Phenology: flowering occurs from September through April.

Discussion: it is easily distinguished by the narrowly fusiform, many-leaved pseudobulbs, the linear-elliptic leaves, and the small, successively pink-purple flowers produced at the apex. The sepals and petals are subsimilar, and the lip is broadly obovate to suborbicular with the column basally adnate.

Additional specimens examined: Guanacaste: Nicoya, San Antonio, Parque Nacional Barra Honda, Cerros Barra Honda, bosque cercano al parqueo en el inicio del sendero Ceiba, 10°10'23.24"N, 85°21'38.22"W, 367 m, epífita en bosque húmedo premontano transición a basal, 21 febrero 2012, *D. Bogarín 9500 y F. Pupulin* (unvouchered).

10. *Encyclia* Hook., Bot. Mag. 55: pl. 2831. 1828.
TYPE: *Encyclia viridiflora* Hook.

Plants epiphytic or lithophytic, rarely terrestrial, caespitose. *Pseudobulbs* spherical, subovoid, ovoid, conic-ovoid, fusiform, pyriform or subpyiriform, heteroblastic, subtended by scarious bracts. *Leaves* 2–3, on short tubular petioles at the apex of pseudobulbs, ligulate, oblong, linear or elliptic, acute or subacute, conduplicate. *Inflorescence* apical, erect or arching, racemose or paniculate. *Flowers* showy, spread, sometimes scented. *Sepals* and *petals* elliptic, ovate, obovate or spathulate, simple, free, membranaceous to fleshy. *Lip* 3-lobed, narrowing to the middle conforming an isthmus, free or basally adnate to the column, the lateral lobes arching and clasping the column, midlobe sessile, or separated by a clear isthmus, with a central keeled callous. *Column* straight, semiterete, truncate, lateral wings or teeth present or absent. *Anther* incumbent anther, the stigma dorsal. *Pollinia* 4, of equal size, ovate or obovate, with caudicles. *Anther cap* cucullate, 4-celled. *Capsule* pyriform to fusiform, smooth or warty.

A Neotropical genus of about 120 species ranging from Mexico (Sonora) and Florida (USA) through Central America and the West Indies to Peru, Argentina, and Brazil (Rio Grande do Sul). Nine species are reported from Costa Rica. A single species occurs in BHNP.

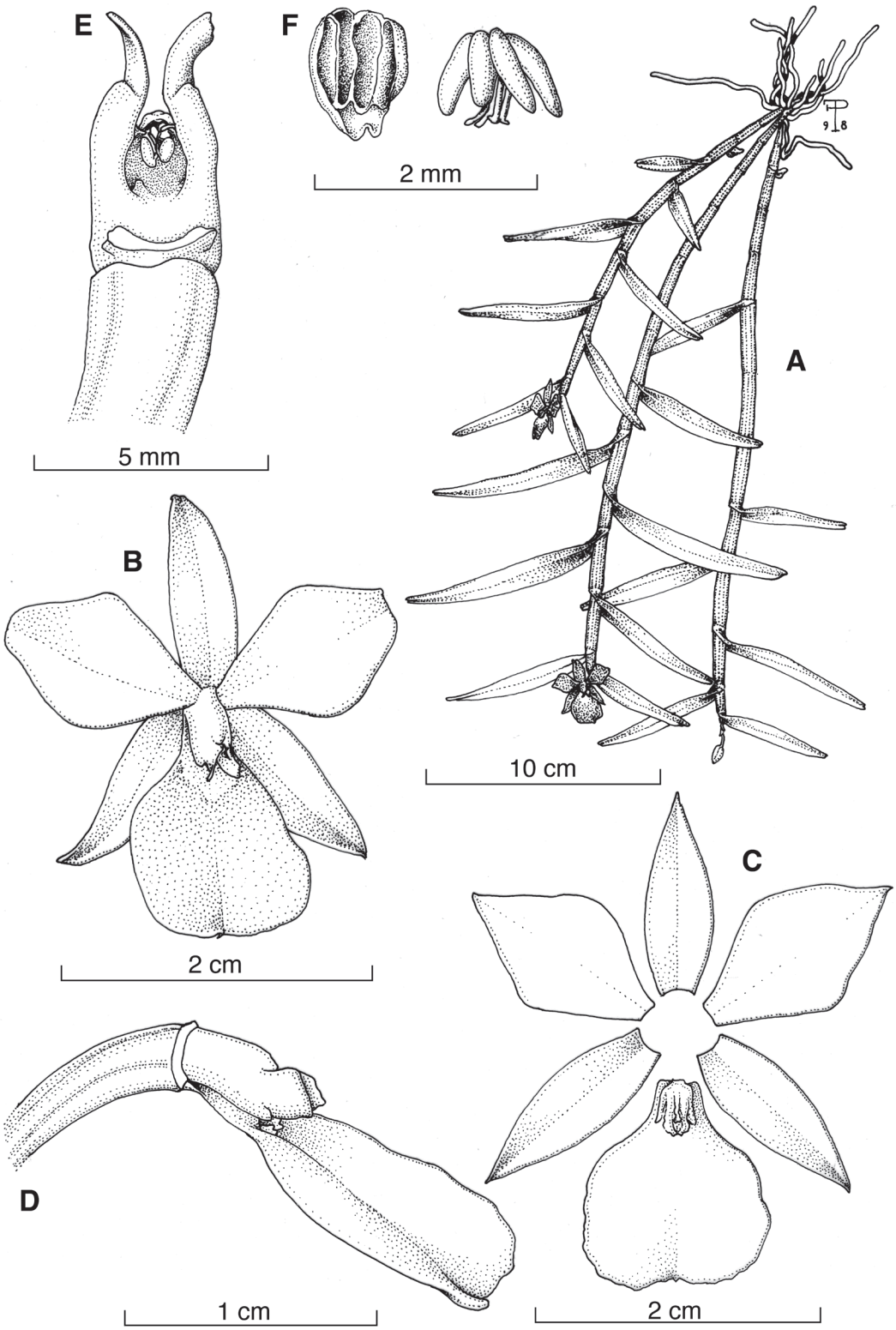

FIGURE 26. *Dimerandra emarginata* (G. Mey.) Hoehne. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 325* (JBL).

Encyclia macrochila (Hook.) Neumann, Rev. Hort., II, 4: 137. 1846. Fig. 11C, 27.

Basionym: *Epidendrum macrochilum* Hook., Bot. Mag. 63: t. 3534 (1836). TYPE: [MEXICO.] "A charming epiphyte, introduced from Mexico, by Charles Horsfall, Esq., in whose fine collection at Everton it flowered in June, 1836, when a drawing and specimen of the handsome flowers were kindly communicated by Mrs. Mrs. Horsfall," *C. Horsfall s.n.* (Holotype: K).

Heterotypic synonyms: *Cymbidium cordigerum* and homotypic synonyms from the authors, *non Cymbidium cordigerum* Kunth in F.W.H.A. von Humboldt, A.J.A. Bonpland & C.S. Kunth, Nov. Gen. Sp. 1: 341 1816.

Epidendrum atropurpureum and homotypic synonyms from the autors, *non Epidendrum atropurpureum* Willd., Sp. Pl. 4: 115. 1806. *Epidendrum macrochilum* var. *albopurpurea* C. Morren, Ann. Soc. Roy. Agric. Gand 2: 365, t. 86. 1846. TYPE*:* not designated.

Encyclia atropurpurea var. *leucantha* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17: 45. 1922. *Encyclia cordigera* f. *leucantha* (Schltr.) Withner, Cattleyas & Relatives 5: 104. 1998. TYPE: PANAMA (Lectotype: designated by Christenson, 1991: PANAMA. Sehr selten auf Hügeln bei Panama City, *C. W. Powell 149*: AMES; Isolectotype: MO).

Plants epiphytic, caespitose, to 80 cm tall. *Roots* produced from the base of the pseudobulb and the rhizome, flexuous, 2–3 mm in diam., whitish with green tips. *Pseudobulbs* ovoid to pyriform, 8–11× 3–6 cm, subtended by ovate, acute papery sheaths, shredded with age, 2(rarely 3)-foliate at the apex. *Leaves* on short tubular petioles at the apex of pseudobulbs, oblong or elliptic-oblong, ensate, coriaceous, conduplicate, dorsally keeled, acute to subacute, the apex irregularly bilobed, curving with age, 10–50 × 2–4 cm. *Inflorescence* apical, racemose, distichous, peduncle 13–35 cm, bracts 6–8 mm, acute, adpressed, infundibuliform, raceme 6–25 cm, rarely with 1 basal branch. *Floral bracts* triangular, acute, adpressed, scarious, 1–3 × 3–4 mm. *Ovary* and pedicel 2.5–3.3 cm, smooth, with minute lenticels. *Flowers* showy, resupinate, scented, the sepals and petals greenish to brownish, lip white, striped with magenta at base of lateral lobes and along the callus, strongly suffused with pink or magenta at the middle toward the apex (rarely pure white). *Dorsal sepal* spathulate, elliptic-oblanceolate, acute to subacute, dorsally carinate, apically curved, 2.6–3.6 × 0.5–1.1 cm. *Lateral sepals* spathulate, cuneate-oblanceolate, acute, slightly apiculate, strongly curved toward the apex, dorsally carinate, 2.4–3.5 × 0.8–1.2 cm. *Petals* unguiculate, spathulate-ovate or cuneate-ovate, acute or apiculate, dorsally carinate, 2.3–3.5 × 1.0–1.8 cm. *Lip* basally adnate to the column for 3 mm, deeply 3-lobed, shortly unguiculate, 2.9–3.1 × 2.8–3.1 cm across lateral lobes, lateral lobes oblong-lanceolate, falcate, obtuse, suberect and flanking the column in natural position, slightly stripped with magenta, 0.7–1.5 × 0.5–0.8 cm, isthmus about 1 mm long, subquadrate; midlobe 2.0–3.6 × 1.3–3.0 cm, suborbicular, obovate or oblong, retuse or obtuse, callus with 2 longitudinal fleshy keels, which made up a fovea on the isthmus, 0.8–1.1 × 0.3–0.6 cm, sulcate, with a second callous with 3 magenta veins running and reducing slightly toward the apex. *Column* subterete, truncate, cuneate-obovate, subpandurate, basally sulcate, 1.0–1.8 cm, midtooth triangular, subequal to lateral teeth, without wings; anther apical; stigma dorsal. *Anther cap* 4-celled, cucullate, ovate to orbicular. *Pollinia* 4, in 2 pairs with caudicles, without viscidium. *Capsule* 4 × 2.3 cm, fusiform to obovoid-ellipsoid.

Distribution: from Mexico to Colombia and Venezuela.

Distribution in the Park: fairly common around the main trails at Cerro Barra Honda and Las Delicias.

Etymology: from the Greek *macro,* "big," *and cheilon*, "lip," in reference to the large size of the labellum.

Habitat and ecology: epiphytic in tropical moist forest, premontane moist forest, basal belt transition and tropical dry forest, moist province transition. Plants are restricted to the northern and central Pacific lowlands of Puntarenas, Guanacaste, and San José (Puriscal and Turrubares) from 0 to 700 m of elevation. They are common in sunny areas and disturbed lands such as pastures, river edges, tree fences, and primary and secondary forest. At BHNP, it is observed growing on several hosts such as *Bursera simarouba* (Burseraceae), *Cedrela* spp. (Meliaceae), and *Plumeria rubra* (Apocynaceae), both in secondary forest and disturbed areas around the Park boundaries.

Encyclia macrochila is reported to be pollinated by medium-sized, black female carpenter bees (*Xylocopa* sp., Hymenoptera: Anthophoridae) (Janzen et al., 1980), and another species of *Xylocopa*; these authors suggested that the shape and color of the flower of *E. macrochila* are similar to the common legume tree, *Gliricidia sepium* (Fabaceae), which is frequently visited by the same bees in search of nectar.

Phenology: plants flower from November to April.

Discussion: it is easily distinguished by the racemose inflorescences (never branched) with showy, scented, large flowers. The pseudobulbs are ovoid to pyriform, and very conspicuous in healthy and well-developed specimens. The brown spathulate sepals are strongly curved at the apex, the suborbicular, obovate, or oblong midlobe of the lip is white with three magenta stripes at the base. The lip is larger (2.4–3.5 × 0.8–1.2 cm) than those of other species of the genus and is the most conspicuous structure of the flower. The column is not winged or toothed apically, with an evident yellow anther cap.

Additional specimens examined: BHNP, Bosque de Cactus, 10°10'32.1"N, 85°21'13.3"W, 639 m, bosque húmedo premontano transición a basal, epífitas en lomas rocosas, 28 enero 2009, *D. Bogarín 6148 y F. Pupulin* (JBL-Spirit).

11. *Epidendrum* L., Sp. Pl. ed. 2: 1347. 1763., *nom. cons.*
TYPE: *Epidendrum nocturnum* Jacq. *type. cons.*

Plants epiphytic or rarely terrestrial herbs to subshrubs, small to large, variable in size and habit, caespitose, creeping, erect to pendent, occasionally with pseudobulbs. *Leaves* distichously arranged along the stem, occasionally 1 apical leaf or several apical leaves distributed throughout the stem or aggregate at the apex of the stem or pseudobulb, flattened, conduplicate or terete, subcoriaceous to fleshy, not

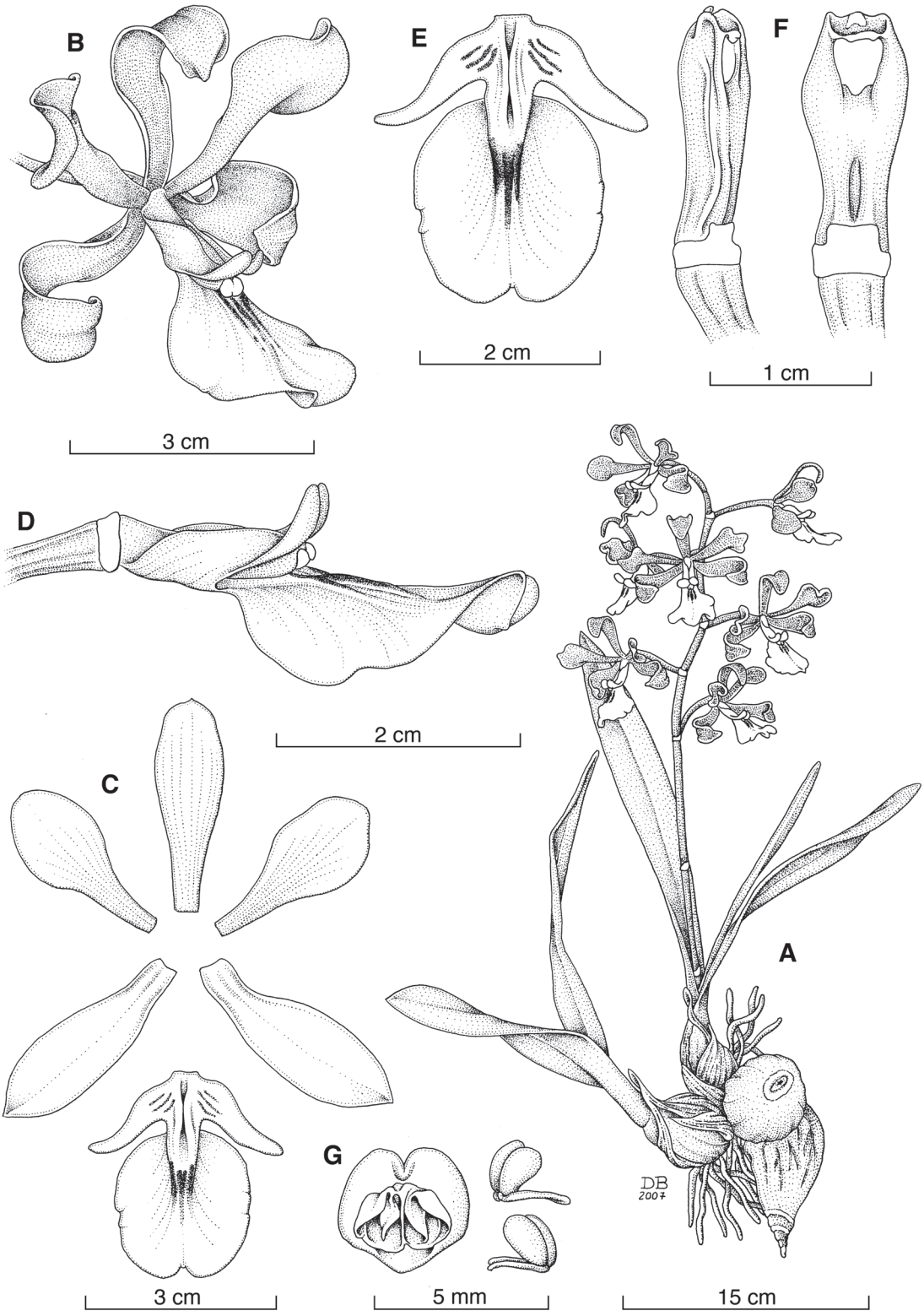

FIGURE 27. *Encyclia macrochila* (Hook.) Neumann. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Lip, flattened. **E,** Column and lip, side view. **F,** Column, side and ventral view. **G,** Pollinarium and anther cap. Drawn by D. Bogarín from *Bogarín 13* (JBL).

petiolate. *Inflorescence* apical, rarely lateral, a 1- to many-flowered raceme, spike, panicle, umbel or subumbellate. *Flowers* resupinate or not, small to large and showy. *Sepals* and *petals* subsimilar, free, usually spreading. *Lip* simple or lobed, mostly united to the ventral portion of the column, usually with fleshy calli at the base, simple or 3-lobed, callose. *Column* mostly fused with the lip, but sometimes totally free or half fused with the lip just to the apex, often provided with a hooded clinandrium. Anther cap cucullate. *Pollinia* 2, 4, or rarely 8, waxy.

Epidendrum is one of the largest genera of Neotropical orchids with more than 1500 species. The genus is widely distributed throughout the Neotropics, from North Carolina to northern Argentina, including the Antilles. About 200 species are reported from Costa Rica. Four species occur in BHNP.

KEY TO SPECIES OF *EPIDENDRUM*

1a. Plants with pseudobulbs ..... *E. stamfordianum*
1b. Plants without pseudobulbs 2
2a. Plants with abbreviated stems < 5 cm long ..... *E. congestioides*
2b. Plants with elongated stems >10 cm long 3
3a. Inflorescence subumbellate, subsessile, 3–5 green flowers ..... *E. vulgoamparoanum*
3b. Inflorescence racemose, pedunculate, > 6 white flowers ..... *E. coronatum*

11a. ***Epidendrum congestoides*** Ames & C.Schweinf., Schedul. Orch. 10: 61–63. 1930. Fig. 11D, 28.

TYPE: COSTA RICA. Guanacaste: vicinity of Tilarán, 10–31 Jan 1926, alt. 500–650 m, *P. C. Standley & J. Valerio 44933* (Holotype: AMES).

Homotypic synonyms: *Nanodes congestioides* (Ames & C. Schweinf.) Brieger, Orchideen 8(29–32): 512. 1976.

Plants epiphytic, cespitose, without pseudobulbs, with abbreviated, foliaceous stems, up to 5 cm tall. *Roots* filiform, flexuous, glabrous. *Stems* flattened, to 5 cm long, 0.8 cm in diam., entirely concealed by closely appressed leaf sheaths, 5- to 11-leaved. *Leaves* distichous, elliptic-ovate, imbricate basally, fleshy, conduplicate, retuse, carinate, dorsally apiculate, 1.0–2.3 × 0.6–0.9 cm, glaucous-green or suffused with purple when exposed to sunlight, not articulated with the sheaths, the margins somewhat revolute, dentate-fimbriate or erose. *Inflorescence* terminal from the upper leaf, sessile, 1- to 2-flowered, flowering only once. *Floral bracts* shorter than the ovary, obovate, rounded, imbricating, denticulate, unequal. *Flowers* small, fleshy, pale green with purplish suffusion, the lip emerald green. *Ovary* triquetrous, keeled. *Dorsal sepal* ovate-lanceolate, acuminate, dorsally carinate near the apex, 10 × 4 mm. *Lateral sepals* subsimilar, elliptic-lanceolate, acute, the margins somewhat denticulate, dorsally carinate, the lateral sepals falcate, concave, with a serrulate keel, 10–12 × 4 mm. *Petals* oblique, narrowly lanceolate, acute or subacute, the apical margins denticulate, nearly as long as the sepals, 9 × 2.8 mm. *Lip* with a ligulate claw adnate to the column, partially enfolding the column in natural position, the lamina ovate, somewhat cordate at the base, acute, mucronate, 9 × 5.5 mm. *Column* short, stout, up to 6.6 mm. *Clinandrium-hood* 3-toothed, the margins erose or fimbriate-dentate, 1 mm long. *Pollinia* 4, ovoid, laterally compressed, on a short caudicle. *Anther cap* hemiglobose, 4-celled.

Distribution: Guatemala to Costa Rica.

Distribution in the Park: only one population was located at Las Cascadas.

Etymology: from the Latin *congestum*, "congested," in allusion to the crowded leaves and flowers, and the Greek *oides*, "resembling," in allusion to the similar *Epidendrum congestum* Rolfe.

Habitat and ecology: it is found on tropical wet and moist lowland forest to up to 1000 m of elevation in both the Caribbean and Pacific. Plants were observed growing on tall trees of *Brosimum alicastrum* (Moraceae) in the humid areas of the gallery forest at BHNP. It is usually found in well-lit spots, and when exposed to full sunlight the plants can present a strong purple pigmentation on the leaves and flowers instead of glaucous-green leaves.

Phenology: from December to June.

Discussion: plants are characterized by the small, compact, cespitose, creeping habit with fleshy distichous leaves arranged along the stems. Mature specimens can form a mass of stems closely appressed to the phorophyte, and juveniles may grow loosely hanging from branches or main tree trunks. The inconspicuous green flowers suffused with purple are produced in pairs on a short inflorescence closely appressed to the leaves. From other species of *Epidendrum* of BHNP it is distinguished by the lack of pseudobulbs, abbreviated stems less than 5 cm long, and the 2-flowered inflorescences (vs. many-flowered, usually more than 3 flowers in *E. coronatum*, *E. satmfordianum*, and *E. vulgoamparoanum*).

Additional specimens examined: BHNP, Las Cascadas (the waterfalls), entering from Finca San Diego (Finca Los Trejos), 10°10'59.86"N, 85°20'17.4"W, 86 m, premontane moist, transition to tropical moist forest, epiphytic in gallery forest on *Brosimum alicastrum* "Ojoche" (Moraceae) close to a stream, 22 February 2012, *D. Bogarín s.n.* (unvouchered).

11b. ***Epidendrum coronatum*** Ruiz & Pav., Syst. Veg. Fl. Peruv. Chil. 1: 242. 1798. Fig. 11E, 29.

TYPE: PERU. Habitat in Pozuzo supra arbores et saxa. Floret Septembri et Octobri, *H. Ruiz & J. A Pavón s.n.* (Holotype: MA).

Heterotypic synonyms: *Epidendrum sulphuroleucum* Barb. Rodr., Gen. Spec. Orchid. 1: 56. 1877. TYPE: BRAZIL. Dans la serra da fazenda de Santa Rosa, au Carmo do Rio Claro, province de Minas Geraes. Fleurit en Septembre, *J. Barbosa Rodrígues s.n.* (Holotype: at Herb. Barb. Rodr., destroyed; Lectotype: designated by Jiménez and Hágsater, Icon. Orchid. (Mexico) 11: text with t. 1113, 2008a: AMES, copy, K).

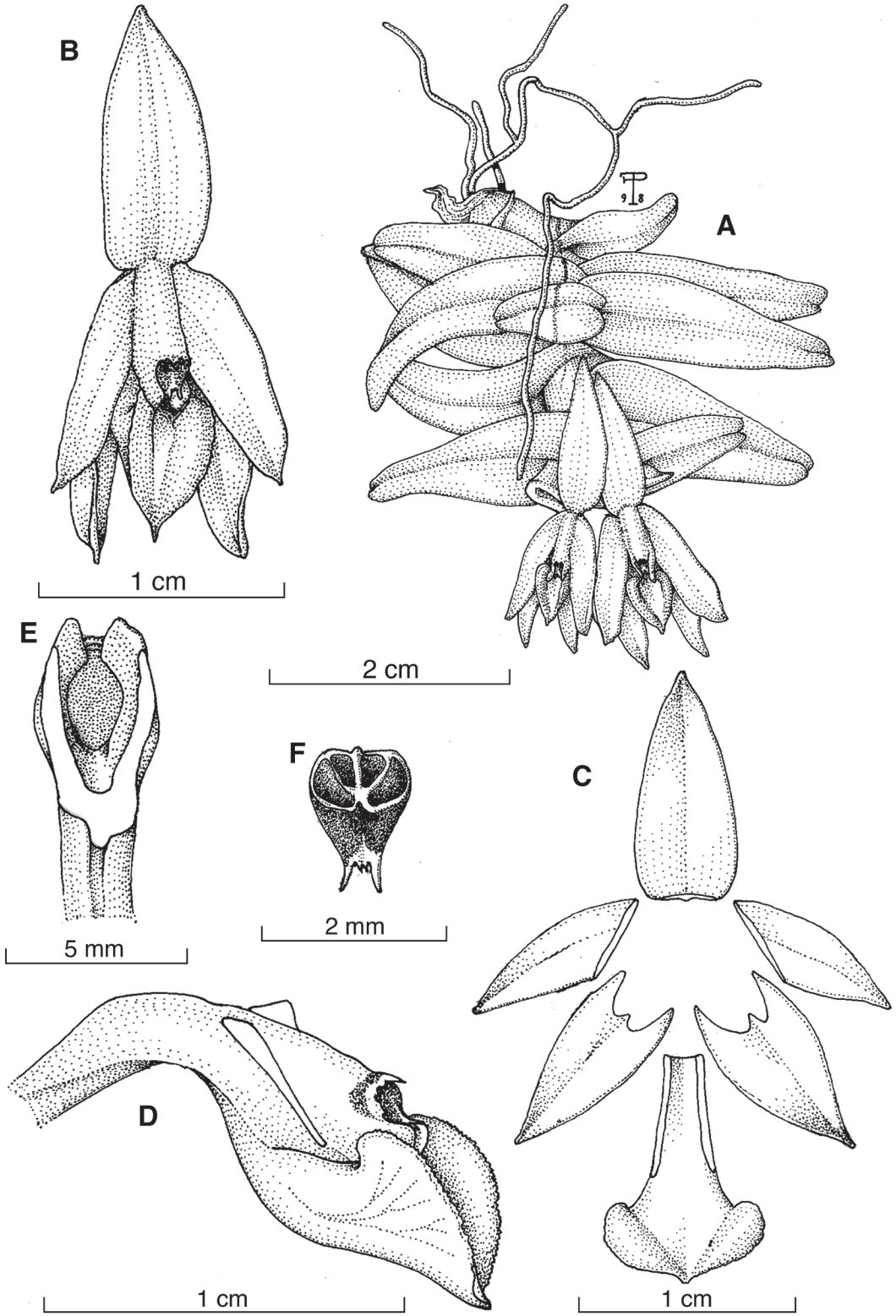

FIGURE 28. *Epidendrum congestoides* Ames & C.Schweinf. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 296* (JBL).

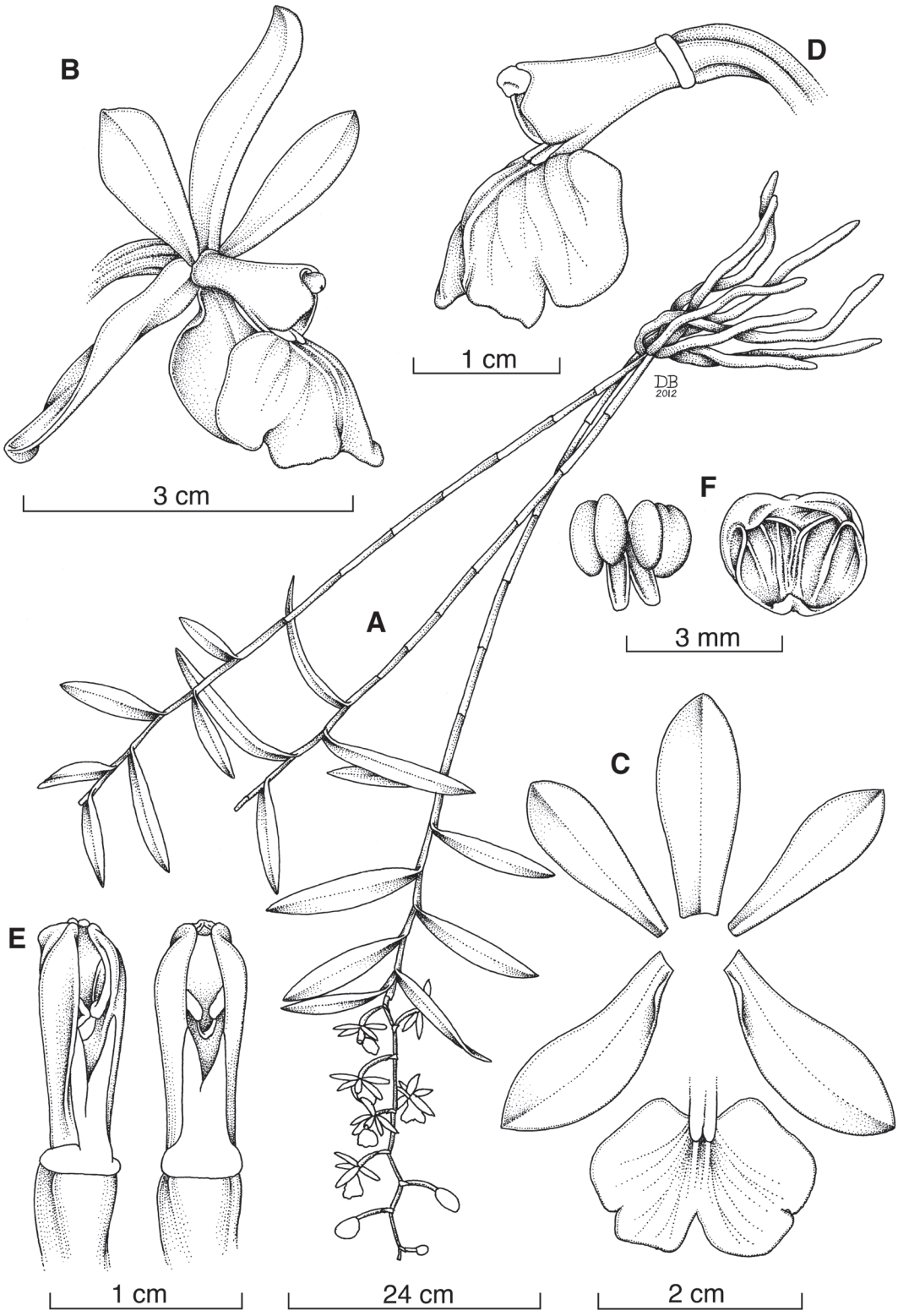

FIGURE 29. *Epidendrum coronatum* Ruiz & Pav. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by D. Bogarín from *Bogarín 1699* (JBL).

Epidendrum moyobambae Kraenzl., Repert. Spec. Nov. Regni Veg. 1: 185. 1905. TYPE: PERU. Dep. Loreto, bei Moyobamba. Wald (ziemlich trocken, Sträucher spärlich) in 800–900 m, *A. Weberbauer 4563* (Holotype: B, destroyed, photo: AMES, F, MO, NY, SEL).

Epidendrum subpatens Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17: 40. 1922. TYPE: PANAMA. Im Gebiete des Gatun-Sees und auch in Veraguas bei Santiago, *C. W. Powell 86* (Holotype: B, destroyed; Lectotype designated by Christenson, 1991: AMES-23943; Isolectotypes: K, photo: AMES, MO-955940).

Epidendrum benignum Ames, Schedul. Orchid. 2: 26. 1923. TYPE: COSTA RICA. Forêts de Nicoya, May 1900, *A. Tonduz 13928* (Holotype: US).

Epidendrum amazonicum Schltr., Beih. Bot. Centralbl. 42(2): 78. 1925. TYPE: BRAZIL. Amazonas: Baixo, Rio Branco, 1913, *G. Kuhlmann 780* (Holotype: B).

Plants epiphytic, pendent to suberect, stout, caespitose, without pseudobulbs, with short rhizome and foliaceous stems up to 70 cm tall. *Roots* fleshy, flexuous, glabrous, to 5 mm in diam. *Stems* elongate, cane-like, straight to flexuous, ridged, cylindrical, to 9 mm in diam., to 62.5 cm long, entirely enfolded by the tubular, leaf-bearing sheaths, purple-spotted, which are 1–5 cm long, 5- to 16-leaved. *Leaves* oblong-elliptic to elliptic-lanceolate, acute or subacute, conduplicate, distichous, distributed toward the apical half of the stem, coriaceous or subcoriaceous, dark green glossy or light green, sometimes suffused with purple, retuse, 7.0–18.2 × 1.8–4.4 cm. *Inflorescence* apical, racemose, distichous, slightly fractiflex, hanging or arching-nutant, elongate, lax, peduncle short with 3 oblong-triangular, acute bracts, with up to 25 flowers, to 40 cm long, basally with several appressed sheaths. *Floral bracts* scale-like, subacute, concave, to 2 mm long. *Ovary* pedicellate, smooth, grooved, arcuate, 2.0–2.5 cm long, including the pedicel. *Flowers* medium-sized, spread, ivory-white or white-cream, column greenish, the sepals and petals greenish white, resupinate. *Dorsal sepal* elliptic-spathulate to obovate, cuneate, slightly revolute basally, acute 2.0–2.2 × 0.7–0.8 cm. *Lateral sepals* subsimilar, subfalcate and slightly revolute basally, obovate to elliptic or spathulate, acute, fleshy, 2.0–2.3 × 0.9–1.0 cm. *Petals* narrowly obovate to spathulate or oblanceolate, fleshy acute, 1.9–2.0 × 0.6–0.7 mm. *Lip* adnate to the column, clawed, entire, arcuate, convex, the lamina 3-lobed, the lateral lobes deflexed suborbicular, trapezoid to dolabriform, the midlobe retuse or with the apex deeply slit appearing bilobulate, 2.1–2.7 × 1.7 cm; the disc laminar, shortly bicarinate in front of the column, with several low keels radiating toward the sides of the lamina and 1 prominent keel running toward the apex of the midlobe. *Column* straight, wider at the apex, wholly adnate to the lip, 1.4 × 0.5 cm. *Clinandrium hood* abbreviated, entire, 1.2 cm long. *Pollinia* 4, laterally compressed, ovoid, subequal, with granulose caudicles and viscidium. *Rostellum* apical, slit. *Anther cap* hemiglobose, 4-celled with lamellae.

Distribution: from Mexico to Brazil and Peru.

Distribution in the Park: found at Las Cascadas on a main tree trunk along a creek. It probably also occurs at Los Mesones. Another plant was found growing at La Jaralosa in Zona Protectora Cerros de Jesús, 6 km from BHNP in humid evergreen forest.

Etymology: from the Latin *coronatum*, "crowned," probably referring to the inflorescence that crowns the stem.

Habitat and ecology: it is found in tropical wet forest from the central to northern Pacific and the dry western areas of Valle Central from 0 to 700 m of elevation. It was observed growing on *Spondias mombin* and *Guazuma ulmifolia* (Sterculiaceae).

Phenology: from April to August, but flowers mainly from May to June.

Discussion: it is distinguished by the relatively large pendant or suberect plants, with elongate, cylindrical stems covered by several dark-green, glossy, coriaceous, distichous leaves articulated with the leaf sheaths. The inflorescences are apical, racemose, hanging, with several ivory-white flowers with a prominent 3-lobed lip. From other species of *Epidendrum* in BHNP it is easily distinguished by the lack of pseudobulbs and the elongate, racemose inflorescences bearing 6–25 white-ivory flowers.

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, ascenso por el sector de La Jaralosa, 10°05'58.1"N, 85°19'11.7"W, 436 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario sobre un yurro con árboles altos, 14 julio 2005, *D. Bogarín 1699, F. Villalobos, C. Aguilar, O. Durán, F. Paniagua* (JBL). BHNP, Las Cascadas (the waterfalls), entering from Finca San Diego (Finca Los Trejos), 10°10'59.86"N, 85°20'17.41"W, 86 m, premontane moist, transition to tropical moist forest, epiphytic in gallery forest on *Brosimum alicastrum* "Ojoche" (Moraceae) close to a stream, 22 February 2012, *F. Pupulin 8190 & D. Bogarín* (JBL-spirit).

11c. ***Epidendrum stamfordianum*** Bateman, Orchid. Mexico & Guatemala, t. 11. 1838. Fig. 11F, 30.

TYPE: GUATEMALA. Isabal, 1837, *G. U. Skinner s.n.* (Holotype: K).

Homotypic synonyms: *Auliza stamfordianum* (Batem.) Brieg., Die Orchideen 3. Aufl. 1 (9): 548. 1977.

Heterotypic synonyms: see Jiménez and Hágsater, 2008b.

Plants epiphytic, cespitose, erect, to about 50 cm tall. *Roots* fleshy, flexuous, glabrous, to 2.5 mm in diam. Pseudobulbs stalked, fusiform, enfolded by many large bracts becoming papyraceous with age, 8–28 cm long, 1.5–2.2 cm in diam., 2- to 4-leaved near the apex. *Leaves* rather variable, oblong-elliptic to ligulate or oblanceolate, conduplicate, obtuse, slightly retuse, coriaceous, 10–22 × 2.5–6.5 cm. *Inflorescence* appearing basal, apical from a short abortive shoot along the rhizome, erect to slightly arcuate, racemose or paniculate, usually many-flowered raceme to 50 cm long, peduncle 4–8 cm long, enfolded by 2–3 triangular bracts. *Ovary* terete, smooth, up to 3.5 cm long. *Flowers* medium-sized, 8–30 flowers, showy, sepals

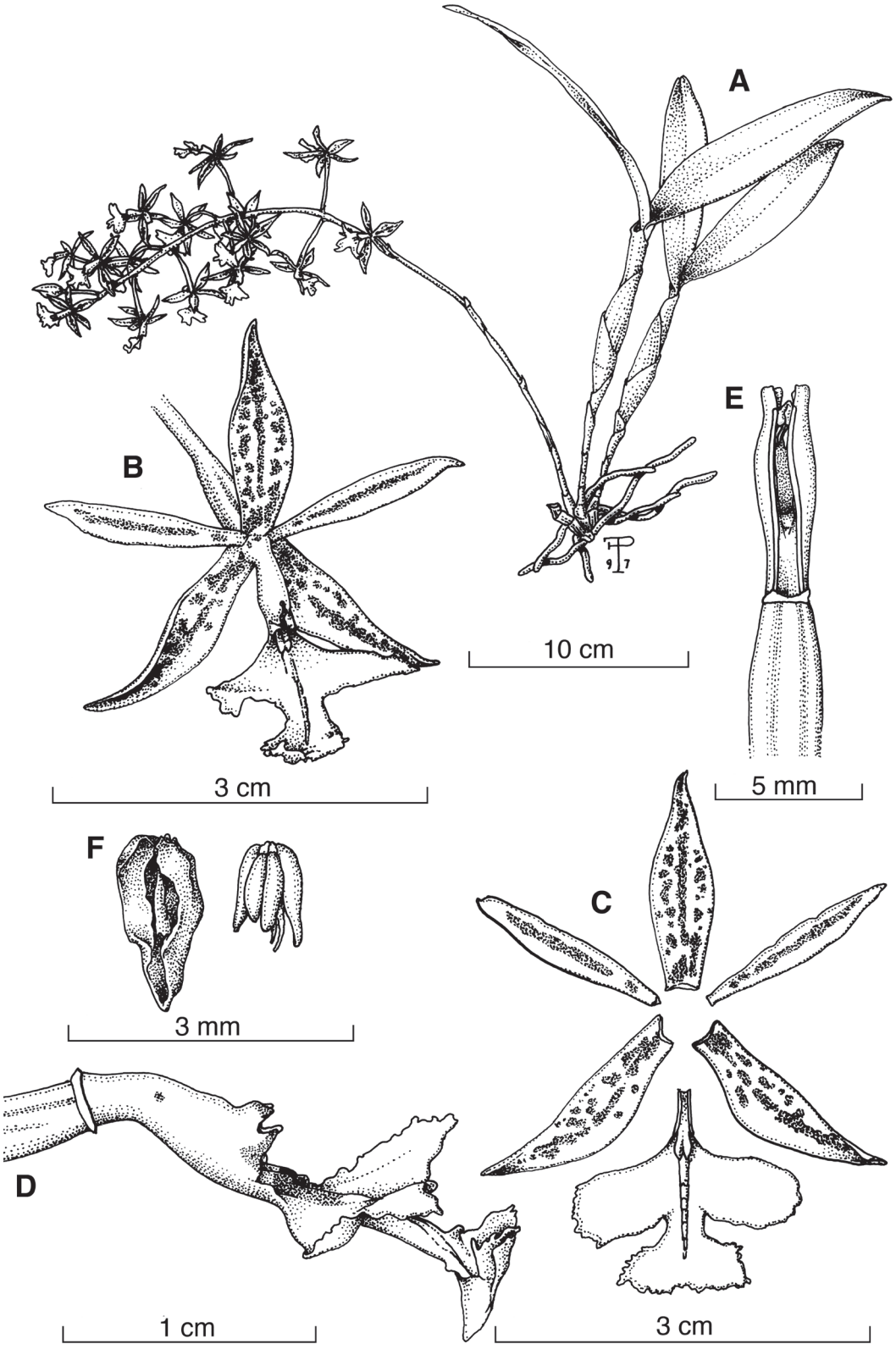

FIGURE 30. *Epidendrum stamfordianum* Bateman. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 370* (USJ).

and petals greenish yellow marked with dark purple, the lip with the lateral lobes white and the midlobe yellow, variously spotted or suffused with lilac to purple. *Dorsal sepal* elliptic-lanceolate, acute, concave and submucronate near the apex, 11.8–2.0 × 0.3–0.5 cm. *Lateral sepals* spreading, free, entire, subequal, elliptic-oblanceolate, acute, falcate, concave and submucronate near the apex, 1.8–2.0 × 0.3–0.5 cm. *Petals* oblique, linear-elliptic or linear-oblong, acute to acuminate, entire, slightly crenulate at the apex, 1.2–1.8 × 0.3–0.6 cm. *Lip* unguiculate, the claw adnate to the column, the lamina prominently 3-lobed, the midlobe transversely oblong, with a short claw at the base, crenulate to serrulate; the lateral lobes broad, subquadrate-elliptic to reniform, rounded, crenulate; disc provided with a short bilobed callus at the base and a median, low keel running to the middle of the midlobe; the entire lip 1.7 × 2.0 cm between the lateral lobes. *Column* clavate, stalked, arcuate basally, adnate to the lip just to the apex. *Clinandrium hood* cucullate, funnel-shaped, 3-toothed, 9 mm long. *Pollinia* 4, laterally compressed, semiovoid, ancipitose, in 2 pairs of different size, on a short caudicle. *Rostellum* apical, slit. *Anther cap* cucullate, lanceolate, 4-celled.

Distribution: Mexico to Colombia and Venezuela.

Distribution in the Park: widespread in BHNP. It is commonly observed in the evergreen forest of Las Cascadas, along the Ceiba trail at Cerros Barra Honda and Las Delicias.

Eponymy: in honor of the Earl of Stamford and Warrington, who put together an extensive collection of tropical orchids in Enville Hall, England, in the middle of the 19th century.

Habitat and ecology: plants can be found in seasonal tropical wet or moist forest in the Pacific lowlands of Península de Nicoya, central Pacific, and the dry areas of western Valle Central from 0 to 700 m. It was observed in disturbed areas or in secondary forest mostly on *Brosimum aliscastrum* (Moraceae), *Cedrela odorata* (Meliaceae), *Samanea saman* (Fabaceae), *Sideroxylum capiri*, and *Spondias mombin*.

Phenology: plants flower from November to May.

Discussion: plants are distinguished by the fusiform pseudobulbs having 2–4 coriaceous leaves, the inflorescence racemose or paniculate, arching, developed from a short abortive shoot along the rhizome appearing basal and the flowers with yellow sepals and petals spotted with magenta and the white lip with the midlobe yellow. At BHNP, it is the only species of *Epidendrum* having pseudobulbs. Because of the vegetative resemblance, it could be confused with *Guarianthe skinneri*. However, *E. stamfordianum* has 2–4 leaves in each pseudobulb (vs. 2 in *G. skinneri*), the inflorescence is developed from a short abortive shoot at the base (vs. apical from a fully developed pseudobulb), the flowers are white-yellow with magenta spots (vs. rose-purple), and the pseudobulb lacks a green spathe that becomes papery before flowering, as happens in *G. skinneri*.

Additional specimens examined: BHNP, Sendero Ceiba, desviación hacia Las Cascadas, La Mantequilla, 10°10'37.0"N, 85°21'09.6"W, 415 m, bosque húmedo premontano transición a basal, epífitas sobre Myrtaceae, en bosque secundario, 11 julio 2005, *D. Bogarín 1665 y F. Paniagua* (JBL-spirit).

11d. ***Epidendrum vulgoamparoanum*** Hágsater & L. Sánchez S., Icon. Orchid. (Mexico) 8: t. 898. 2006. Fig. 11G, 31.

TYPE: COSTA RICA: Alajuela: entre Río Grande de Atenas y Balsa, 400–485 m, colectada por Clarence Kl. Horich 20 Dec. 1982, prensado de material cultivado 13 oct. 1983, *E. Hágsater 6963* (Holotype: INB; Isotype: AMO).

Plants epiphytic, cespitose, erect or subpendent, without pseudobulbs, with short rhizome and foliaceous stems up to 35 cm tall. *Roots* fleshy, flexuous, glabrous, to 1.5 mm in diam. *Stems* elongate, flattened or laterally compressed, 35 cm long, to 1.4 cm in diam., completely enfolded by the tubular, leaf-bearing sheaths, 5- to 9-leaved. *Leaves* distichously arranged, elliptic-oblong to ovate, coriaceous, retuse, conduplicate, entire, persistent, 3.5–8.0 × 1.0–3.0 cm. *Inflorescence* apical, a short subumbellate, subsessile raceme bearing 3–5 flowers, produced from the axil of the upper leaf, flowering only once. *Floral bracts* smaller than the ovary, triangular, acute. *Ovary* smooth, terete, wider apically, to 2.5 cm long. *Flowers* medium-sized, green, resupinate, producing a plastic-like smell. *Dorsal sepal* elliptic, acute, entire, revolute basally, 3.0 × 0.9 cm. *Lateral sepals* subsimilar, lanceolate-elliptic to obliquely-elliptic, acute, somewhat falcate, revolute basally, 3.2 × 1.0 cm. *Petals* linear-elliptic to elliptic-oblanceolate, acute, spreading, entire, 2.8 × 0.5 cm. *Lip* adnate to the column, clawed, the lamina 3-lobed, concave, arching toward the apex, widely reniform or obovate, deeply cordate at the base, somewhat 3-lobed at apex, apiculate, 2.8 × 3.5 cm; the disc with 2 thickened, subglobose, slightly diverging calli. *Column* straight, clavate, with a terminal tooth and a nectary. *Clinandrium hood* prominent, entire, erose-fimbriate, 1.2 cm long. *Pollinia* 4, laterally compressed, subequal, with caudicles and viscidium. *Rostellum* subapical, slit. *Anther cap* hemiglobose, 4-celled.

Distribution: from the Pacific lowlands of Costa Rica and Panama (probably also in Rivas, Nicaragua).

Distribution in the Park: widespread in disturbed areas close to the boundaries of BHNP on insolated *Tamarindus indica* (Fabaceae-Mimosaceae) or *Tabebuia* spp. and along the main trails of the Park at Cerro Barra Honda, Las Delicias, and Las Cascadas.

Etymology: from the Latin *vulgo*, "commonly, generally," and *amparoanum*, in reference to the fact that this species has been wrongly identified as *Epidendrum amparoanum* Schltr.

Habitat and ecology: a widespread epiphyte of the tropical wet or tropical moist forest of the Pacific lowlands and the dry areas of western Valle Central, from sea level to 800 m of elevation. The flowers emit a plastic-like smell that is stronger in the last hours of the day.

Phenology: from December to July.

Discussion: it is characterized by a lack of pseudobulbs and having elongate, flattened, or laterally compressed

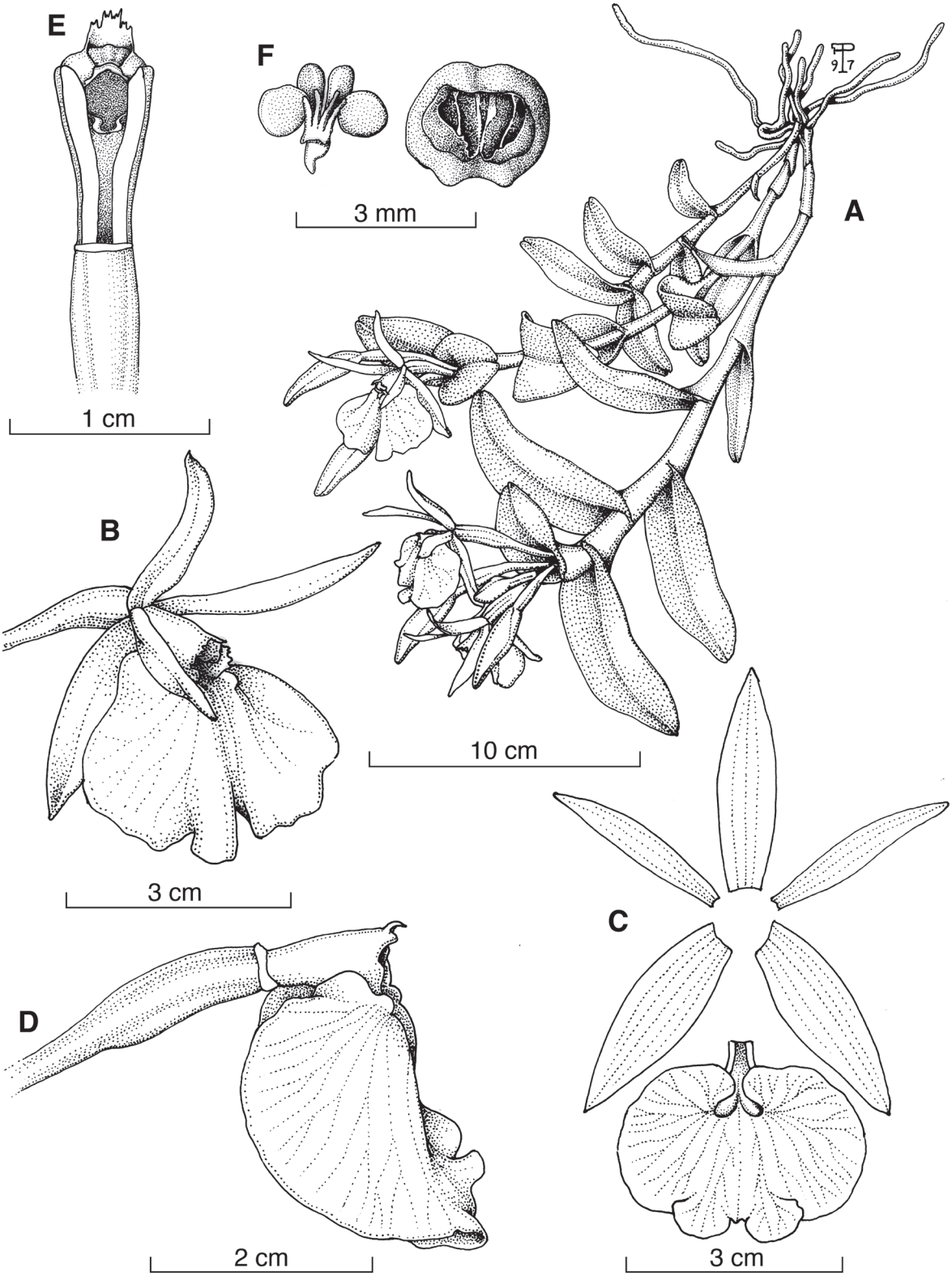

FIGURE 31. *Epidendrum vulgoamparoanum* Hágsater & L.Sánchez. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 328* (JBL).

foliaceous stems with subumbellate, subsessile, apical racemes bearing 3–5 simultaneous green fragrant flowers. The name *E. amparoanum* (=*Epidendrum barbeyanum* Kraenzl.) was applied to this species (Pupulin 1998; Dressler, 2003; Hágsater and Sánchez, 2006).

Additional specimens examined: BHNP, Sendero Ceiba y Mirador, 10°10'06.1"N, 85°21'47.4"W, 430 m, bosque húmedo premontano transición a basal, epífitas sobre *Spondias mombin*, en bosque secundario, 12 julio 2005, *D. Bogarín 1686 y F. Paniagua* (JBL-spirit).

12. *Guarianthe* Dressler & W.E. Higgins, Lankesteriana. 7: 37. 2003.

TYPE: *Guarianthe skinneri* (Bateman) Dressler & W.E. Higgins

Plants epiphytic, caespitose, erect, often in large, dense clumps. *Pseudobulbs* clavate, fleshy, apically bifoliate, concealed by long tubular scarious sheaths, the oldest pseudobulbs striated and without leaves. *Leaves* subopposite, conduplicate, elliptic to oblong-lanceolate, coriaceous, thick. *Inflorescence* terminal, racemose, from a prominent papyraceous spathe with 4–12 flowers clustered together. *Flowers* showy, spread, resupinated, purple-rose, or orange. *Sepals* subsimilar, elliptic, free, spreading, or connivent. *Petals* broader than the sepals, widely elliptic to rhombic-ovate, free, sometimes waved along the margins. *Lip* infundibuliform, funnel-shaped, folded closely over the column, and spreading apically in natural position. *Column* clavate, wingless, more or less arcuate. *Anther* incumbent, terminal, operculate. *Pollinia* 4, ceraceous, with caudicles. *Capsule* ellipsoid, prominently ribbed.

A genus of four species ranging from Mexico through Central America and northern South America. Three species in Costa Rica and one in BHNP.

Guarianthe skinneri (Bateman) Dressler & W.E. Higgins, Lankesteriana. 7: 37. 2003. Fig. 11H, 32.

Basionym: *Cattleya skinneri* Bateman, Orchid. Mexico & Guatemala, t. 13. 1839. TYPE: GUATEMALA. *G. U. Skinner s.n.* (Holotype: K).

Plant epiphytic, caespitose, erect, stout, to about 50 cm tall. *Rhizome* cylindric, repent, covered by tightly appressed scarious, imbricate bracts, to 5 cm long. *Roots* fleshy, flexuous, glabrous to 2–3 mm in diam., whitish, the tips green. Pseudobulbs stalked, fusiform or clavate, attenuated into a terete jointed stalk, laterally compressed, wrinkled and furrowed with age, enfolded by many tightly appressed bracts becoming papyraceous, 8–40 cm long, 1.5–3.5 cm in diam., 2 leaved apically. *Leaves* oblong-elliptic, conduplicate, fleshy-coriaceous, acute to obtuse, slightly retuse, arching, 9.0–22.0 × 2.5–6.5 cm. *Inflorescence* apical, racemose, erect, usually with 4–15 flowers, to 15 cm long, peduncle to 10 cm long, developed from a prominent papyraceous spathe to 6–12 cm long. *Ovary* terete, slender, smooth, pedicellate, up to 6.5 cm long. *Flowers* medium-sized, showy, rose-purple, rarely white, the lip with the center white, rarely yellow or purple. *Dorsal sepal* linear-lanceolate to elliptic-lanceolate, acute, erect, entire, somewhat reflexed, 3.5–6.5 × 0.8–1.8 cm. *Lateral sepals* spreading, free, entire, subequal, elliptic-lanceolate, acute, somewhat oblique, 4.0–6.5 × 1.0–1.8 cm. *Petals* broadly ovate or elliptic to lanceolate, acute or obtuse, entire, somewhat undulate, wider than sepals, 3.5–6.7 × 1.6–6.5 cm. *Lip* infundibuliform in the lower half, funnel-shaped or folded closely over the column, apically expanded and somewhat undulate, the lamina oblong-elliptic, obovate, somewhat pandurate or obscurely 3-lobed when spread out, truncate, emarginate or obtuse, with a prominent keel along the middle, 3.5–8.0 × 2.0–4.5 cm. *Column* semiterete, clavate, straight, 3-toothed at the apex, to 1.7 cm long. *Pollinia* 4, laterally compressed, ovoid, with granulose caudicles. *Anther cap* cucullate, 4-celled.

Distribution: from southern Mexico to Costa Rica.

Distribution in the Park: one population was found at Cerro Barra Honda near the cactus forest, in a rocky area of scattered trees of *Bursera simarouba*, *Plumeria rubra*, and *Cedrela odorata*. A flower was collected on the ground at Cerros de Jesús, probably below where the plant was located high in the canopy.

Eponymy: dedicated to the Briton George Ure Skinner (1804–1867), businessman, diplomat, amateur botanist, and the most crucial figure in the history of orchids in Central America during the first half of the 19th century.

Habitat and ecology: epiphytic or lithophytic in premontane wet and premontane moist forest, tropical dry forest and moist province transition, in the seasonal warm, humid areas of the Cordillera de Guanacaste, Tilarán, and Central, around Valle Central toward Península de Nicoya and the seasonal areas of Valle del Térraba from 200 to 1400 m of elevation.

Phenology: from January to April, rarely in December and May.

Discussion: it is distinguished by the fusiform, bifoliate pseudobulbs, the apical racemose inflorescence developed from a prominent papyraceous spathe, and the rose-purple flowers with a trumpet-like lip, folded around the column in the lower half and spreading apically. It is the national flower of Costa Rica. Populations are reduced in the wild because of overcollection and the destruction of the habitat. At BHNP, it could be confused with *Epidendrum stamfordianum*, but plants have 2-leaved pseudobulbs with shorter, apical, racemose inflorescences and bigger, rose-purple flowers.

Additional specimens examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 421 m, bosque húmedo premontano transición a basal, epífita en *Plumeria rubra* (Apocynaceae), 21 febrero 2006, *D. Bogarín 2607* (JBL-spirit). Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, 370 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario maduro sobre una quebrada estacional con árboles altos, 23 febrero 2012, *D. Bogarín 9515 y F. Pupulin* (JBL-spirit).

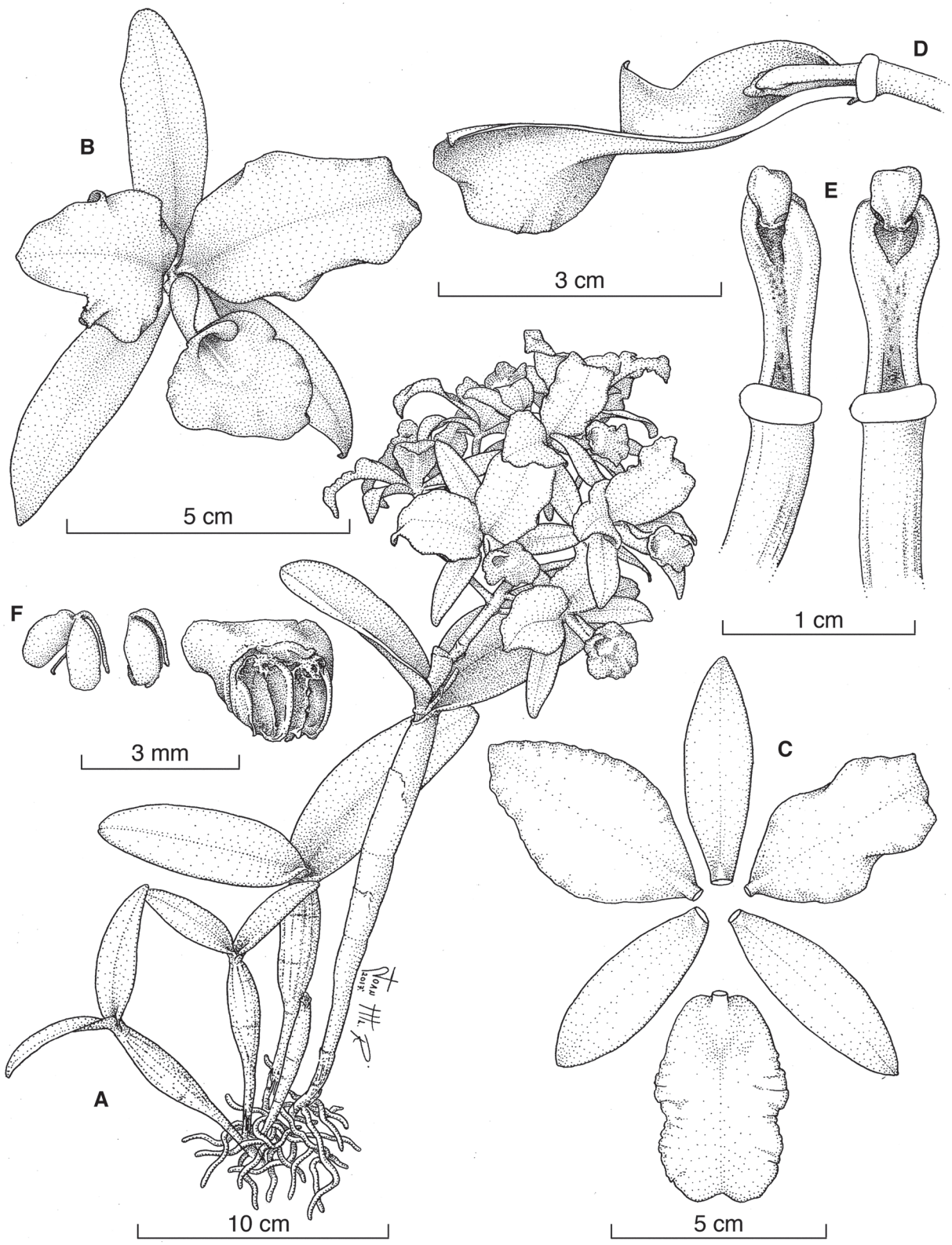

FIGURE 32. *Guarianthe skinneri* (Bateman) Dressler & W.E. Higgins. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip (longitudinal section), side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by Joan M. Ramírez from *Bogarín 2607* (JBL).

13. *Habenaria* Willd., Sp. Pl. 4(1): 5, 44. 1805.
TYPE: *Habenaria macroceratitis* Willd.

Plants terrestrial or palustrine, erect herbs. *Roots* fleshy or tuberous. *Tubers* ovoid, fusiform, or subglobose. *Stem* erect, with cauline or basal leaves, the leaves rarely reduced to bracts. *Leaves* thin to fleshy, rosulate, or spiralate, usually prominent, deciduous during the dry season. *Inflorescence* terminal, erect, few- to many-flowered, spicate or racemose. *Flowers* spurred, spread, often showy, in racemes, rarely solitary. *Floral bracts* often large and conspicuous. *Sepals* subequal, free or connate at the base, the dorsal erect, usually concave, forming a hood over the column, the laterals spreading or deflexed. *Petals* similar to the sepals but usually smaller, or more or less deeply bifid (rarely trifid or polyfid), usually connivent with the dorsal sepal. *Lip* simple or 3-lobed, often adnate to the column, spreading or pendulous, at the base producing a spur. *Column* short, footless. *Stigmas* often 2-lobed and elongated into short or comparatively long processes. *Anther* erect, more or less resupinate, persistent. *Pollinia* granular, sectile, with short or sometimes long separated caudicles from the base.

A Pantropical genus of about 600 species found mainly in grasslands, woodlands, savannas, meadows, or swamps. About 20 species in Costa Rica. A single species in BHNP.

Habenaria macroceratitis Willd., Sp. Pl. 4(1): 44. 1805. Fig. 11I, 33.
TYPE: Jamaica. *Habitat in graminosis depressis subalpinis Jamaicae* (Lectotype designated by Cafferty and Jarvis, 1999: LINN-1054.14).

Plants terrestrial, with a single slender, foliaceous stem, without pseudobulbs, up to 1.2 m tall, stem, and leaves deciduous during the dry season. *Tuber* ovoid, subglobose, up to 4 cm in diam. *Roots* fibrous, numerous, up to 4 mm in diam. *Leaves* obovate or oblong-elliptic, acute or obstuse, caulinar, subcoriaceous, keeled, somewhat plicate, helical, 10–17 leaves, the lower leaves smaller than the apical, articulate with the leaf sheaths, 6–24 × 2–7 cm. *Leaf sheaths* tubular, appressed to the stem, 3.5–4.0 cm long. *Inflorescence* apical, racemose, lax, with several helical flowers, 15–25 cm long, covered by prominent leafy bracts to 4 cm long. *Floral bracts* prominent ovate, acute, up to 8 cm. *Ovary* pedicellate, up to 3.5 cm long. *Flowers* showy, resupinate, the lateral sepals and the spur green, the petals and the dorsal sepal white with the apex cream, the anther yellowish, provided with long, filiform spurs. *Dorsal sepal* ovate to orbicular, deeply concave, slightly emarginate, obtuse, margins recurved, 1.0 × 1.2 mm. *Lateral sepals* ovate to elliptic, subfalcate, free, spread, conduplicate, somewhat concave, with revolute margins, reflexed apically, 4.5 × 2.0 cm. *Petals* bifid, the upper lobe 1.2 × 3.5 mm, oblong, subfalcate, erect, connivent with the dorsal sepal forming a hood over the column, the lower lobe linear-filiform, attenuate, expanded, falcate apically, up to 5.0 × 0.1 cm. *Lip* strongly trilobed, the midlobe oblong, 2.0 × 0.3 cm, the lateral lobes longer than the middle, linear, deflexed, attenuate, 4.0 × 0.1 mm, the spur prominent, linear, widened apically, laterally flattened, hanging, 8.2–10.0 cm long. *Column* with 2 falcate arms, papillose at the base, the anther with 2 chambers in which the 2 hemipollinaria are inserted, surrounded by membranous sacciform tissue with a longitudinal opening, stigma 2-lobed, the lobes falcate, connivent, leaving a rounded spur entrance, 3.5 × 1.2 cm. *Pollinarium* 2, obovate, granular, and sectile, with a filiform stipe, viscidium peltate. *Anther cap* membranaceous.

Distribution: from Florida (USA) and Mexico to Guyana, Trinidad, and the Antilles.

Distribution in the Park: common at the beginning of Ceiba and Mirador trails and around the parking area at Cerro Barra Honda.

Etymology: from the Greek *macro*, "large," *keras*, "horn," and *itis*, "swollen," probably in allusion to the large swollen spur of the lip.

Habitat and ecology: terrestrial in seasonal tropical premontane wet and premontane moist forest from 0 to 250 m of elevation. Plants grow vegetatively during the wet season starting in May and develop inflorescences after June. During the dry season the leaves fall, and the tuber remains alive underground. Plants may be pollinated by nocturnal moths, as the white flowers with long spurs suggest.

Phenology: from August to October.

Discussion: it is easily characterized by the terrestrial plants with a subglobose tuber and a single elongate, slender, foliaceous stem with helical caulinar leaves, which are deciduous during the dry season. The flowers are showy, white with green sepals. The lip is deeply 3-lobed with a long filiform spur.

Additional specimens examined: BHNP, bifurcación del camino en Sendero Ceiba y Mirador, 10°10'25.4"N, 85°21'40.1"W, 410 m, bosque húmedo premontano transición a basal, terrestres a orillas del camino, bosque secundario, 23 julio 2005, *D. Bogarín 1726 y F. Paniagua* (JBL-spirit). Same locality, *D. Bogarín 1724 y F. Paniagua* (JBL-spirit). BHNP, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestres orillas del camino, bosque secundario, 7 noviembre 2011, *D. Bogarín 9413* (CR).

14. *Heterotaxis* Lindl., Bot. Reg. 12: t. 1028. 1826.
TYPE: *Heterotaxis crassifolia* Lindl.

Plants epiphytic, pendent, with sympodial growth and laterally compressed, oblong, unifoliate, aggregate pseudobulbs subtended by several foliaceous sheaths (rarely without pseudobulbs). *Leaves* coriaceous, linear to linear-oblong or ensiform, obtuse to acute. *Inflorescence* produced from the axil of the leaves, 1-flowered. *Flowers* fleshy, yellowish, campanulate with perianth fibers. *Sepals* oblong, fleshy, acute. *Petals* linear-oblanceolate, acute. *Lip* simple, obscurely 3-lobed, elliptic, articulate with the column foot with a thickened, often farinose callus. *Column* elongate, arcuate, semiterete, produced at the base into a short foot. Pollinia 4, in 2 different sized pairs, on a short, rounded, basally dilated stipe. *Anther cap* cucullate, glabrous, 1-celled. *Capsules* ellipsoid, with lateral dehiscence.

A Neotropical genus of about 13 species ranging from northern Mexico to Brazil, Bolivia, and the Caribbean. Three species in Costa Rica, one in BHNP.

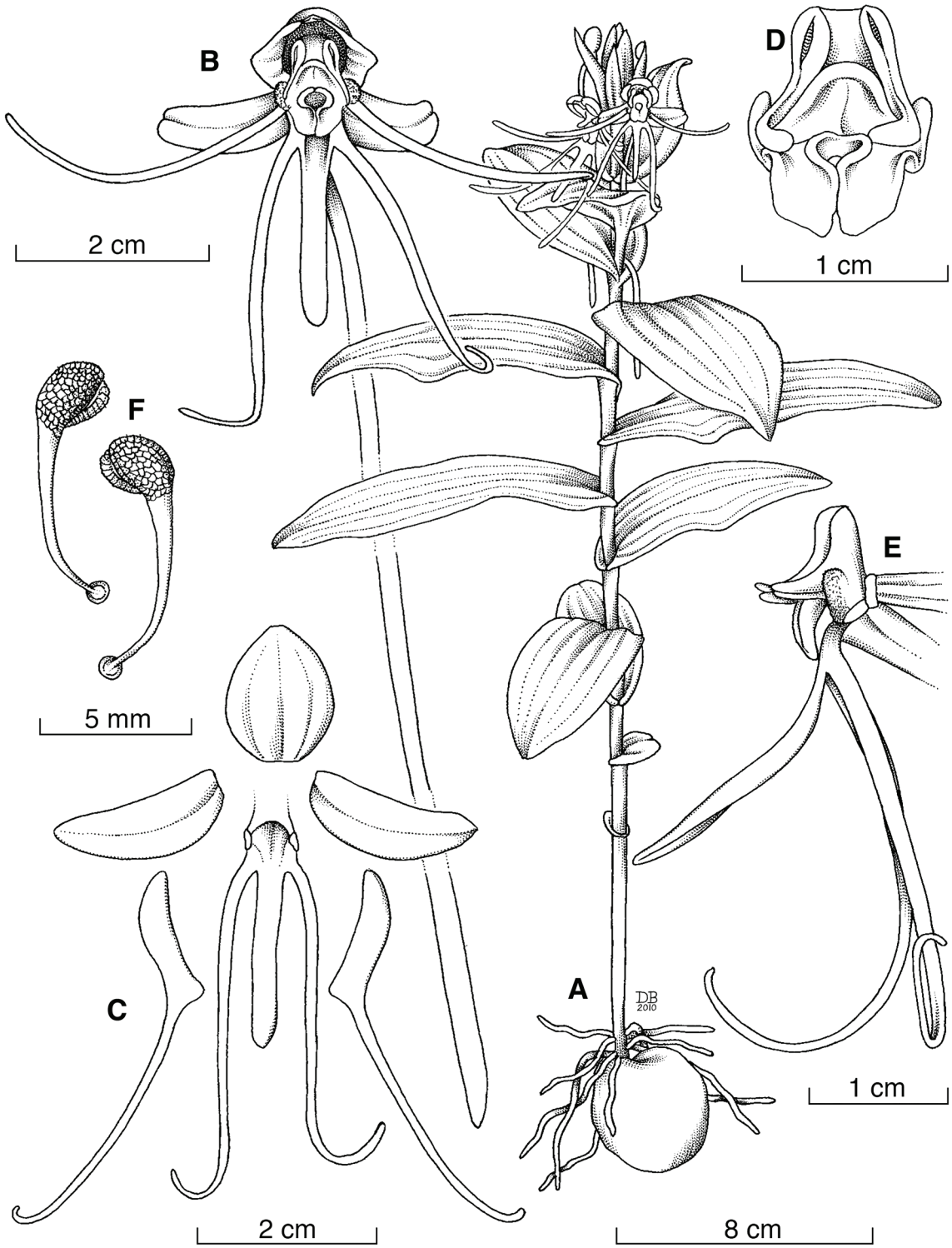

FIGURE 33. *Habenaria macroceratitis* Willd., **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium. Drawn by D. Bogarín from *Bogarín 1726* (JBL).

Heterotaxis sessilis (Sw.) F. Barros, Hoehnea 29(2): 11. 2002. Fig. 12A, 34.

Basionym: *Epidendrum sessile* Sw., Prodr. 122. 1788. TYPE: JAMAICA. *O. Swartz s.n.* (Holotype: BM).

Homotypic synonyms: *Maxillaria sessilis* (Sw.) Fawc. & Rendle, Fl. Jamaica 1: 120–121. 1910, *nom. illeg.*

Plants epiphytic, cespitose, pendent, with a short rhizome, to about 50 cm tall. *Roots* filiform, glabrous, to 2 mm in diam. *Pseudobulbs* oblong, inconspicuous, monophyllous, subtended by 2–3 distichously imbricating, fleshy, foliaceous sheaths, to 3.0 × 1.5 cm. *Leaves* coriaceous, linear to linear-oblong, obtuse to subacute, forming at the base a more or less complanate petiole, 7.0–47.0 × 1.4–2.8 cm. *Inflorescence* produced from the axils of the upper leaves, generally 1-flowered, with a short peduncle 1 to 3.5 cm long, provided by a scarious bract. *Ovary* pedicellate, subclavate, about 1 cm long. *Flowers* of moderate size, pale yellow, the lip marked with purple. *Dorsal sepal* oblong-elliptic to lanceolate, subacute, conspicuously concave, fleshy, 17.0 × 6.5–7.0 mm. *Lateral sepals* obliquely ovate-oblong, subacute, dorsally carinate, 16 × 6 mm, adnate to the column, forming an inconspicuous, rounded mentum. *Petals* linear-oblanceolate, acute, curved, 13 × 4 mm. *Lip* obscurely 3-lobed, elliptic-lanceolate, contracted at the base and articulate with the column foot, to 16 × 9 mm when spread out; lateral lobes rounded, erect; midlobe subobtuse, thickened and farinose to minutely papillose; disc with a ligulate, fleshy, thickened, farinose callus. *Column* elongate, arcuate, semiterete, to 12 mm long, produced at the base into a short foot. *Pollinia* 4, in two different sized pairs, on a short, rounded, basally dilated stipe. *Anther cap* cucullate, glabrous, 1-celled. *Capsule* ellipsoid, 6-ridged, to 3 cm long.

Distribution: widespread from southern Mexico and Florida (USA) to Brazil and the Antilles.

Distribution in the Park: it is found at Las Cascadas and Los Mesones in the humid evergreen forest. The specimen studied was collected at Cerros de Jesús.

Etymology: from the Latin *sessilis*, "sessile, stalkless," in allusion to the compressed leaf base.

Habitat and ecology: plants are common in tropical seasonal or deciduous dry forest and humid tropical moist forest along the Caribbean and Pacific lowlands at elevations below 800 m. Plants are generally found on large trunks in medium-shaded conditions, often forming large clumps on the host tree. Mostly found on *Anacardium excelsum*, *Brosimum aliscastrum*, and *Sideroxylum capiri*.

Phenology: flowering season occurs from February to May, but may extend to October.

Discussion: it is characterized by the pendent, fan-shaped plants with fleshy, conspicuously veined leaves; the pseudobulbs are obsolete, 1-leaved, subtended by several foliaceous sheaths. The flowers are inconspicuous, campanulate, yellow with the lip purple-spotted, and produced at the base of the pseudobulbs.

Additional specimens examined: BHNP, Las Cascadas (the waterfalls), entering from Finca San Diego (Finca Los Trejos), 10°10'59.86"N, 85°20'17.41"W, 86 m, premontane moist, transition to tropical moist forest, epiphytic in gallery forest on *Brosimum alicastrum* "Ojoche" (Moraceae) close to a stream, 22 February 2012, *D. Bogarín s.n.* (unvouchered).

15. *Laelia* Lindl., Gen. Sp. Orchid. Pl. 96, 115. 1831. *nom. cons.*

TYPE: *Laelia grandiflora* (La Llave & Lex.) Lindl.

Plants epiphytic or rupicolous, caespitose. *Pseudobulbs* aggregate, compressed or terete, thickened, discoid, clavate, orbicular, laterally compressed, rugulose to sulcate. *Leaves* 1–3 at the pseudobulb apex, elliptic to linear, coriaceous, subsessile. *Inflorescence* apical, a simple or compound raceme developed on an elongated scape with flowers arranged in a helical, subdistichous or distichous pattern. *Flowers* large and showy, clustered at the apex of the inflorescence, resupinate. *Sepals* subequal to the petals, often narrower, free, spreading, flat or undulate. *Petals* subequal or broader than the sepals, spreading, often undulate-crispate. *Lip* free or slightly adnate to the column, more or less 3-lobed, the lateral lobes usually convolute enfolding the column, flat to crispate, with a callus of several keels or lamellae running toward the apex. *Column* winged or wingless, often toothed at the apex. *Anther* operculate, incumbent. *Pollinia* 8, unequal, waxy, ovoid, laterally compressed. *Capsule* ellipsoid.

A Neotropical genus of about 25 species ranging from northern Mexico to Brazil, Bolivia, and the Caribbean. Two species in Costa Rica, one in BHNP.

Laelia rubescens Lindl., Edwards's Bot. Reg. 26: t. 41, also misc. 20. 1840. Fig. 12B, 35–36.

TYPE: "For this specimen I am indebted to Mr. Barker, who purchased it some time ago from Mr. Joseph Knight, Nurseryman, in the King's Road. Its native country is unknown, but is probably Mexico," *J. Knight s.n.* (Holotype: K).

Homotypic synonyms: *Amalia rubescens* (Lindl.) Heynh., Alph. Aufz. Gew. 2: 29. 1846.

Cattleya rubescens (Lindl.) Beer, Prakt. Stud. Orchid.: 214. 1854.

Bletia rubescens (Lindl.) Rchb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 425. 1862.

Encabarcenia rubescens (Lindl.) Archila & Szlach., Revista Guatemalensis 17: 26. 2014.

Schomburgkia rubescens (Lindl.) Peraza & Carnevali, Taxon 65: 1259. 2016.

Plants epiphytic, rarely rupicolous, slightly repent, caespitose up to 75 cm tall. *Roots* filiform, flexuous, to 2 mm in diam., with green or reddish tips. *Rhizome* short, covered by papyraceous bracts. *Pseudobulbs* aggregate, sessile, elliptic to orbicular, subglobose, laterally flattened, subprostrate, rugulose, or somewhat wrinkled appearance, especially in the old pseudobulbs, 3.0–8.2 × 2.5–6.2 cm, subtended by clasping ovate, membranaceous, conduplicate sheaths up to 6.5 cm long. *Leaves* 1 (rarely 2), at the apex of the pseudobulb, oblong-elliptic, obtuse to obliquely retuse at the apex, fleshy-coriaceous, glossy, conduplicate, somewhat cuneate abaxially, 3.5–20.0 × 3.1–5.5 cm. *Inflorescence*

FIGURE 12. **A–I.** Orchid species found at Barra Honda National Park. **A,** *Heterotaxis sessilis* (*Pupulin 8201*, JBL). **B,** *Laelia rubescens* (*Bogarín 1666*, JBL). **C,** *Lalexia quadrifida* (*Bogarín 1676*, JBL). **D,** *Leochilus scriptus* (*Bogarín 9385*, JBL). **E,** *Lophiaris oerstedii* (*Pupulin 8189*, JBL). **F,** *Malaxis aurea* (*Bogarín 1755*, JBL). **G,** *Maxillariella acervata* (*Pupulin 4053*, JBL). **H,** *Oeceoclades maculata* (*Bogarín 4061*, JBL). **I,** *Pelexia barrahondaensis* (*Pupulin 8168*, JBL). Photographs by the authors.

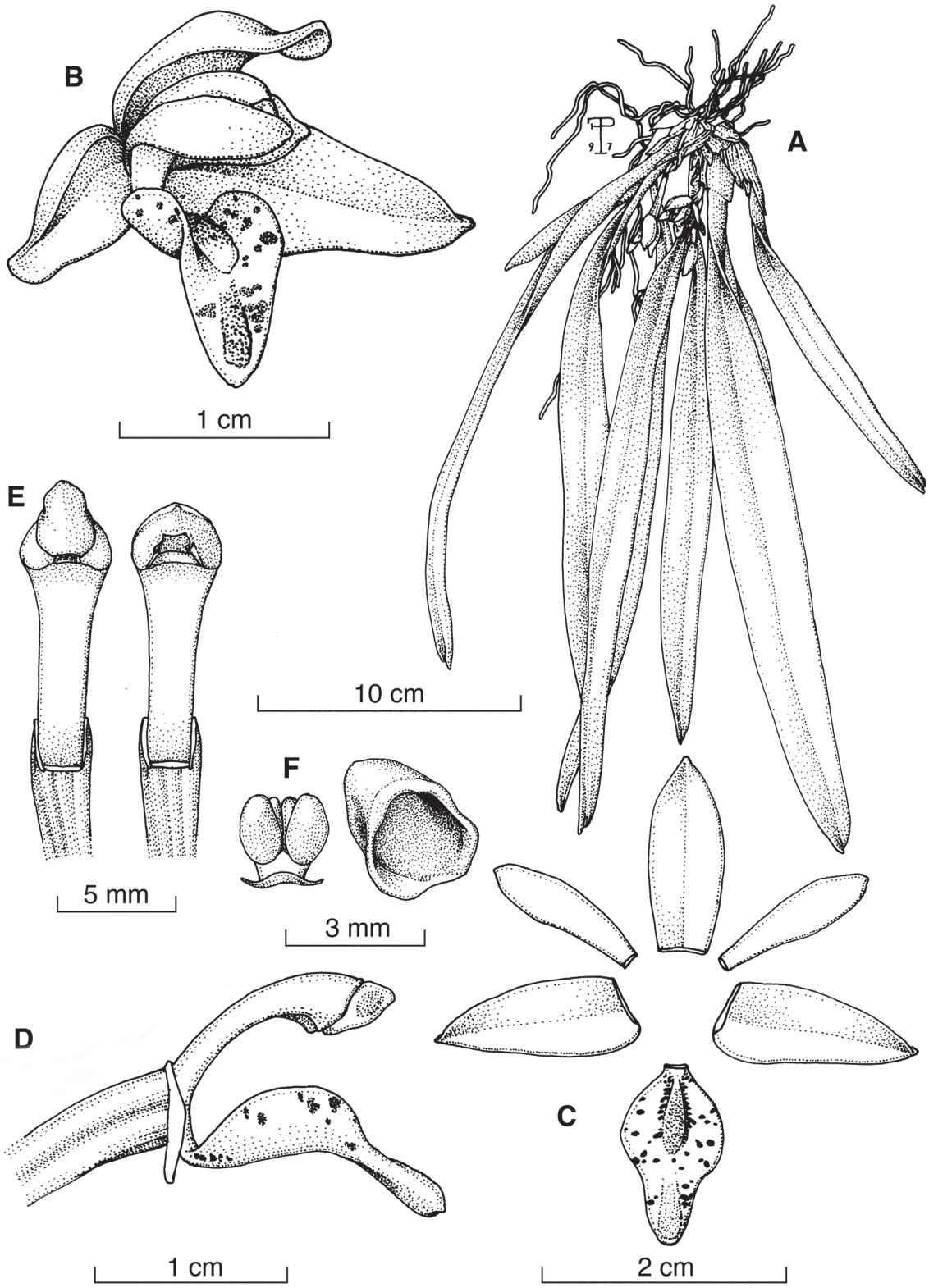

FIGURE 34. *Heterotaxis sessilis* (Sw.) F. Barros. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 312* (JBL).

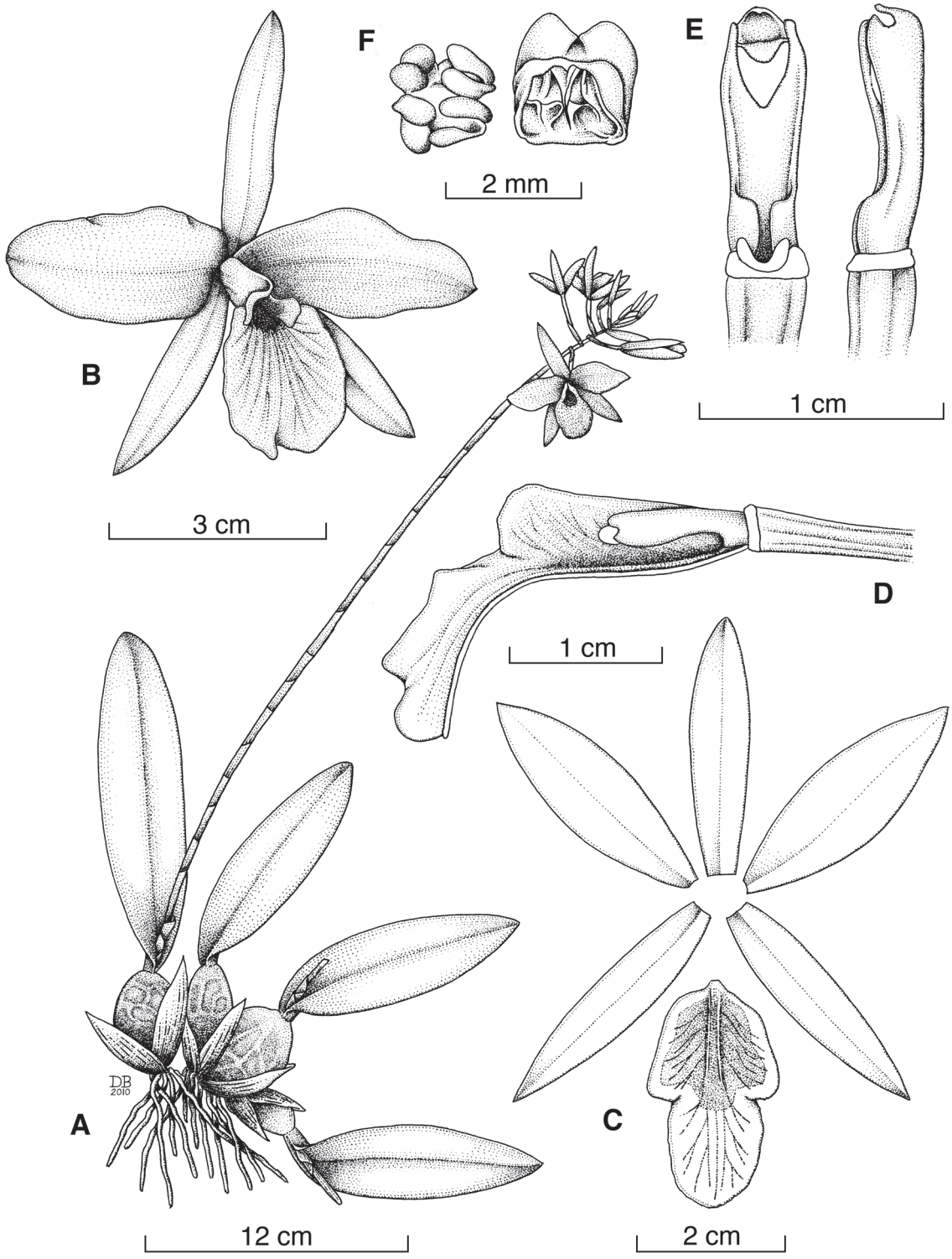

FIGURE 35. *Laelia rubescens* Lindl. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip (longitudinal section), side view. **E,** Pollinarium and anther cap. Drawn by D. Bogarín from *Bogarín 1666* (JBL).

FIGURE 36. *Laelia rubescens* flowering in situ at BHNP. Photograph by F. Pupulin.

terminal, elongated, terete, subcorymbose, successively flowered, the flowers arranged in a helical, subdistichous pattern, concealed by several tubular, acute, papyraceous bracts to 7 cm long, peduncle, 25–95 cm long, rachis to 6 cm long. *Floral bracts* oblong-lanceolate, obtuse to subacute, canaliculate, scarious, 1.5 × 0.2 cm. *Ovary* pedicellate, 2.3–4.5 cm long. *Flowers* rose-purple or rose-lavender, rarely white, with a dark purple or carmine blotch on the central portion of the lip surrounded by a white-cream stain at the base of the midlobe, spread, fragrant (grape-like). *Sepals* linear-elliptic or linear-lanceolate, obtuse to narrowly acute, somewhat oblique, slightly thickened apically, 3.2–4.3 × 0.4–0.7 cm. *Petals* free, spread, broadly elliptic, wider than sepals, obtuse to acute, somewhat undulate, 3.4–4.2 × 1.5–1.8 cm. *Lip* 3-lobed, 2.2–3.7 × 1.7–2.2 cm, lateral lobes rounded-obtuse, involute, folded over the column, midlobe oblong-quadrate to oblong-oval, subtruncate to acute or somewhat emarginate, basally puberulent, spread, wavy, 1.0–1.7 mm wide, with 2–3 parallel keels extending up to the base of the midlobe and several low keels radiating from the base toward the margins. *Column* semiterete, clavate, basally cuniculate in the entrance of a short nectary, somewhat broadened and tridentate apically, 7–13 mm long. *Stigma* ventral, entire. *Anther* incumbent, operculate, 4-celled. *Pollinia* 8, with caudicles.

Distribution: from Mexico to the northern and central Pacific of Costa Rica.

Distribution in the Park: it is a common epiphyte growing on several phorophytes such as *Bursera simarouba* and *Bursera permollis* (Burseraceae), *Spondias mombin*, *Cedrela odorata* (Meliaceae), *Brosimum aliscastrum* (Moraceae), and *Sideroxylum capiri* (Sapotaceae). It is found along Ceiba and El Mirador trails, toward Las Cascadas, Bosque de Piedra, Los Mesones, Las Delicias, and Cerros Quebrada Honda.

Etymology: from the Latin *rubescens*, "turning red, reddening," in allusion to the flowers' color.

Habitat and ecology: plants are common elements of the tropical seasonal or deciduous dry forest of northern Guanacaste and Puntarenas at elevations below 800 m. They grow in medium-shaded environments or exposed to full sunlight conditions, often forming large colonies on the host tree branches (Fig. 36).

Phenology: flowering season occurs from September to February, rarely to March.

Discussion: it is characterized by the aggregate, elliptic to orbicular, subglobose, flattened, ancipitous pseudobulbs having a single elliptical leaf and the long pedunculate apical inflorescence with several rose-purple flowers with the petals wider than the sepals and the lip involute, folded

over the column with a dark purple center. The flower is similar in appearance to a small *Guarianthe skinneri*.

Additional specimens examined: BHNP, Sendero Ceiba, desviación hacia Las Cascadas, La Mantequilla, 10°10'37.0"N, 85°21'09.6"W, 415 m, bosque húmedo premontano transición a basal, epífita sobre Myrtaceae, en bosque secundario, 11 julio 2005, *D. Bogarín 1666 y F. Paniagua* (JBL-spirit). BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, epífita en *Plumeria rubra* (Apocynaceae), 21 febrero 2006, *D. Bogarín 2598* (JBL-spirit).

16. *Lalexia* Luer, Harvard Pap. Bot 16(2): 358. 2011.
TYPE: *Lalexia quadrifida* (Lex.) Luer.

Loddigesia Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 105: 251 (2006), *nom. illeg*.

Plants epiphytic, caespitose. *Stems* erect, enclosed by tubular sheaths, with an annulus. *Leaf* coriaceous, elliptical to oblong, acute, sessile or petiolate. *Inflorescence* apical, racemose, distichous, subcongested, produced from a papery spathe, multiflowered and longer than the leaf. *Flowers* resupinate, yellow to yellow-green, secund. *Sepals* connate in an ovate, obtuse, subcarinate, concave synsepal, *Petals* ovate, acute, concave. *Lip* obovate-pandurate, slightly arcuate, the margins irregular, basally truncate, the basal lobes rounded and erect, the midlobe rounded, obtuse. *Column* terete, slightly arcuate, footed, apically denticulate with a prominent clinandrium. *Anther*, apical. *Stigma* ventral. *Pollinia* 2, obovate. *Anther cap*, cucullate, with 2 cells.

A genus of one or two species ranging from Mexico to northern South America and the Antilles. One species in Costa Rica and at BHNP.

Lalexia quadrifida (La Llave & Lex.) Luer, Harvard Pap. Bot. 16(2): 358. 2011. Fig. 12C, 37.

Basionym: *Dendrobium quadrifidum* La Llave & Lex., Nov. Veg. Descr. 2 (Orch. Opusc.): 40–41. 1825. TYPE: Habitat supra arbores versus Jesus del monte, propé Vallisoletum. Floret Septembri, *J. J. M. de Lexarza s.n.* (Holotype: G).

Homotypic synonyms: *Humboltia quadrifida* (La Llave & Lex.) Kuntze, Revis. Gen. Pl. 2: 668. 1891.
Loddigesia quadrifida (La Llave & Lex.) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 105: 251. 2006. *Pleurothallis quadrifida* (La Llave & Lex.) Lindl., Edwards's Bot. Reg. 28: Misc. 70. 1842. *Stelis quadrifida* (La Llave & Lex.) R. Solano & Soto Arenas, Icon. Orchid. (Mexico) 5–6: xi. 2003. *Specklinia quadrifida* (La Llave & Lex.) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 263. 2004.

Heterotypic synonyms*: Pleurothallis racemiflora* Lindl. ex Lodd. Bot. Cab. 10: t. 949. 1824 [1825], *nom. illeg*.
Pleurothallis lyroglossa Schltr., Repert.Spec. Nov. Regni Veg. 8(191–195): 566. 1910. TYPE: COSTA RICA. [Guanacaste]: in den Wäldern von Nicoya, blühend im Dez 1899, *A. Tonduz s.n.* (Museo Nacional de Costa Rica) 13731 (Holotype: B, destroyed; Lectotype: designated by Luer, 2000, tracings of the original drawing of the holotype made under Schlechter's supervision: AMES).

Plants epiphytic, caespitose, up to 16 cm tall. *Roots* slender, up to 1 mm in diam., white with green tips. *Ramicaul* cylindrical, erect, stout, 1-leaved, up to 5 cm long, covered by papyraceous, tubular bracts, appressed bracts to 7 cm long. *Leaf* erect, glossy, glaucous-translucent adaxially, light green abaxially, oblong-elliptic to elliptic-obovate, obtuse, conduplicate, thick, somewhat arcuate, the base cuneate into a petiole, 5.0–13.0 × 1.8–2.5 cm. *Inflorescence* apical, racemose, distichous, subcongested, with 5–30 secund, simultaneous flowers, to 28 cm long, peduncle to 8 cm long, produced from a papery spathe up to 1.5 cm long. *Floral bracts* oblique acute, to 5 mm long. *Pedicel* 5 mm long, persistent. *Ovary* cylindrical, basally arcuate, sulcate, up to 5 mm long. *Flowers* resupinate, yellow to yellow-green, secund. *Dorsal sepal* ovate, acute, concave, glabrous, subcarinate, 0.7–1.2 × 0.4–0.5 cm. *Lateral sepals* connate in an ovate, obtuse, subcarinate, concave synsepal, 0.7–1.3 × 0.4–1.2 cm. *Petals* ovate, acute, concave, parallel to the column, 0.5–0.9 × 0.3–0.4 cm. *Lip* obovate-pandurate, slightly arcuate, the margins irregular, basally truncate, the basal lobes rounded and erect, the midlobe rounded, obtuse, the disc with 2 low, thick, keels running from the base up to the middle third, sulcate between the keels, hinged to the column foot, 4–6 × 2–3 mm. *Column* 3.0 × 0.8 cm, terete, slightly arcuate, footed, apically denticulate with a prominent clinandrium. *Anther*, apical. *Stigma*, ventral. *Pollinia* 2, obovate. *Anther cap*, cucullate, with 2 cells.

Distribution: from Mexico to Colombia, Venezuela, and the Antilles.

Distribution in the Park: they are found growing on *Syderoxylum capiri* (Sapotaceae), *Brosimum aliscastrum* (Moraceae), and *Spondias mombin*, along the trails El Mirador and La Ceiba, and along Las Cascadas and Bosque de Piedra.

Etymology: from the Latin *quadrifidus*, "four-divided, split into four," in allusion to perianth parts.

Habitat and ecology: epiphytic in tropical dry forest and tropical moist forest along the Pacific coast around Península de Nicoya, Cordillera de Tilarán, and Valle Central toward Península de Osa, at elevations from 100 to 1200 m.

Phenology: from December to April.

Discussion: characterized by the caespitose, erect plants without pseudobulbs, the slender, elongate, cylindrical stems with 1 oblong, fleshy, coriaceous, glaucous, translucent adaxially leaf, producing a lax inflorescence with completely yellow secund flowers. The flowers have a distinct synsepal, and the lip is distinguished by its panduriform shape (Luer, 2011). According to phylogenetic studies, this species is related to *Pleurothallis* R. Br. rather than to *Stelis* Sw., but it can also be recognized as a distinct genus (*Lalexia* Luer) because it forms an independent clade apart from *Pleurothallis* s.s. (Pérez-Escobar et al., 2017). If

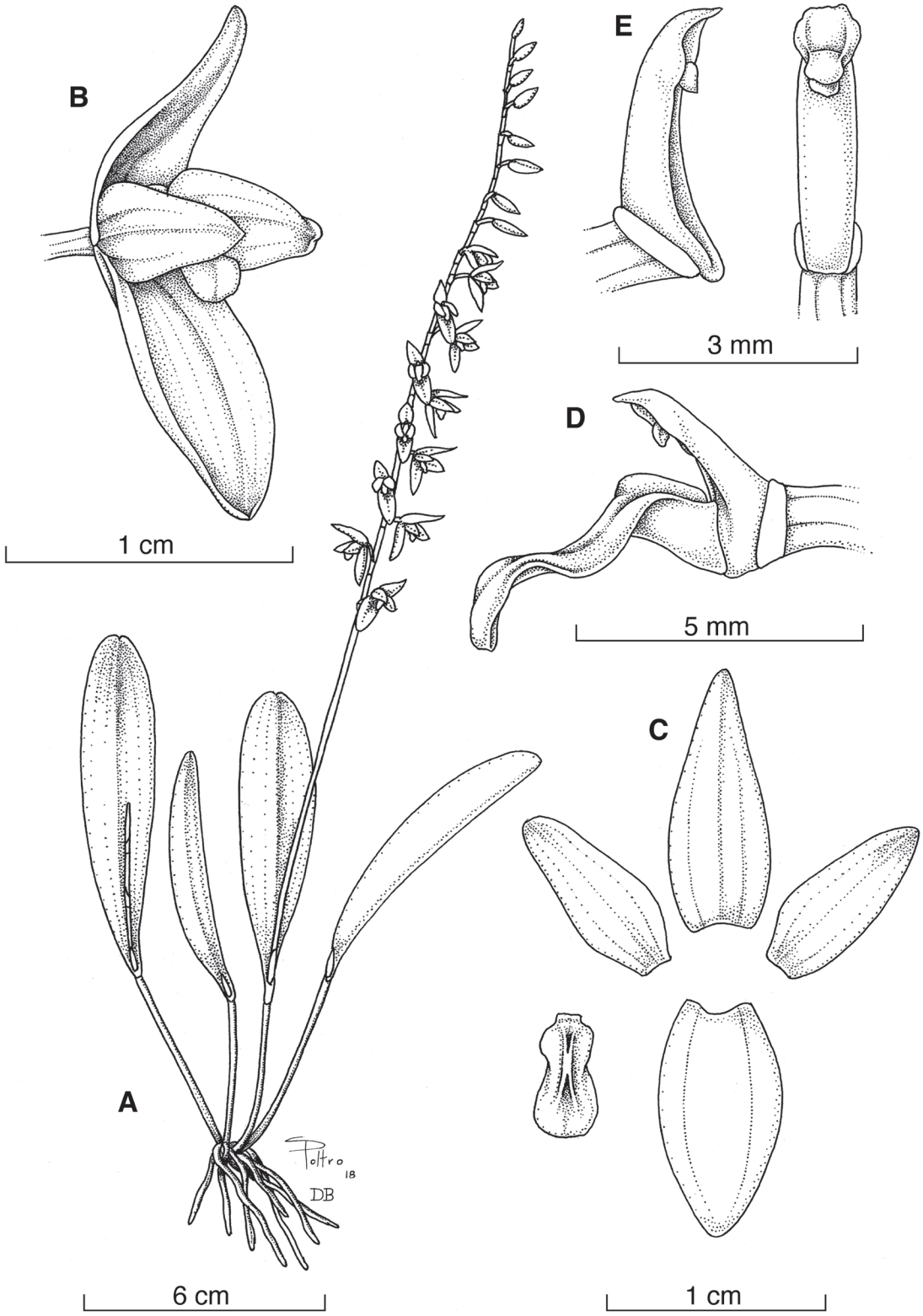

FIGURE 37. *Lalexia quadrifida* (La Llave & Lex.) Luer. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. Drawn by D. Bogarín and S. Poltronieri from *Bogarín 1676* (JBL).

treated in *Pleurothallis*, it should be named as *Pleurothallis quadrifida* (Lex.) Lindl. The name *Pleurothallis racemiflora* (Sw.) Lindl. ex Hook. was applied to this species (Pupulin, 2002); however, it refers to a different species found in Cuba, the Dominican Republic, and Jamaica known as *Stelis multirostris* (Rchb.f.) Pridgeon & M.W. Chase. In addition, *Pleurothallis racemiflora* Lindl. ex Lodd. (=*Pleurothallis quadrifida* (Lex.) Lindl.) is illegitimate because *Pleurothallis racemiflora* (Sw.) Lindl. ex Hook. (=*Stelis multirostris*) has priority.

Additional specimens examined: Guanacaste: BHNP, Sendero Ceiba, sector de Las Cascadas, 10°11'15.0"N, 85°20'36.1"W, 210 m, bosque húmedo premontano transición a basal, epífitas en árbol caido de *Ficus* sp. (Moraceae), 11 julio 2005, *D. Bogarín 1676 y F. Paniagua* (JBL-spirit). BHNP, sector de Las Cascadas ingresando por Finca San Diego (Finca Los Trejos), 10°11'02.90"N, 85°20'20.02"W, 104 m, bosque húmedo premontano transición a basal, epífitas en árbol de Ojoche, *Brosimum alicastrum* (Moraceae), 7 noviembre 2011, *D. Bogarín 9406, Minor Díaz & Dorian Méndez* (JBL-spirit).

17. *Leochilus* Knowles & Westc., Fl. Cab. 2: 143. 1838. TYPE: *Leochilus oncidioides* Knowles & Westc.

Plants small, caespitose, epiphytic herbs with short creeping rhizomes, often growing on twigs. *Pseudobulbs* ovoid, laterally compressed, more or less ancipitous, 1- to 2-foliate at apex, subtended by 1–2 foliaceous sheaths, often hidden. *Leaves* conduplicate, elliptic to oblong, subcoriaceous, articulate. *Inflorescence* lateral, a successively few- to many-flowered raceme or panicle. *Flowers* small, resupinate, greenish yellow usually striped with brown. *Sepals* and *petals* spreading, the lateral sepals variously connate. *Lip* simple or 3-lobed, oblong, the apex bilobed, provided near the base with a fleshy callus serving as an open nectary filled with oil. *Column* erect, nearly terete, footless, often provided with stigmatic arms. *Anther* terminal, operculate, incumbent. *Stigma* rounded, ventral. *Pollinarium* 2, waxy, yellow, pyriform. *Capsule* triangular, ellipsoid.

A Neotropical genus of about 12 species ranging from southern Florida through Mexico, Central America, the Antilles, and South America. Five species in Costa Rica and one at BHNP.

Leochilus scriptus (Scheidw.) Rchb. f., Xenia Orchid. 1(1): 15, t. 6. 1854. Fig. 12D, 38.

Basionym: *Cryptosanus scriptus* Scheidw., Allg. Gartenzeitung 11(13): 101. 1843. TYPE: [BRAZIL]. *Patria Brasilia. Dem habitus und der organisation der Blume nach würde diese Gattung ihre Stelle zwischen Maxillaria und Cymbidium finden* (Holotype: not stated).

Homotypic synonym: *Oncidium scriptum* (Scheidw.) Rchb. f., Ann. Bot. Syst. 6: 772. 1863.

Heterotypic synonym: *Leochilus retusus* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 256. 1923. TYPE: COSTA RICA. [Alajuela]. Arbres des haies au Maderal de San Mateo, alt. 400 m, Jan 1922; fleurs jaune-pâles, *A. M. Brenes 229* (Holotype: B, destroyed; Lectotype designated by Barringer,1986: CR-25897; Isolectotype: AMES).

Plant twig epiphyte, cespitose, to about 15 cm tall, with abbreviated rhizome. *Roots* fleshy, white with green vegetative apex, to 1 mm in diam. *Pseudobulbs* ovate to elliptic, laterally flattened, to 3.2 × 1.5 cm, basally covered by 2–3 leafy sheaths, monophyllous. Leaf linear to linear-elliptic, obtuse, conduplicate, slightly emarginate or unequally 2-lobed, coriaceous, contracted into a short petiole, to 10.0–12.0 × 1.2–2.0 cm. *Inflorescence* basal, to 16 cm long, 1- to many-flowered (mainly 3-flowered), arching, racemose or somewhat paniculate; peduncle terete; bracts triangular-lanceolate, acute, about 0.7 cm long. *Flowers* small, greenish yellow spotted with purple or reddish-brown markings on the petals and lip. *Dorsal sepal* elliptic-obovate, free, concave, acute, keeled on the reverse surface, to 5.5–6.0 × 0.3–0.4 mm. *Lateral sepals* obliquely elliptic-obovate, conduplicate, spreading and somewhat reflexed apically, acute to slightly apiculate, to 7.0 × 0.3 mm. *Petals* linear or ovate-oblong, somewhat conduplicate, apiculate, parallel to the column, to 6.0–7.0 × 3.0–3.5 mm. *Lip* obovate, obtuse, the apex somewhat retuse, flat, spreading or slightly concave, with a small, concave nectary at the base provided with pilose margins; callus trapezoidal, with a central papillose groove and 2 distinct parallel, fleshy, puberulent calli running up to the half of the lip; entire lip 9 × 5 mm. *Column* short, with a pair of triangular, acute, ligular, porrect stigmatic arms, to 2.5 mm long. *Pollinia* 2, subspherical, on a short, ligulate stipe; viscidium peltate, brown. *Anther cap* hemiglobose, 2-celled.

Distribution: from Mexico to northern South America and the Antilles.

Distribution in the Park: plants are easily found growing on insolated trees in pastures surrounding the Park, mostly on twigs of old calabash trees. A population was located between Millal and Caballito, on the eastern boundary of PBNH.

Etymology: from the Latin *scriptus*, "written," in allusion to the petals' marks.

Habitat and ecology: a twig epiphyte of tropical moist and tropical wet forest along the Caribbean and Pacific lowlands from 100 to 1200 m of elevation. It is commonly found on twigs of *Crescencia cujete*, *Codiaeum variegatum* (Euphorbiaceae), *Trichilia havanensis* (Meliaceae), or *Hibiscus* L. sp. (Malvaceae) fences in disturbed areas, gardens, or insolated trees. It is pollinated by two species of Polybiine wasps: *Stelopolybia areata* and *S. hamiltoni* (Chase, 1986).

Phenology: plants flower mostly from October to January, but may throughout the year.

Discussion: plants are distinguished by the monophyllous laterally flattened pseudobulbs, basally covered by 2–3 leafy sheaths and the racemose or paniculate inflorescences with small green-yellow flowers, spotted with red-brown. The seedlings are fan-shaped.

Additional specimens examined: Guanacaste: Nicoya, San Antonio, camino entre Millal y Caballito, en finca limítrofe al Parque Nacional Barra Honda, 10°13'11.27"N,

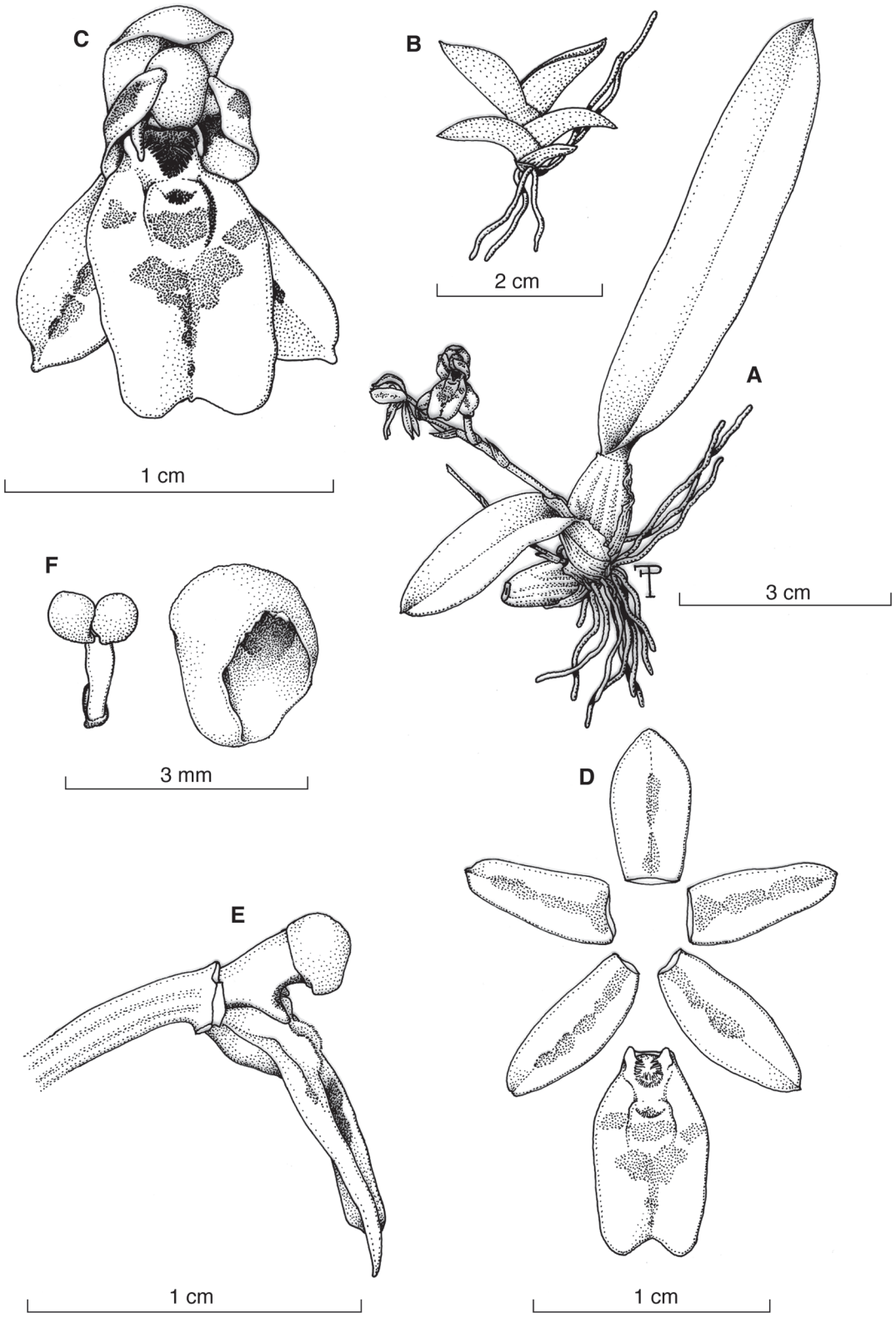

FIGURE 38. *Leochilus scriptus* (Scheidw.) Rchb.f. **A,** Habit. **B,** Juvenile plant. **C,** Flower. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 374* (JBL).

85°19'53.94"W, 16 m, epífita sobre ramitas de *Crescentia cujete* (Jícaro) en bosque húmedo premontano transición a basal, 4 noviembre 2011, *D. Bogarín 9385* (JBL-spirit).

18. *Lophiaris* Raf., Fl. Tellur. 4: 40–41. 1836[1838].
TYPE: *Lophiaris lanceana* (Lindl.) Braem.

Plants epiphytic or lithophytic caespitose herbs. *Pseudobulbs* short, subglobose, 1-leaved. *Leaf* conduplicate, fleshy, abaxially keeled, often spotted with red or purple, suberect, or pendant. *Inflorescences* lateral from the base of the pseudobulbs, paniculate or racemose. *Flowers* showy, resupinate, spreading, red, purple, yellow, or white with red or maroon spots or blotches. *Sepals* and *petals* subsimilar, clawed, often spotted with red-brown, crisped-undulate. *Lip* 3-lobed, the midlobe larger than the laterals with the callus made up of small teeth or protuberances, often spotted. *Column* short, cylindrical, the stigmatic surface suborbicular, usually with small horns or wings at each side and a tabula infrastigmatica. *Anther* terminal, operculate. *Pollinarium* 2, yellow, obpyriform, with stipe and viscidium.

A Neotropical genus of about 25 species distributed from Florida (USA) and Mexico to South America and the Antilles. One species in Costa Rica and BHNP.

Lophiaris oerstedii (Rchb. f.) R. Jiménez & Carnevali, Harvard Pap. Bot. 5(2): 423. 2001. Fig. 12E, 39.

Basionym: *Oncidium oerstedii* Rchb.f., Bonplandia (Hanover) 2(7): 91. 1854. *nom. cons. prop.* TYPE: Unzweifelhaft die schönste Entdeckung des Hrn. Dr. Oersted, *A. S. Oersted s.n.* (Holotype: W). *Oncidium carthagenense var. oerstedii* (Rchb. f.) Lindl., Fol. Orchid. Oncidium 40. 1855.

Homotypic synonyms: *Trichocentrum oerstedii* (Rchb. f.) R. Jiménez & Carnevali, Icon. Orchid. (Mexico) 5–6: ix. 2002 [2003].

Plants epiphytic, cespitose, pendent to suberect, up to 45 cm long with abbreviated rhizome. *Roots* up to 2 mm in diam., white with green tips. *Pseudobulbs* oblate to globose or broadly ovoid, short, 1.2 × 1.4 cm, unifoliate, enclosed by 4 imbricate, conduplicate papyraceous sheaths 2.5–4.5 × 2.0–2.8 cm. *Leaves* fleshy-coriaceous, elliptic-oblong to obovate, 37.2–42.3 × 7.4–7.7 cm, dark green matte, purple-spotted, conduplicate, abaxially keeled, acute, petiole to 4 cm. *Inflorescence* basal, lateral, racemose or paniculate, erect to arched, up to 120 cm long with 7 or more branches, the branches 3- to 7-flowered, peduncle bracts 6–8 × 3–5 mm, lanceolate, acute; bracts subtending the lateral branches similar, broadly lanceolate-ovate, acute, to 8 mm long; floral bracts 1.5–4.0 × 1.0–1.5 mm, triangular-ovate, acute. *Ovary* pedicellate, cylindric, to 25 mm long. *Flowers* resupinate, medium-sized for the genus, white-spotted and blotched with reddish purple, the lip white stained with reddish purple, basally tinged with yellow, the callus pink, the column stained with brown with the tabula infrastigmatica yellow, the wings white stained with pink. *Dorsal sepal* unguiculate, spathulate, suborbicular to ovate, obtuse, 11.7 × 9.2 mm. *Lateral sepals* unguiculate, ovate to oblong, subacute, 12.8 × 6.2 mm. *Petals* unguiculate, ovate to oblong, obtuse, undulated, 10.0 × 8.8 mm. *Lip* deeply 3-lobed, pandurate, 10.7 × 11.0 cm, the lateral lobes shorter than the midlobe, ovate, obtuse, the midlobe reniform, retuse, somewhat bilobate, undulate, the isthmus 3.5 × 4. 0 mm, the disc 4.5 × 3.7 mm, a callus made up by 4 tuberculate protuberances and a central tuberculate keel. *Column* to 5.7 mm long, thick basally, with 2 stigmatic, reniform wings, with a sulcate tabula infrastigmatica. *Pollinarium* 2, obpyriform, cleft, the stipe suborbicular with 2 pointed projections, viscidium rounded, yellow. *Anther cap* cucullate, operculate, papillose, white stained with purple.

Distribution: from Mexico to Costa Rica, perhaps ranging to western Panama.

Distribution in the Park: found at Las Cascadas in the humid gallery forest.

Eponymy: named after its discoverer and collector, the Danish botanist Anders Sandøe Ørsted (1816–1872).

Habitat and ecology: epiphytic on main tree trunks or in lower branches in the humid evergreen forest close to streams, lagoons, or rivers in shady conditions.

Phenology: plants flower from October to November.

Discussion: among the orchids of BHNP, *Lophiaris oerstedii* can be easily recognized even when not in flower by the large, conduplicate, thick-succulent leaves borne on a small, rudimentary pseudobulb. Fertile specimens are unmistakable by the long, paniculate inflorescences with several white, purple-speckled flowers.

Cetzal-Ix and Balam Narvaez (2012) and Cetzal-Ix and collaborators (2016) treated what they considered the only species of *Lophiaris* from Costa Rica as *L. crispiflora* (Schltr.) Balan & Cetzal, a taxon supposedly ranging from eastern Honduras through Caribbean Nicaragua and Costa Rica to northwest Panama (the type specimen from Panama City, Margin of the Pacific Ocean, *Powell 1*). On the other hand, they treated *L. oerstedii* (Rchb.f.) R. Jiménez, Carnevali & Dressler, originally described from a Nicaraguan collection by A. Oersted, as restricted to the countries north of Costa Rica, where it spans to northwestern Mexico.

We were tempted, following the Cetzal-Ix and Balam Narvaez (2012) and Cetzal-Ix et al. (2016) proposal, to treat the Caribbean populations as *Lophiaris crispiflora* (comparing them with the recorded distribution of this taxon in Caribbean Nicaragua and Honduras) and regarding those confined to the Pacific side of the continental divide as *L. oerstedii*. However, from a phytogeographic point of view, the Caribbean lowlands of Nicaragua, which drain into the San Juan River, are indistinguishable from the seasonal, Pacific plains of Guanacaste in northern Costa Rica, which are separated from the humid region of the Caribbean by a chain of high volcanoes that loses elevation toward the northwest. Also, from a morphological point of view, our observations do not support designating populations from the Pacific and the Caribbean watersheds as belonging to different species. If a single species alone of *Lophiaris* has to be named in the flora of Costa Rica, we favor the use of *L. oerstedii*, which is the oldest available name. The fine, colored illustration of a flower made by Oersted of his Nicaraguan collection of the type looks precisely the same as the flowers that we documented from populations found at BHNP.

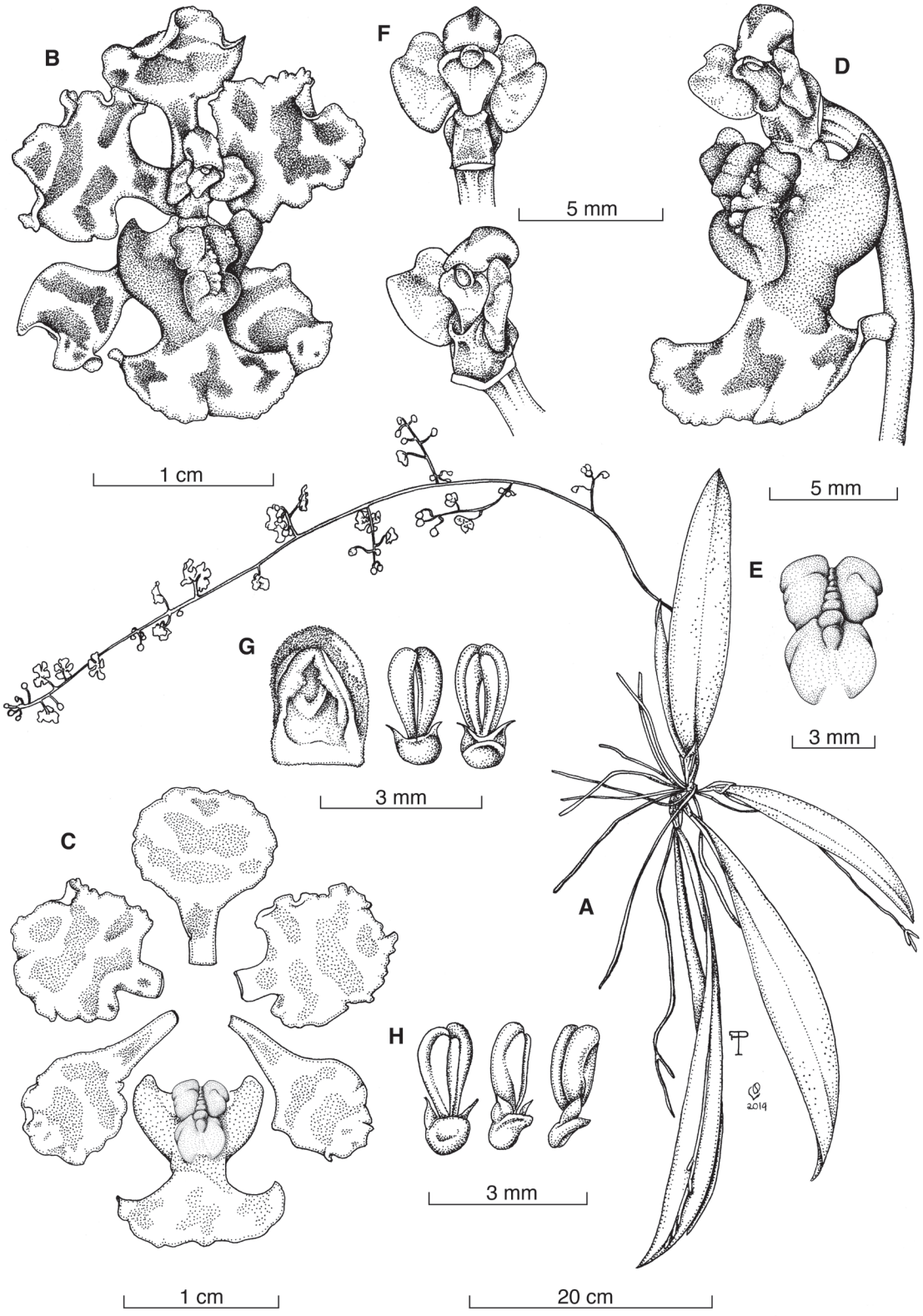

FIGURE 39. *Lophiaris oerstedii* (Rchb.f.) R. Jiménez, Carnevali & Dressler. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Lip callus, detail of tuberculate protuberances. **F,** Column, side and ventral view. **G,** Pollinarium and anther cap. Drawn by F. Pupulin, inked and rendered by L. Oses from *Pupulin 8189* (JBL).

Additional specimens examined: BHNP, Las Cascadas (the waterfalls), entering from Finca San Diego (Finca Los Trejos), 10°10'59.86"N, 85°20'17.41"W, 86 m, premontane moist, transition to tropical moist forest, epiphytic in gallery forest on *Brosimum alicastrum* "Ojoche" (Moraceae) close to a stream, 22 February 2012, *F. Pupulin 8189 & D. Bogarín* (JBL-spirit).

19. *Malaxis* Sol. ex Sw., Prodr. 8, 119. 1788.
TYPE: *Malaxis spicata* Sw.

Plants terrestrial or rarely epiphytic, rhizomatous, often creeping, or with globose corms or conic-ovoid pseudobulbs. *Leaves* 1–3, ovate, oblong or cordate, not articulated, petiolate, with the sheath embracing the base of the inflorescence. *Inflorescence* a few- to many-flowered subcorymbose, subumbellate or elongate raceme, terminal, erect, unbranched, with persistent floral bracts. *Flowers* inconspicuous, resupinate or not, generally green or brownish. *Sepals* free or with the lateral sepals connate, spreading, broader than petals. *Petals* narrowly linear to filiform. *Lip* sessile, usually on the upper part of the flower, erect or spreading, entire or lobed above and auriculate below, concave with a basal cavity. *Column* very short, terete, lacking a foot. *Anther* terminal, suberect or incumbent. *Pollinia* 4, without caudicles. *Capsule* small, ovoid.

A cosmopolitan genus of nearly 300 species, mostly in Asia and Oceania. About 20 species in Costa Rica, 1 in BHNP.

Malaxis aurea Ames, Schedul. Orch. 5: 3, f. 1. 1923. Fig. 12F, 40.
TYPE: COSTA RICA. Cartago. Las Cóncavas, flowers apricot-yellow, leaf and rachis yellowish oil-green, *C. Lankester 346* (Holotype: K).

Plants terrestrial, up to 22 cm high, with an underground monophyllous, deciduous, white corm, and abbreviated rhizome, 1.7 × 1.8 cm. *Roots* slender, filiform, up to 1 mm in diam., white to gray. *Pseudobulbs (corms)* hypogeous or among the organic litter, subglobose, ovoid, covered by leafy bracts, up to 1.0 × 1.2 cm; petiole tubular, up to 12 cm long. Leaf ovate, cordate to auriculate at the base where it clasps the peduncle, abaxially keeled, with a conspicuous midvein and several parallel secondary veins, entire, subacute to obtuse, 3.8–10.0 × 4.0–6.2 cm. *Inflorescence* apical, subumbellate, supported by a sulcate peduncle of 12 cm long, rachis 8 mm with several helical flowers, opening successively. *Floral bracts* to 1 mm long, green, shorter than the slender pedicels. *Ovary* to 1.3 mm long. *Flowers* small, not resupinate, to 5.1 mm long, light green to yellow with age. *Dorsal sepal* oblong-elliptic to linear-ovate, obtuse, with the margins recurved or strongly coiled in natural position, 2.6 × 1.3 mm. *Lateral sepals* subsimilar to the dorsal sepal, obovate-elliptic to oblong-elliptic, acute, with margins recurved, strongly coiled in natural position, 2.5 × 1.5 mm. *Petals* linear-filiform, oblong, obtuse to acute, strongly reflexed with the tips connivent, 2.0 × 0.2 cm. *Lip* thick, subcordate to broadly ovate, complanate-concave, inflexed, with a thick rostrate apicule to 0.6 mm long, and 2 holes at the base forming a groove in the center, 1.6 × 2.0 cm. *Column* small, inconspicuous, 0.5 × 0.6 mm. *Pollinia* 4, ovoid. *Anther cap* cucullate. *Capsule* ellipsoid, 6 × 3 mm, valved.

Distribution: from Mexico to Costa Rica.

Distribution in the Park: plants grow terrestrially among organic litter and dead leaves between calcareous rocks in the shade in the rocky cactus forest at Cerro Barra Honda and Las Delicias.

Etymology: from the Latin *aureus*, "golden yellow," in allusion to the color of the flowers.

Habitat and ecology: terrestrial in tropical wet and moist forest and premontane wet forest from 300 to 1500 m of elevation along the Cordilleras de Guanacaste and Tilarán, Reventazón Valley and Las Cóncavas, Cartago. Plants are deciduous during the dry season when the basal corms are still alive until the beginning of the wet season when they start to develop new leaves and inflorescences.

Phenology: plants flower from July to September.

Discussion: plants are terrestrial with ovoid, unifoliolate pseudobulbs hidden under the ground or organic litter, the leaf blade is cordate, and the inflorescence is apical, subumbellate, with green-yellow flowers opening successively. At BHNP, it is the only terrestrial species with unifoliolate pseudobulbs and apical inflorescences.

Additional specimens examined: BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, terrestres en sitio rocoso con hojarasca, 26 Julio 2005, *D. Bogarín 1755 y F. Paniagua*. BHNP, Cerro Corralillo, Sector Las Delicias, en bosque al final de las plantaciones de frijol, 10°11'11.82"N, 85°21'09.28"W, 481 m, terrestre entre rocas y materia orgánica en bosque húmedo premontano transición a basal, 5 noviembre 2011, *D. Bogarín 9397 & E. Artavia* (JBL-spirit). Same locality, *D. Bogarín 9398 & E. Artavia* (CR).

20. *Maxillariella* M.A.Blanco & Carnevali, Lankesteriana 7(3): 527–528. 2007.
TYPE: *Maxillariella diuturna* (Ames & C. Schweinf.) M.A. Blanco & Carnevali.

Plants epiphytic, rhizomatous, cespitose (rarely subcespitose), erect, suberect, or hanging. *Rhizome* elongated, covered by several bracts. *Pseudobulbs* ovoid, laterally flattened, rarely reduced or even absent, separated by the rhizome segments, sometimes covered by foliaceous sheaths and scarious bracts. *Leaves* 1–2, linear-elliptic to oblong, conduplicate, developed at the apex of the pseudobulbs. *Inflorescence* 1-flowered, produced from each leaf or bract axil. *Floral bract* shorter than the pedicel and ovary. *Flowers* small to medium size, resupinate, campanulate, white, red, yellow, or orange, sometimes spotted with purple or red. *Sepals* free, oblong, acute to obtuse. *Petals* oblong, acute. *Lip* simple or obscurely 3-lobed with a glossy callus. *Column* terete, with a very short column foot. *Anther* apical. *Pollinia* 2, with caudicles. *Capsule* small, ovoid with lateral dehiscence.

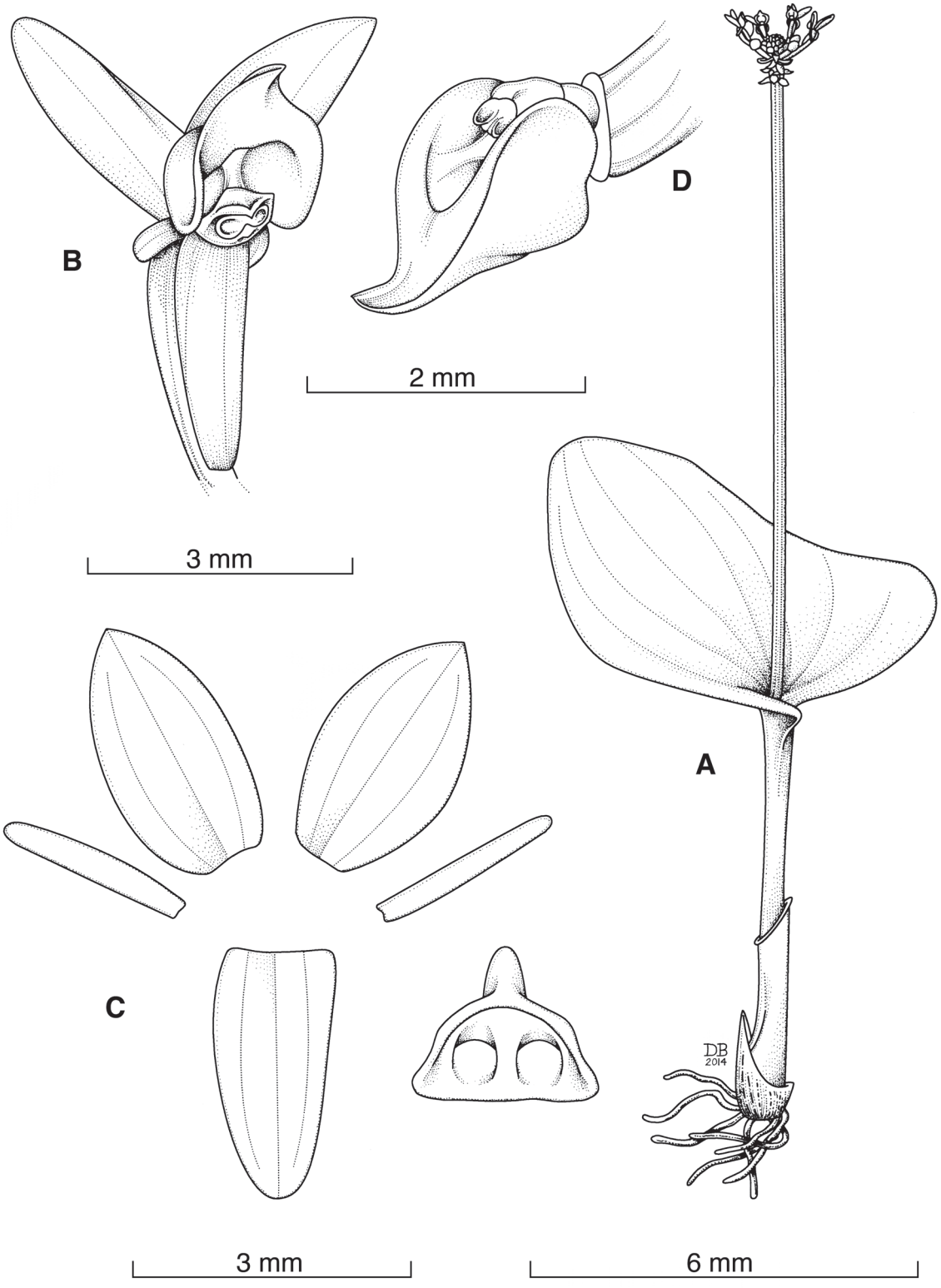

FIGURE 40. *Malaxis aurea* Ames. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. Drawn by D. Bogarín from *Bogarín 1755* (JBL).

A Neotropical genus of nearly 50 species, from Mexico and Central America to Peru and Brazil. About 15 species in Costa Rica, 1 in BHNP.

Maxillariella acervata (Rchb. f.) M.A. Blanco & Carnevali, Lankesteriana 7(3): 528. 2007. Fig. 12G, 41.

Basionym: *Maxillaria acervata* Rchb.f., Bonplandia 3:217.1855. TYPE: [COSTA RICA. Alajuela: San Mateo, Surubres]: Ad Surungnes in Costarica, *A. Oersted s.n*. (Holotype: W; Isotype: K).

Plants epiphytic, cespitose, pendent to suberect, straggly, to about 25 cm long. *Roots* filiform, slender, glabrous, emerging at the base of the plant or from the rhizome at the connection of old and new pseudobulbs, 0.5–1.0 mm in diam. *Pseudobulbs* unifoliate, ovoid, laterally flattened, separated by an elongate rhizome, 1.4–3.0 × 0.6–1.2 cm, rhizome internodes 1.5–2.0 cm long, covered by scarious, imbricate papyraceous, conduplicate sheaths 1.1 × 0.6 cm. *Leaves* 1 leaf at the apex of each pseudobulb, linear to narrowly oblong, obliquely retuse, conduplicate, subcoriaceous, 7.5–9.0 × 0.5–0.7 cm, basal leaves articulated with the sheaths surrounding the base of the pseudobulb, linear, 4.5–5.5 × 0.5–0.7 cm. *Inflorescence* 1-flowered, borne at the base of each pseudobulb. Pedicel to 7.5 mm long. *Ovary* pedicellate, linear, to 1 cm long. *Floral bracts* ovate-elliptic, acute, to 8 mm long. *Flowers* small, to 1.3 cm in diam., the sepals and petals creamy yellow rarely with pale red stains, the lip with a purple blotch at base, the apex yellow, the column yellowish with purple spots. *Dorsal sepal* oblong-elliptic, acute, conduplicate, slightly concave toward the apex, 11.0 × 3.5 mm. *Lateral sepals* free at base, elliptic, acute, conduplicate, subfalcate, 11.0 × 3.5 mm. *Petals* elliptic, acute, subfalcate, slightly conduplicate, 8.0 × 2.5 mm. *Lip* obscurely 3-lobed, ovate; lateral lobes rounded erect in natural position; midlobe oblong, obtuse to emarginate or somewhat truncate; the callus oblong, glossy, running just before the mid, entire lip 8.0 × 4.5 mm between the lateral lobes. *Column* terete, arcuate, dilated and ciliate at apex, to 6 mm long. *Pollinia* 2, ovoid, cleft, on a horseshoe-like stipe. *Anther cap* cucullate, rounded, ciliate at apex, 2-celled.

Distribution: known only from Costa Rica.

Distribution in the Park: found at Cerros de Jesús on a fallen branch, and likely found at Las Cascadas and Los Mesones in Barra Honda.

Etymology: from the Latin *acervatus*, "heaped," in allusion to the cespitose habit with crowded pseudobulbs and short rhizomes.

Habitat and ecology: plants grow epiphytically in the canopy of tall trees in evergreen tropical moist forest and tropical dry forest, moist province transition along rivers and streams in the lowlands of the Pacific watershed. Common on *Anacardium excelsum* and *Pachira quinata*.

Phenology: plants flower mostly from May to October.

Discussion: easily distinguished by the crowded caespitose plants with ovoid, flattened pseudobulbs separated by short rhizomes. The pseudobulbs are unifoliate at apex, subtended by foliaceous sheaths at base; the leaves are linear-ligulate. The flowers are inconspicuous, cream with a yellow lip with purple at the base and acute sepals and petals.

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, 10°05'41.71"N, 85°18'59.58"W, 370 m, bosque húmedo premontano transición a basal, epífita en bosque secundario maduro sobre una quebrada estacional con árboles altos, 23 febrero 2012, *D. Bogarín 9520 y F. Pupulin* (CR).

21. *Oeceoclades* Lindl., Edwards's Bot. Reg. 18: sub t. 1522. 1832; et Gen. et Sp. Orch. 235. 1833.

TYPE: *Oeceoclades maculata* (Lindl.) Lindl.

Plants terrestrial, caespitose, rarely lithophytic. *Roots* basal, thick. *Pseudobulbs* 1- to 3-leaved apically, heteroblastic, cylindrical, fusiform, conical, or ovoid. *Leaves* linear-lanceolate, ovate or elliptic, acute to acuminate, conduplicate, coriaceous or plicate, articulate at the base, usually petiolate, green, or maculate with light and dark green. *Inflorescence* lateral, usually exceeding leaves, simple or branching, bracts inconspicuous, persistent. *Ovary* cylindrical, grooved. *Flowers* spread, relatively small and showy, white, yellow, green, or brown, sometimes purple striped. *Sepals* free obovate, spathulate oblique at the base. *Petals* free, subequal to sepals, obovate to elliptic-oblong, often broader than sepals. *Lip* free to base, trilobed, basally spurred, the callus thickened at the spur entrance or with parallel ridges, lateral lobes free to base of column, midlobe flat, or convex. *Column* relatively short, with a distinct foot. *Pollinia* 2, ovoid or pyriform.

A genus of about 50 species native to Africa, Madagascar, and tropical Asia. *Oeceoclades maculata* is naturalized and widespread in the Neotropics, ranging from Florida to Brazil and the Antilles. One species in Costa Rica and BHNP.

Oeceoclades maculata (Lindl.) Lindl., Gen. Sp. Orchid. Pl. 237–238. 1833. Fig. 12H, 42.

Basionym: *Angraecum maculatum* Lindl., Coll. Bot. 3: pl. 15. 1821. TYPE: Messrs. Loddiges sent it to us in the middle of last December. Messrs. Loddiges informs us that they are uncertain from what quarter they received it, but they think from South America (Holotype: K).

Homotypic synonyms: *Limodorum maculatum* (Lindl.) Lodd., Bot. Cab. 5: t. 496. 1821.

Aerobion maculatum (Lindl.) Spreng., Syst. Veg. 3: 718. 1826.

Eulophia maculata (Lindl.) Rchb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 647. 1863.

Eulophidium maculatum (Lindl.) Pfitzer, Entwurf. Anordn. Orch.: 87. 1887.

Graphorkis maculata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662. 1891.

Plants terrestrial, caespitose, up to 24 cm tall. *Roots* thick, up to 7 mm in diam., whitish with yellow tips, pilose. *Pseudobulbs* ovoid, sulcate, heteroblastic, covered by papyraceous bracts, evident in young pseudobulbs, eventually deciduous, with 1 at the apex, 4.0 × 2.2 cm. *Leaves* obovate to elliptical, dark green with conspicuous light green irregular macules, cuneate, petiolate, conduplicate, coriaceous, acute, entire, 10–32 × 4.5–5.2 cm. *Inflorescence* lateral, basal, racemose or rarely paniculate or branched, distichous, covered by tightly appressed tubular bracts, to

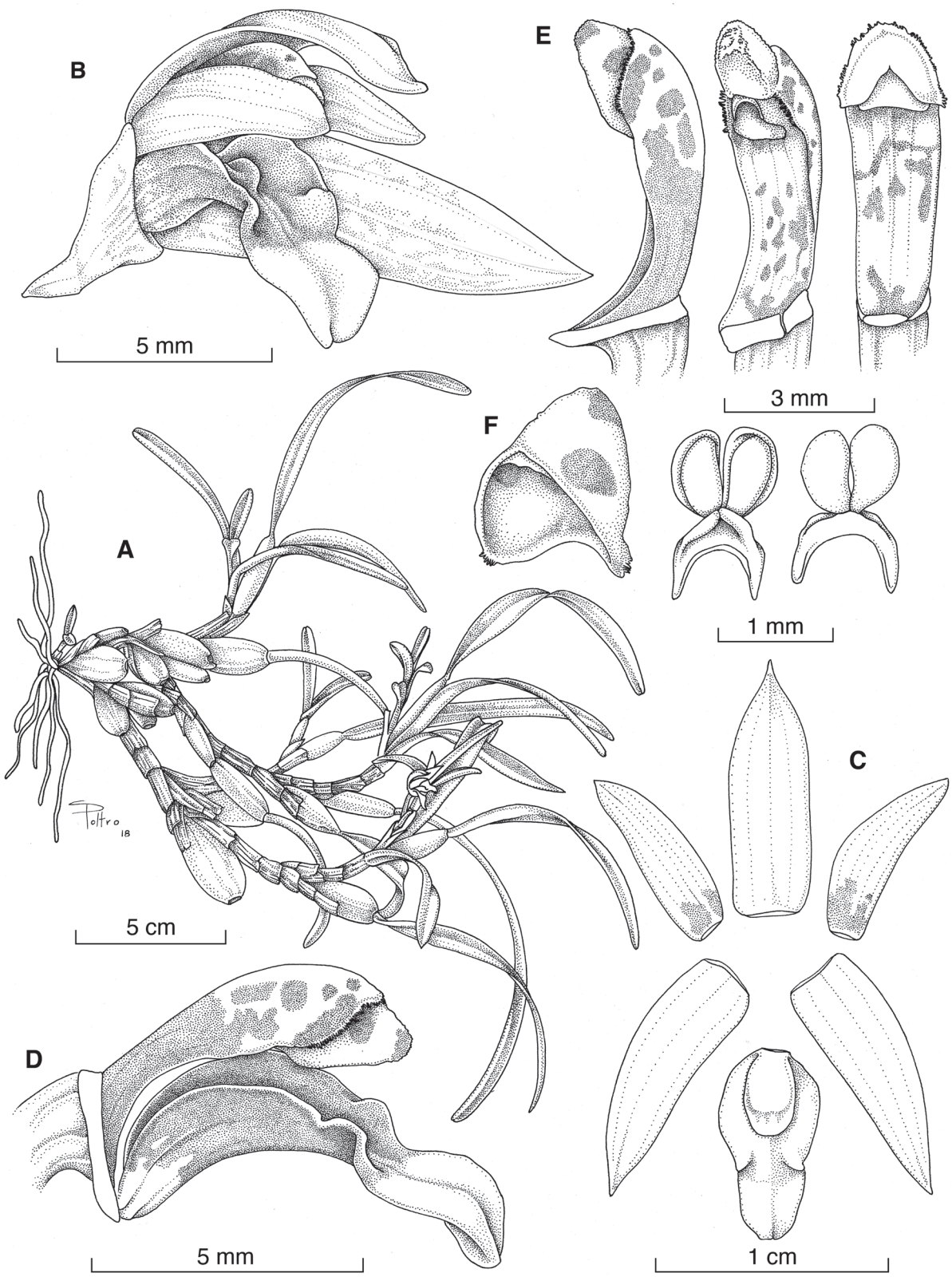

FIGURE 41. *Maxillariella acervata* (Rchb.f.) M.A. Blanco & Carnevali. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by D. Bogarín and rendered by S. Poltronieri from *Bogarín 9523* (JBL).

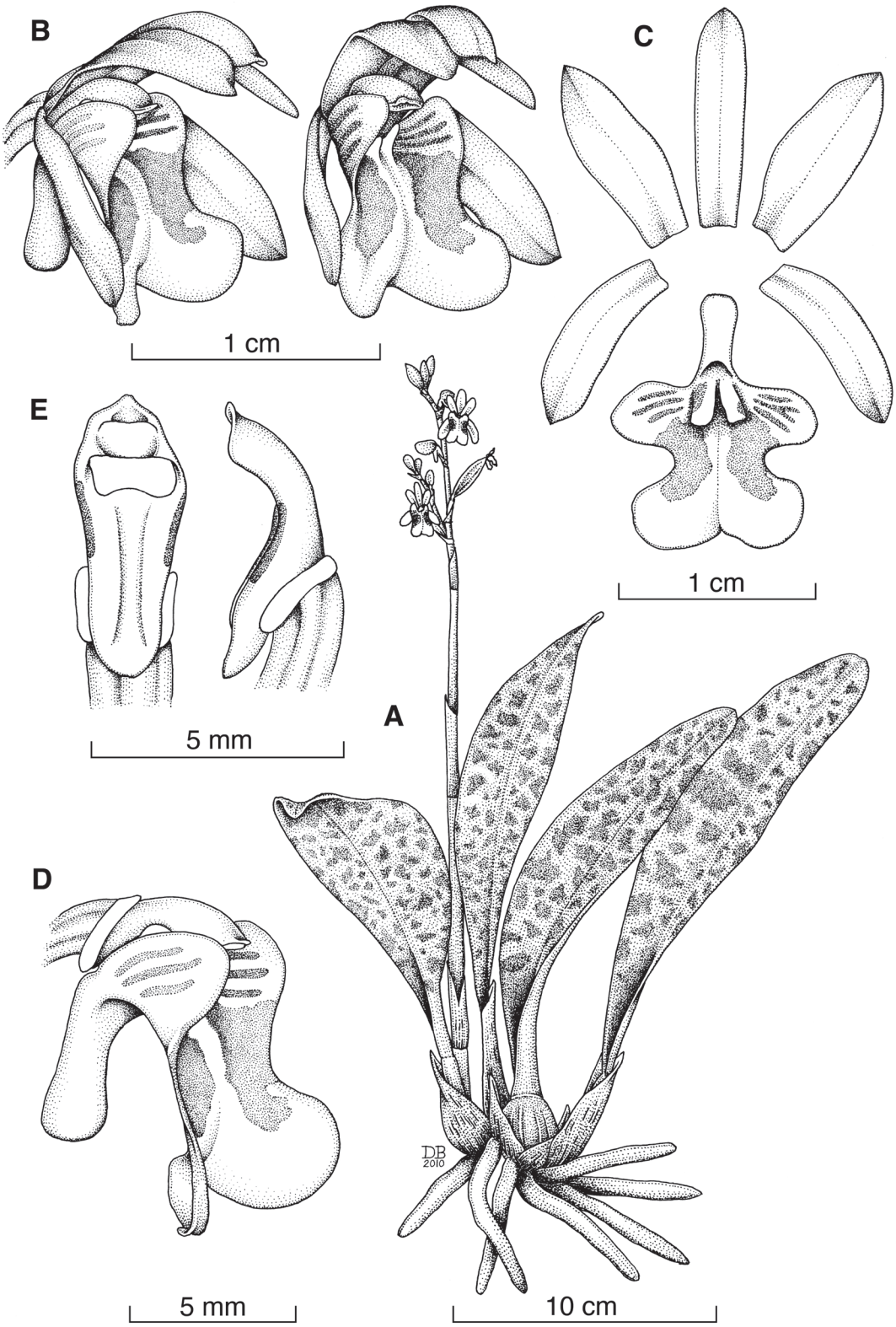

FIGURE 42. *Oeceoclades maculata* (Lindl.) Lindl. **A,** Habit. **B,** Flower, two views. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. Drawn by D. Bogarín from *Bogarín 1729* (JBL).

11 flowers, up to 10–45 cm long, usually exceeding the leaves, with several flowers opening at once (rarely 1–2 open), rachis 7–14 cm. *Ovary* cylindrical, up to 0.5 cm long. *Flowers* small and rather showy, resupinate, up to 1.5 cm, white with the lip white with pink spots and stripes at the basal lobes, spurred. *Dorsal sepal* oblong-elliptic to spathulate, obtuse to acute, conduplicate, free, concave, and rather arcuate, 1.3 × 0.2 mm. *Lateral sepals* subfalcate oblong, acute, conduplicate, free, spread, 1.0 × 0.3 cm. *Petals* obovate, elliptic, acute, free, rather arcuate and connivent with the dorsal sepal, 1.0 × 0.4 cm. *Lip* 3-lobed or deeply panduriform, retuse, conduplicate, provided with a basal rounded, arcuate spur shorter than the blade, the basal lobes parallel and arching toward the column, the midlobe somewhat spread, with a bifid thickened forked callus at the base near the spur entrance, 1.3 × 1.0 cm. *Column* rostrate, concave, widened apically, arcuate, with the foot adnate to the lip, 5.6 × 2.0 mm. *Pollinia* 2, obovate. *Anther cap* cucullate. *Capsule* 3.0 × 1.5 cm, 6-valved.

Distribution: native to Africa but widespread in the Neotropics from Florida (USA) to Argentina and the Antilles. In Costa Rica, it is found along the humid, warm lowlands of the Pacific, Santa Rosa, Guanacaste to Corcovado, Puntarenas and Valle Central, and the Caribbean plains under 900 m.

Distribution in the Park: widespread and abundant at Cerro Barra Honda, Las Delicias, and Las Cascadas, and along the main trails of the Park.

Etymology: from the Latin *maculatus*, "spotted, blotched," in allusion to the conspicuously blotched leaves.

Habitat and ecology: plants grow terrestrially among organic litter and humus in shady conditions, mostly moist to wet understory forests. It is widespread in the Neotropics, where it is considered one of the most successful invasive orchid species (Cohen and Ackerman, 2009). Plants are autogamous and produce many capsules, thus explaining its success in colonizing many areas of the Neotropics. It was first recorded in Costa Rica around 2000.

Phenology: plants flower throughout the year but mostly from August to November. Capsules were observed from November to March.

Discussion: easily distinguished by the terrestrial plants with clustered pseudobulbs and one apical dark green leaf, irregularly maculated with light green. The inflorescences are racemose with small, white flowers stained with pink. They form large populations of several clustered individuals.

Additional specimens examined: BHNP, bifurcación del camino en Sendero Ceiba y Mirador, 10°10'25.4"N, 85°21'40.1"W, 410 m, bosque húmedo premontano transición a basal, terrestres a orillas del camino, bosque secundario, 23 julio 2005, *D. Bogarín 1729 y F. Paniagua* (JBL-spirit). BHNP, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestres orillas del camino, bosque secundario, 7 noviembre 2011, *D. Bogarín 9422* (CR).

22. *Pelexia* Poit. ex Rich., De Orchid. Eur. 37. 1817 [Aug–Sep 1817]; preprint from Mém. Mus. Natl. Hist. Nat. 4: 59. 1818.

TYPE: *Pelexia adnata* (Sw.) Spreng.

Plants terrestrial, often epiphytic with abbreviated stems. *Roots* fleshy, fusiform, fasciculate. *Leaves* arranged in the basal rosette, petiolate, the petiole narrow, the leaves present at flowering but often deciduous. *Inflorescence* slender, erect, covered by several tight sheaths, the rachis loosely or densely few- to many-flowered. *Flowers* small to large, white or green, erect, arcuate, tubular basally forming a nectary adnate to the ovary, spurred, usually green to greenish or white-colored. *Sepals* connate in the lower part, usually pubescent or glandular, lateral sepals arcuate, decurrent with the ovary forming a spur. *Petals* linear, usually oblong-ovate to lanceolate, falcate. *Lip* clawed, arcuate apically, constricted below the apex, widest apically, with basal auricles, entire or crenulate, spurred. Spur adnate to the ovary, rounded or acute. *Column* part shorter than the anther, footed, cuniculate. *Anther* erect, flattened, 2-chambered. *Pollinia* 4, powdery.

A Neotropical genus of about 70 species ranging from Florida (USA) to Mexico, Central and South America, and the Antilles. About 4 species in Costa Rica and 1 in BHNP.

KEY TO THE COSTA RICAN SPECIES OF *PELEXIA*

1a. Flowers small, the lip <10 mm long . . . . . *P. obliqua*
1b. Flowers large, the lip >20 mm long 2
2a. Spur subequal to the ovary length 3
2b. Spur up to half the length of the ovary 4
3a. Apex of spur obtuse to rounded; lip with a distinct isthmus between hypochile and epichile . . . . . *P. barrahondaensis*
3b. Apex of spur acute; the apex of the hypochile reaching the base of the epichile or overlapping it . . . . . *P. maculata* (doubtful in Costa Rica)
4a. Apex of spur rounded . . . . . *Pelexia laxa*
4b. Apex of spur acute. 5
5a. Spur ca. 10 mm . . . . . *P. funkiana*
5b. Spur ca. 3 mm . . . . . *P. congesta*

Pelexia barrahondaensis Bogarín & Pupulin, *sp. nov.* Fig. 12I, 43–44.

TYPE: COSTA RICA. Guanacaste: Nicoya, San Antonio, Parque Nacional Barra Honda, Cerro Corralillo, Sector Las Delicias, in the forest at the upper end of bean plantations and "jaragua" pastures, 10°11'11.19"N, 85°21'08.46"W, 438 m, terrestrial among rocks and organic materials in premontane moist, transition to tropical moist forest, 24 February 2012, *F. Pupulin 8198, D. Bogarín and S. Villagra* (Holotype: JBL-spirit; Isotype: CR).

Species floribus turpiter similis illis Pelexiae gutturosae (Rchb.f.) Garay *per labium isthmo rectangularis inter*

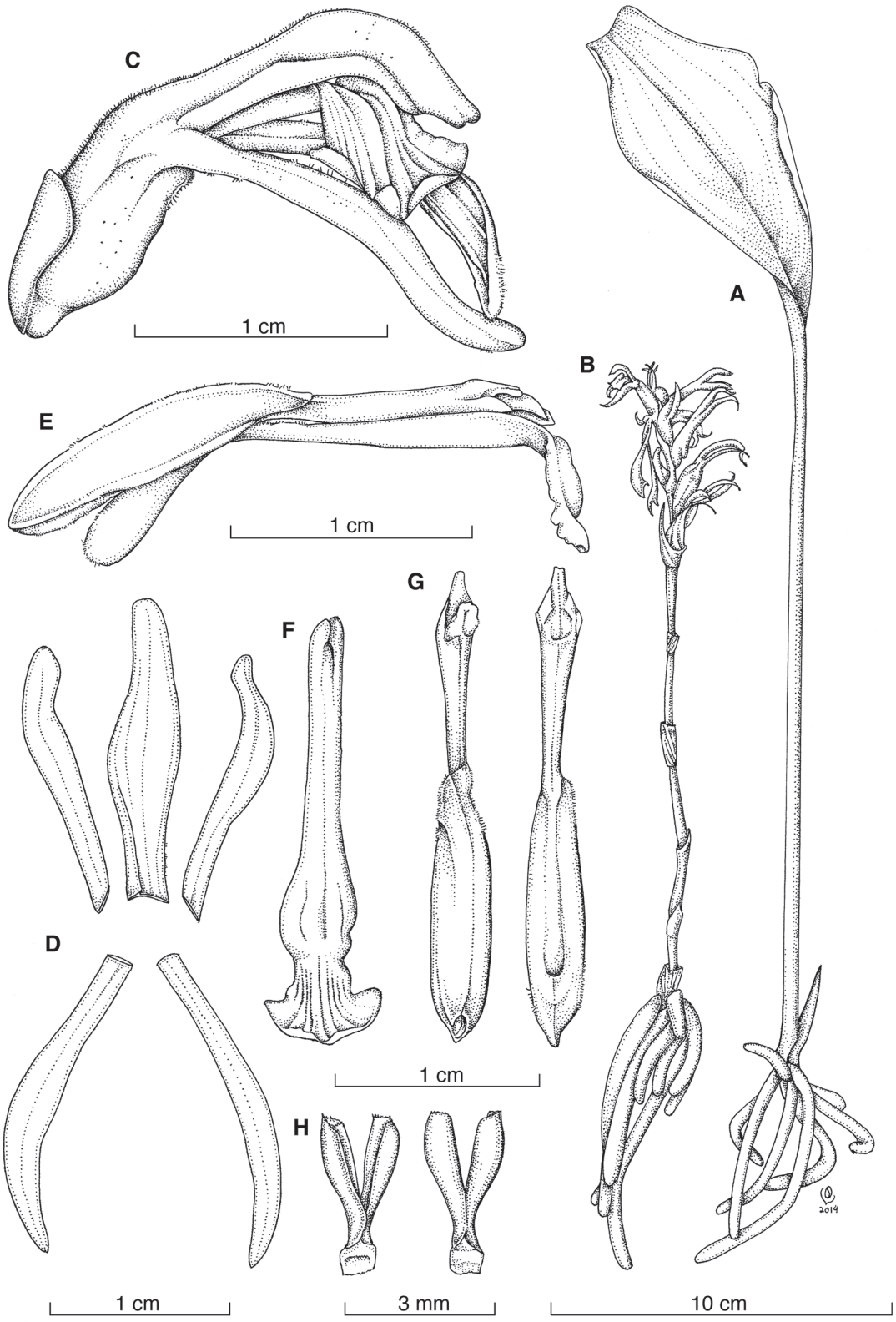

FIGURE 43. *Pelexia barrahondaensis* Bogarín & Pupulin. **A,** Leafy habit. **B,** Leafless habit. **C,** Flower. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Column, side and ventral view. **G,** Pollinarium and anther cap. Drawn by F. Pupulin, inked and rendered by L. Oses from *Pupulin 8189* (JBL).

FIGURE 44. *Pelexia barrahondaensis* flowering in situ at BHNP. Photograph by F. Pupulin.

epichilum et hypochilum munitum, sed pedunculo foliorum multo longiore, nectario duplo longiore et epichilo ecalloso recedit; a Pelexiae maculatae Rolfe *per labium ecallosum confert, sed foliis concoloribus viridibus, nectario multo longiore obtuso facile distinguitur*.

Plants terrestrial, up to 26 cm tall, deciduous during the dry season and at flowering. *Roots* thick, succulent, fusiform, fasciculate, 8–10 cm long, to 9 mm in diam., pubescent. *Leaves* 1-leaf, developed from the abbreviated stem, conspicuously petiolate, elliptic-ovate, acute, conduplicate, deciduous at flowering, 10–13 × 3.1–6.2 cm; petiole narrow, basally reddish-pinkish, 13–23 cm long. *Inflorescence* apical, erect, stout, racemose, subdense, produced from the center of the basal rosette when the plant is deciduous, helical or subdistichous, pubescent or densely glandular, with about 8 flowers opening in succession, scape 19.5–29.5 cm long, peduncle 13.5–23.0 cm long, rachis 5.5–6.5 cm long, with about 7 tightly appressed tubular, acute, somewhat glandular cauline bracts, to 1.7–3.0 × 0.5–0.6 cm. *Floral bracts* ovate, acute to acuminate, basally glandular, shorter, or as long as the ovary, 1.6 × 0.5 cm. *Ovary* glandular-pubescent, cylindrical, fusiform, ridged, to 1.1 × 0.3 cm. *Flowers* medium, up to 2 cm long, densely glandular-pubescent in the outer part of the floral parts, resupinate, basally tubular, arcuate toward the apex, brown-green, the lip white with the mesochile yellow, the epichile white with green stripes. *Dorsal sepal* oblong-elliptic, truncate, concave, arcuate, adaxially pubescent, 16.1 × 4.2 mm. *Lateral sepals* narrowly oblong, basally connate, subacute, falcate, arcuate, with the margins involute, the apexes touching each other, adaxially pubescent, 17.7 × 2.5 mm. *Petals* linear to narrowly oblong, falcate, subacute, connivent with the dorsal sepal forming a hood over the column, 14.7 × 2.0 mm. *Lip* clawed, oblong, arcuate, adnate to the lateral sepals, with 2 digitate basal auricles, canaliculate, the blade constricted basally and below the apex, the hypochile oblong, mesochile obovate, the isthmus subquadrate, the epichile reniform, undulate, crisped, curved downward, with 2 parallel keels from the apical constriction to the epichile apex and several veins radiating toward the margins, 23.0 × 6.5 mm. *Nectary* to 1 cm long. *Column* cylindrical, oblong, slightly wider at apex, dorsally sulcated beaked, 9.6 mm. *Pollinia* 2, narrowly ovoid to oblong, puberulent with a blackish rounded viscidium.

Distribution: known only from BHNP, Costa Rica.

Distribution in the Park: known only from Cerro Corralillo in the area of Las Delicias, in a patch of forest at the upper end of bean plantations and jaragua pastures.

Etymology: named for Barra Honda National park, where the species was discovered.

Habitat and ecology: terrestrial or lithophytic on rocky limestone areas among organic matter in a secondary forest. Plants grow in medium to full sunlight conditions.

Phenology: the plants studied flowered in February. Inflorescences start to develop in November, just before the beginning of the dry season.

Discussion: the *Pelexia* species found at Barra Honda shows a mix of morphological characters similar to several other species in the genus but combined in a unique way. The long spur, almost equaling the length of the ovary, is similar to that of *P. callosa* Ames, *P. hondurensis* Ames, and *P. saccata* Rolfe, three species restricted in distribution to northern Central America, as well as the mostly Andean *P. maculata* Rolfe. The latter has been recorded from Costa Rica by Szlachetko and collaborators (2005) on the basis of a collection from the northern, Caribbean foothills of the Talamanca mountain chain. Still, this species's occurrence north of the Panamanian isthmus is unlikely, as its distribution is restricted to South America, where it has been otherwise documented from Colombia to Bolivia and Brazil. The general outline of the lip of *P. barrahondaensis*, which presents a distinct rectangular isthmus between hypochile and epichile, is rare in *Pelexia*, and to our knowledge, it can only be observed in *P. gutturosa* (Rchb.f.) Garay, a species endemic to Honduras. However, the latter has very short leaves, a distinctly shorter spur, and an epichile with a strongly thickened keel along the midvein, while the epichile of *P. barrahondaensis* is ecallose. Also, the absence of callosities on the epichile and the apex of the hypochile is rarely found in *Pelexia* and probably limited to *P. funkiana* (A. Rich. & Gal.) Schltr., a species of broad distribution, and *P. maculata*. *Pelexia funkiana*, however, has a short spur (ca. 3 mm vs. ca. 10 mm), and in Costa Rica it is exclusively known from the wet forests of Caribbean Talamanca. From the wet Caribbean forest of the Tilarán Cordillera in northern Costa Rica is also known *P. congesta* Ames & C.Schweinf, which, however, has an acute spur and lip without an isthmus below the hypochile.

Pelexia barrahondaensis is a rare species at BHNP, where a single population was located on the summit of Cerro Corralillo. Here the plants grow terrestrially in the rocky soil's crevices, where some debris accumulates that helps them survive the very harsh and prolonged dry season of the central Nicoya peninsula.

Additional specimens examined: COSTA RICA. Guanacaste: Nicoya, San Antonio, BHNP, Cerro Corralillo, Sector Las Delicias, en bosque al final de las plantaciones de frijol, 10°11'11.82"N, 85°21'09.28"W, 481 m, terrestres entre rocas y materia orgánica en bosque húmedo premontano transición a basal, 5 noviembre 2011, *D. Bogarín 9395, E. Artavia & O. Cubero* (CR). Same locality, *D. Bogarín 9396, E. Artavia & O. Cubero* (CR). BHNP, Cerro Corralillo, Sector Las Delicias, in forest at the upper end of bean plantations and "jaragua" pastures, 10°11'11.19"N, 85°21'08.46"W, 438 m, terrestrial among rocks and organic materials in premontane moist, transition to tropical moist forest, 24 February 2012, *F. Pupulin 8199, D. Bogarín and Salomón Villagra* (JBL-spirit).

23. *Sarcoglottis* C. Presl., Reliq. Haenk., 1(2): 95. 1827.
TYPE: *Sarcoglottis speciosa* C. Presl.

Plants terrestrial, rarely epiphytic with abbreviated stems. *Roots* fleshy, fusiform, fasciculate. *Leaves* arranged in the basal rosette, sometimes cauline, subsessile or petiolate, and often deciduous before flowering. *Inflorescence* slender, erect, covered by several tight sheaths, the rachis loosely

or densely few- to many-flowered. *Flowers* small to large, erect, arcuate, tubular basally forming a nectary adnate to the ovary, usually green to greenish or dull-colored. *Sepals* dissimilar, lateral sepals decurrent, connate in the lower part, usually pubescent or glandular. *Petals* linear, usually oblong ovate to lanceolate, falcate. *Lip* clawed, arcuate apically, constricted below the apex, widest apically, with basal auricles and prominent V-shaped thickenings, entire or crenulate, spurred. *Column* part shorter than the anther, footed, cuniculate. *Anther* erect, flattened, 2-chambered. *Pollinia* 4, powdery.

A genus of about 45 species ranging from Mexico, Central America, and the Antilles to Bolivia and Argentina. About 7 species in Costa Rica, 3 in BHNP.

Key to Species of *Sarcoglottis*

1a. Inflorescence congested; floral bracts short, less than half the length of the ovary; flowers small (the lip <2 cm long); the petals falcate; the base of midlobe rounded, with 2 keels converging at apex. . . . . *S. calcicola*

1b. Inflorescence laxe to sublaxe; floral bracts long, more than three-fourths the length of the ovary; flowers large (the lip >3 cm long); the petals straight; the base of midlobe truncate, with a central thickening 2

2a. Floral bracts long-acuminate; flowers green; lateral sepals curved-arched, the free portion curved, the margins undulate; nectariferous horns curved, thin, 5 mm long, extending almost to the apex of the spur . . . . . *S. sceptrodes*

2b. Floral bracts acute; flowers bronze; lateral sepals reflexed, the free portion falcate, the margins straight; nectariferous horns straight, stout, 7 mm long, reaching the middle of the spur . . . . . *S. acaulis*

23a. ***Sarcoglottis acaulis*** (J.E.Sm.) Schltr., Repert. Sp. Nov. Regni Veg. 6: 53. 1919. Fig. 13A, 45.

Basionym: *Neottia acaulis* J.E. Sm., Exot. Bot. 2: 105. 1806. TYPE: TRINIDAD. Without specific locality, *A. Anderson s.n.* (Lectotype: designated by Rutkowski et al., 2008: S-Linn).

Homotypic synonym: *Spiranthes acaulis* (J.E. Sm.) Cogniaux, Martius Fl. Bras. 3(4): 221. 1895.

A terrestrial *herb* up to 54 cm high, deciduous during the dry season and at flowering. *Roots* thick, succulent, fusiform, fasciculate, 5–20 cm long, 0.5–1.5 cm in diam., pubescent. *Leaves* 3–5, arranged in a basal rosette, oblanceolate, elliptic-obovate to oblong, acute, somewhat petiolate, 20.4–32.6 × 4.1–5.2 cm; petiole narrow, to 10.2 cm long. *Inflorescence* apical, erect, stout, racemose, subdense or lax, produced from the center of the basal rosette when the plant is deciduous, helical, pubescent or densely glandular, with about 3–9 flowers opening in succession, scape to 26–51 cm long, peduncle 18–35 cm long, rachis 7.0–19.2 cm long, with 6–10 tightly appressed tubular, acute, somewhat glandular cauline bracts, to 5.5–6.5 cm long. *Floral bracts* ovate or oblong-lanceolate, acuminate, basally glandular, with red tips, longer or as long as the ovary, 3.0–4.5 × 0.5–1.0 cm. *Ovary* glandular-pubescent, cylindrical, widened basally, to 3.2 × 0.9 cm. *Flowers* medium, up to 1.5 cm long, densely glandular-pubescent in the outer part of the segments, resupinate, basally tubular, arcuate toward the apex, yellow-green, green, yellowish brownish, or reddish, the buds rostrate. *Dorsal sepal* elliptic to oblong, subacute, deeply concave, reflexed apically, adaxially pubescent, 3.0 × 0.4 cm. *Lateral sepals* subsimilar, narrowly oblong, connate basally, acute, the free portion strongly falcate, reflexed, adaxially pubescent, spreading and somewhat involute apically, 3.4 × 0.6 cm. *Petals* unguiculate, linear-ligulate, subacute, twisted, and slightly reflexed apically and connivent with the dorsal sepal forming a hood over the column, 2.8 × 0.3 cm. *Lip* clawed, strongly arcuate apically, adnate to the lateral sepals, with 2 digitate basal auricles, basally pubescent, canaliculate, the blade constricted basally and below the apex, the hypochile obovate, widened apically, the epichile ovate, with 2 parallel convergent V-shaped keels from the apical constriction to the epichile apex and several veins radiating toward the margins, emarginate, 4.1 × 1.0 cm. *Nectary* to 2.5 cm long. *Column* cylindrical and laterally flattened, basally papillose, somewhat 3-dentate or with 2 arms or projections, beaked at the apex, to 1.2 cm. *Pollinia* 2, narrowly ovoid to oblong, united basally, puberulent with a short black viscidium. *Anther cap* cucullate, rostrate, with 2 cells.

Distribution: broadly distributed from Mexico (type of *Sarcoglottis purpusiorum* Schltr.) to French Guyana, Brazil (type of *S. allemanii* Barb. Rodr.), and Peru in South America, and the West Indies.

Distribution in the Park: they grow on rocky areas among organic matter in the evergreen forest at Cerros de Jesús.

Etymology: from the Latin *acaulis,* "without a stem," in allusion to the basal rosette of leaves, apparently stemless.

Habitat and ecology: terrestrial or lithophytic among organic litter in rocky areas or understory forest in shade. Plants are deciduous during the dry season when they are in bloom. After the dry season, the plants develop several leaves arranged in a basal rosette.

Phenology: plants flower from January to April, mainly in February.

Discussion: like other *Sarcoglottis* species at BHNP, *S. acaulis* is characterized by the terrestrial plants without pseudobulbs, the succulent fasciculate roots, and sessile leaves arranged into a basal rosette, deciduous during the blooming season. It differs from other species of *Sarcoglottis* by the combination of long floral bracts, apically acute (not long-acuminate), reflexed sepals (not simply recurved by bending) with their free portion falcate, and midlobe of the lip distinctly wider than long. Dressler (2003) excluded *S. acaulis* from Costa Rica, but it was recorded by Pupulin (2002). Also, Szlachetko et al. (2005) cited a voucher of this species from Guanacaste (*Kupper 391*, M). We provide here the first illustration of this species for the flora of Costa Rica.

Additional specimens examined: Guanacaste: Nicoya, San Antonio, Parque Nacional Barra Honda, alrededores de la caverna Pozo Hediondo, 10°10'08.3"N, 85°21'49.7"W, 423 m, bosque húmedo premontano transición a basal, terrestres entre piedras calizas, 3 octubre 2014, *D. Bogarín 11207, N. Belfort & A. Karremans* (JBL).

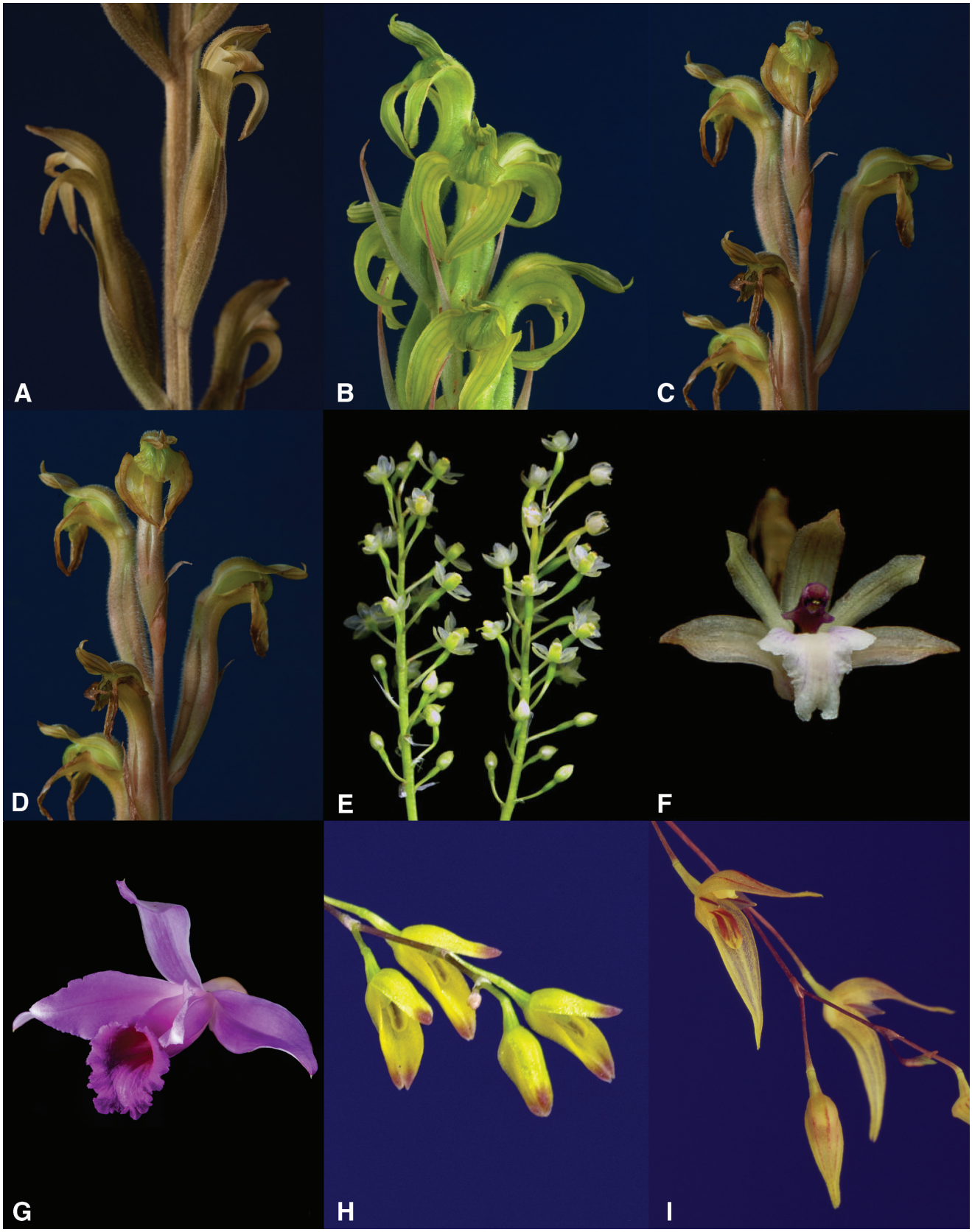

FIGURE 13. **A–I.** Orchid species found at Barra Honda National Park. **A,** *Sarcoglottis acaulis* (*Bogarín 11207*, JBL). **B,** *Sarcoglottis calcicola* (*Bogarín 11206*, JBL). **C,** *S. sceptrodes* (*Pupulin 8194*, JBL). **D,** *S. sceptrodes* (*Pupulin 8196*, JBL). **E,** *Scaphyglottis micrantha* (*Bogarín 1672*, JBL). **F,** *S. stellata* (*Bogarín 1673*, JBL). **G,** *Sobralia fenzliana* (*Bogarín 1693*, JBL). **H,** *Specklinia grobyi* (*Bogarín 1697*, JBL). **I,** *S. panamensis* (*Bogarín 1689*, JBL). Photographs by the authors.

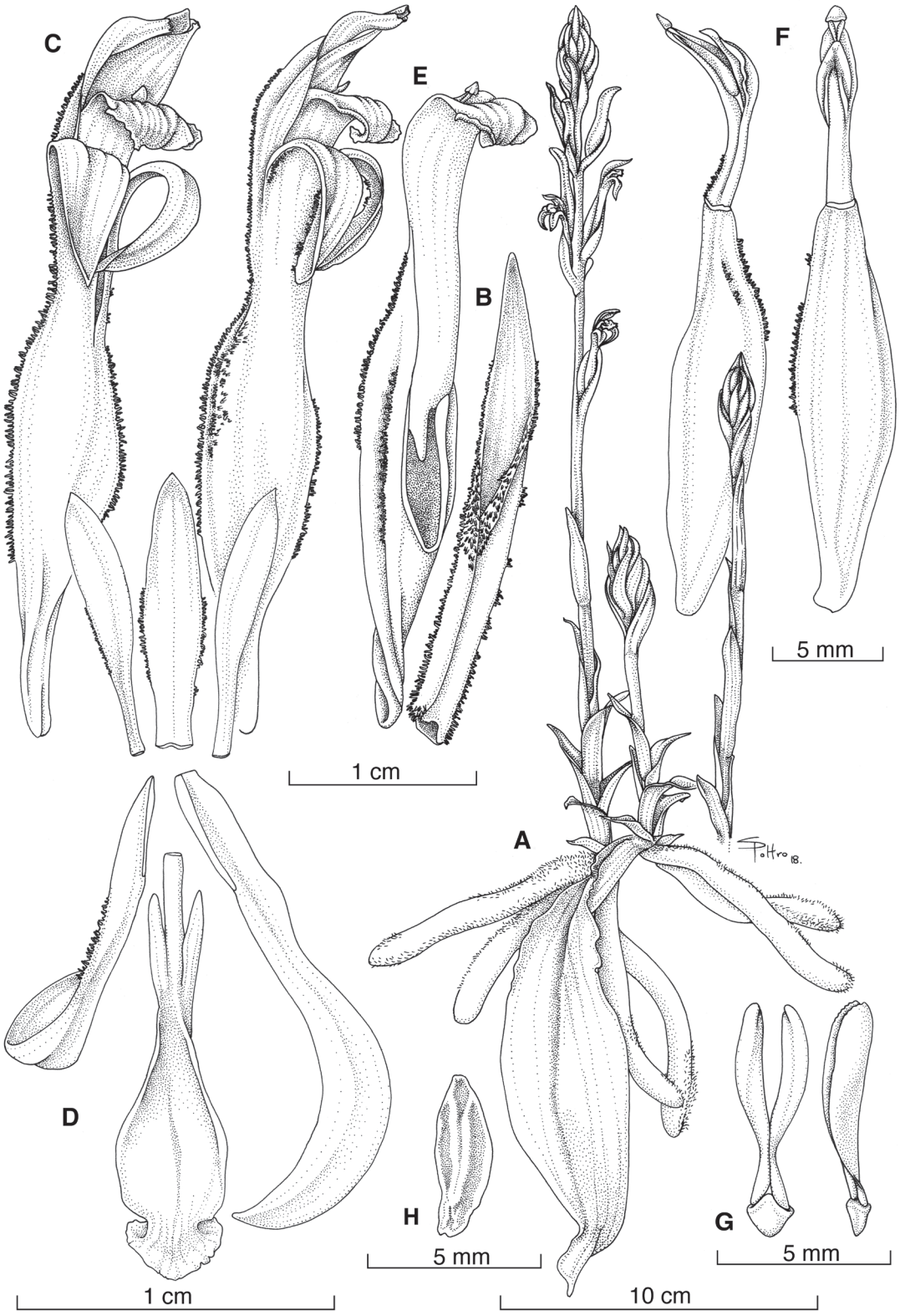

FIGURE 45. *Sarcoglottis acaulis* (Sm.) Schltr. **A,** Leafless habit. **B,** Floral bract. **C,** Flower, two views. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Column, side and ventral view. **G,** Pollinarium. **H,** Anther cap. Drawn by F. Pupulin, inked and rendered by L. Oses from *Bogarín 11207* (JBL).

23b. **Sarcoglottis calcicola** Bogarín & Pupulin, *sp. nov.* Fig. 13B, 46.

TYPE: COSTA RICA. Guanacaste: Nicoya, San Antonio, Parque Nacional Barra Honda, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestres a orillas del camino, bosque secundario, 3 octubre 2014, *D. Bogarín 11206, N. Belfort & A. Karremans* (Holotype: CR; Isotype: JBL).

A Sarcoglotti hunteriana Schltr. *foliis concoloribus viridis, bracteis floralibus breviorbus mediam partem ovarii non assurgentibus, inflorescentia congesta, floribus multo parvioribus recedit*.

A terrestrial *herb* up to 50 cm high, deciduous during the dry season and at flowering. *Roots* thick, succulent, fusiform, fasciculate, 5–17 cm long, 0.5–1.2 cm in diam., pubescent. *Leaves* 3–7, arranged in a basal rosette, oblanceolate, elliptic-obovate to oblong, acute, somewhat petiolate, 13.0–46.0 × 4.9–7.6 cm; petiole narrow, 2.5–9.0 cm long. *Inflorescence* apical, erect, stout, racemose, subdense, produced from the center of the basal rosette when the plant is deciduous, helical, pubescent or densely glandular, with about 15 flowers opening in succession, scape to 28 cm long, peduncle 14–18 cm long, rachis 7–8 cm long, with 6–10 tightly appressed tubular, acute, somewhat glandular cauline bracts, to 1.5–2.0 × 0.6–0.8 cm. *Floral bracts* ovate or oblong-lanceolate, acute to acuminate, basally glandular, shorter than the ovary, 1.5 × 0.8 cm. *Ovary* glandular-pubescent, cylindrical, widened basally, to 1.4 × 0.5 cm. *Flowers* medium, up to 1.5 cm long, densely glandular-pubescent in the outer part of the floral parts, resupinate, basally tubular, arcuate toward the apex, yellow-green, green or yellowish brownish, the buds rostrate. *Dorsal sepal* ovate to elliptic, acute or subacute, deeply concave, reflexed apically, 1.3–1.5 × 0.4–0.5 cm. *Lateral sepals* subsimilar, narrowly oblong, connate basally, subacute, the free portion falcate, reflexed, spreading and somewhat involute apically, 2.2–2.3 × 0.3–0.4 cm. *Petals* linear-ligulate, falcate, obtuse to subacute, twisted and slightly reflexed apically and connivent with the dorsal sepal forming a hood over the column, 1.2 × 0.2 cm. *Lip* clawed, strongly arcuate apically, adnate to the lateral sepals, with two digitate basal auricles, canaliculate, the blade constricted basally and below the apex, the hypochile oblong-obovate, widened apically, the epichile reniform, undulate and somewhat crisped, with 2 convergent V-shaped keels from the apical constriction to the epichile apex and several veins radiating toward the margins, 1.9 × 0.6 cm. *Nectary* to 1.5 cm long. *Column* cylindrical and laterally flattened, basally papillose, somewhat 3-dentate, beaked, to 6 mm. *Pollinia* 2, narrowly ovoid to oblong, puberulent with a short viscidium. *Anther cap* cucullate, rostrate, with 2 cells.

Distribution: known only from Barra Honda National Park in northern Costa Rica.

Distribution in the Park: they grow on rocky areas among organic matter around cactus forests and along the paths La Ceiba, El Mirador, Las Cascadas, Bosque de Piedra, La Palma, and Las Delicias.

Etymology: from the Latin *calx*, "lime," and *cola*, "a dweller," in reference to the species growing on limestone outcrops at Barra Honda.

Habitat and ecology: terrestrial among organic litter in rocky areas or understory forest in shade at around 400 m of elevation. Plants are deciduous during the dry season when they are in bloom. After the dry season, the plants develop several leaves arranged in a basal rosette.

Phenology: from January to April.

Discussion: they are characterized by the terrestrial plants without pseudobulbs, the succulent fasciculate roots, and sessile leaves arranged into a basal rosette, deciduous during the blooming season. The size and shape of leaves vary, and some plants have white-spotted leaves. The flowers are arcuate, with the lateral sepals strongly falcate. Other *Sarcoglottis* species from the area are similar; however, *S. calcicola* differs in the congested inflorescence, floral bracts shorter than the ovary (rather than as long as or longer than the ovary), the small flowers with lip less than 2 cm long, the falcate petals and the base of midlobe rounded, with 2 keels converging at apex. These keels are similar to those of *S. hunteriana* Schltr., also known from Guanacaste, but the latter has leaves mostly marked with silvery stripes and blotches, floral bracts (distinctly exceeding the middle of the ovary), and much larger flowers on a laxly flowered raceme.

Plants of *Sarcoglottis* spp. can also be confused with *Beloglottis costaricensis* when they are not in flower, as both have basal leaves arranged in a rosette; however, in the latter, the leaves have waved margins, whereas in species of *Sarcoglottis* the margin is straight. When in flower, *Sarcoglottis calcicola* has bigger brown-green flowers, instead of the smaller flowers that are white with a green stripe of *B. costaricensis*.

Additional specimens examined: COSTA RICA. Guanacaste: Nicoya, San Antonio, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, terrestres en sitio rocoso con hojarasca, 21 febrero 2006, *D. Bogarín 2593* (JBL-spirit). BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, 22 febrero 2006, *D. Bogarín 2614* (JBL-spirit). BHNP, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestres orillas del camino, bosque secundario, 7 noviembre 2011, *D. Bogarín 9418* (CR).

23c. ***Sarcoglottis sceptrodes*** (Rchb.f.) Schltr., Beih. Bot. Centralbl. 37(2): 421. 1920. Fig. 13C–D, 47.

Basionym: *Spiranthes sceptrodes* Rchb.f., Bonplandia (Hannover) 3: 214. 1855. TYPE: NICARAGUA. Segovia: Guanacarta [Costa Rica: Guanacaste], *A. S. Oersted s.n.* (Holotype: W).

Homotypic synonyms: *Gyrostachys sceptrodes* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 664. 1891. *Gyrostachys sceptrodes* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 664. 1891.

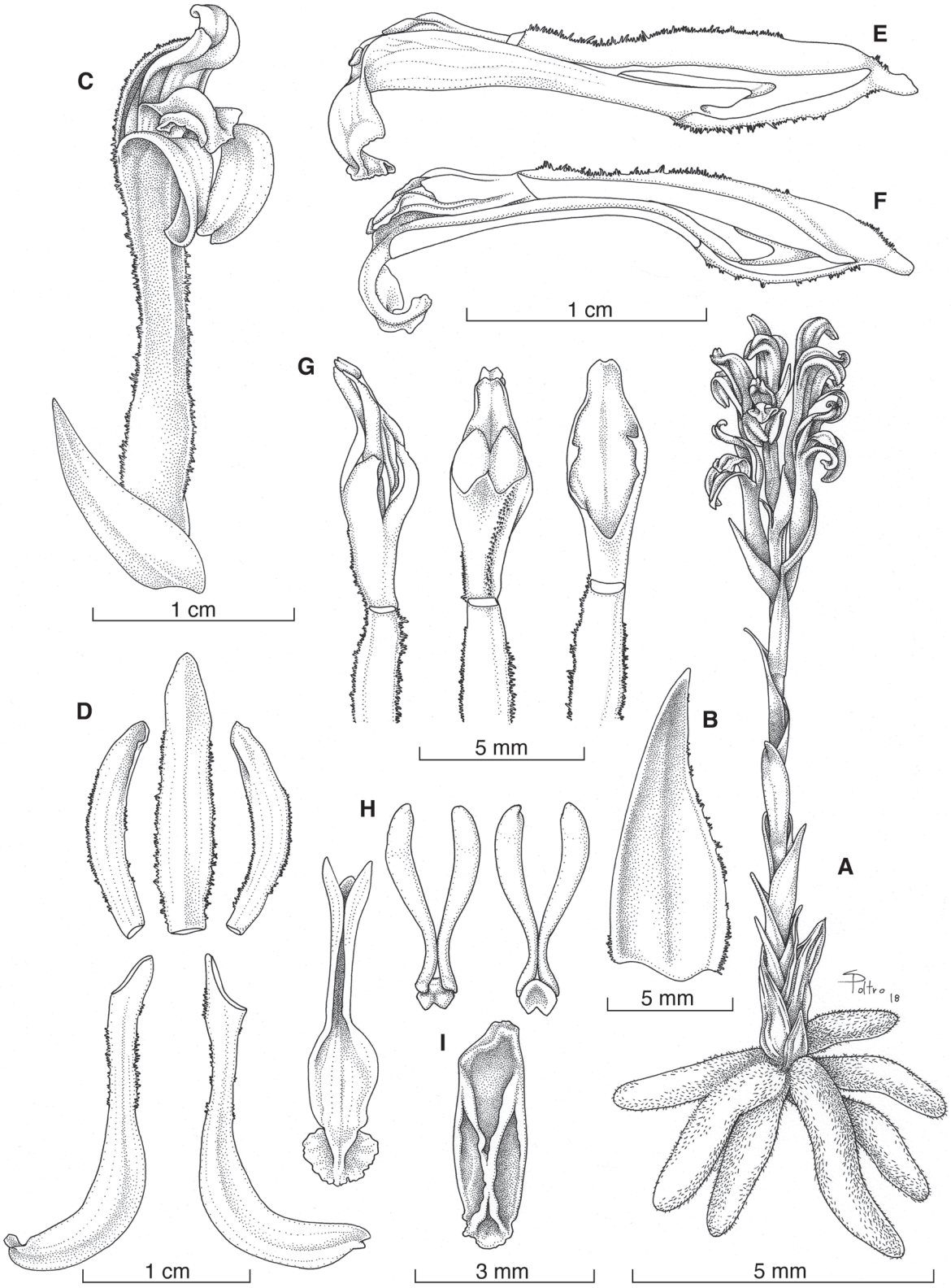

FIGURE 46. *Sarcoglottis calcicola* Bogarín & Pupulin. **A,** Leafless habit. **B,** Floral bract. **C,** Flower. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Column and lip (longitudinal section), side view. **G,** Column, side and ventral views. **H,** Pollinarium. **I,** Anther cap. Drawn by S. Poltronieri and F. Pupulin from *Bogarín 11206* (JBL).

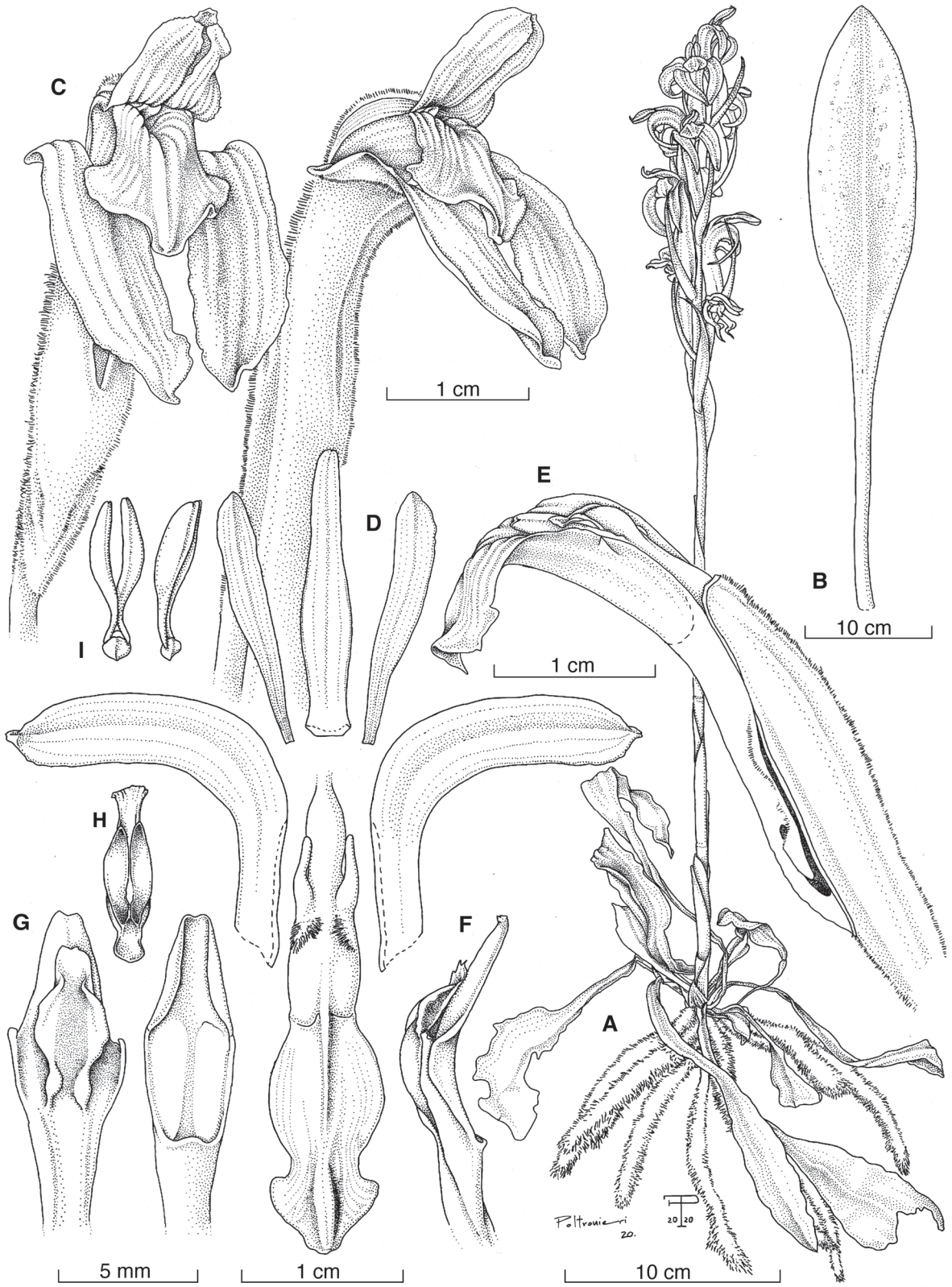

FIGURE 47. *Sarcoglottis sceptrodes* (Rchb.f.) Schltr. **A,** Habit with shredding leaves. **B,** Leaf. **C,** Flower, two views. **D,** Perianth flattened. **E,** Column and lip, side view (the nectary sectioned). **F,** Column, lateral view. **G,** Column, dorsal and ventral view. **H,** Anther cap. **I,** Pollinarium, two views. Drawn by F. Pupulin and rendered by S. Poltronieri from *Pupulin 8195* (JBL).

A terrestrial *herb*, up to 40 cm high, deciduous during the dry season and at flowering. *Roots* thick, succulent, fusiform, fasciculate, 5–20 cm long, 0.5–1.0 cm in diam., pubescent. *Leaves* 3–9, arranged in a basal rosette, distinctly petiolate, the petiole canaliculated, to 20 cm long, the blade elliptic, acute, 11–20 × 4.5–8.2 cm, green, occasionally marked with white spots and small blotches. *Inflorescence* apical, erect, stout, racemose, subdense, produced from the center of the basal rosette when the plant is deciduous, helical, densely glandular, with 5–11 flowers opening in succession, scape to 40 cm long, peduncle 18–25 cm long, rachis 7–8 cm long, with 8–10 tightly appressed tubular, acute, subglabrous caulinar bracts longer than the internodes, to 3.0 × 0.8 cm. *Floral bracts* narrowly lanceolate, long acuminate, basally glandular, subequalling or exceeding the length of the ovary, 3.7–4.6 × 0.7–1.0 cm. *Ovary* glandular-pubescent, cylindrical, to 3.2 × 0.5 cm. *Flowers* large, up to 3.5 cm long from the tips of dorsal and lateral sepals, densely glandular-pubescent in the outer part of the floral parts, resupinate, basally tubular, the dorsal sepal and the petals porrect, the lateral sepals gently bending, yellow-green to green. *Dorsal sepal* linear-lanceolate, subobtuse, concave, gently recurved apically, 1.7 × 0.3 cm. *Lateral sepals* subsimilar, oblong, connate basally, acute, abruptly subacuminate, the free portion curved, spreading, apically subconduplicate, the margins undulate, 2.5–2.7 × 0.4 cm. *Petals* ligulate-oblong, obtuse, abruptly subacute, twisted and slightly upturned from the middle point, apically connivent with the dorsal sepal forming a channel with the base of the lip, 1.70 × 0.26 cm. *Lip* clawed, clearly divided into hypochile and epichile, apically geniculate, extended over the claw into 2 digitate, sinuous, basally hirsute auricles, then canaliculate, the blade constricted basally and below the apex, the hypochile elliptic, widened apically, provided with a low keel above the middle, the epichile subtriangular, truncate at the base, undulate, with a central thickened, rounded keel running from the apical constriction to the epichile apex and several veins radiating toward the margins, 2.9 × 0.7 cm. *Nectary* to 2 cm long. *Column* hemicylindrical, dorsoventrally flattened, broadened in the middle, basally papillose, with 2 subelliptic, truncate wings, beaked, the rostellar apex excise, to 12 mm long. *Pollinia* 2, narrowly ovoid to oblong, sigmoid, puberulent, with a short rounded viscidium. *Anther cap* cucullate, rostrate, with 2 cells.

Distribution: from Mexico to northern Costa Rica.

Distribution in the Park: a large population of *S. acaulis* was located along a seasonal stream in the secondary, premontane moist forest of Zona Protectora Cerros de Jesús.

Etymology: from the Greek *skeptron, sceptrum*, "wand, shaft, or baton," and *odes*, "resembling," in allusion to the shape of the inflorescence.

Discussion: the plants found in this study match well the type specimen of *Sarcoglottis sceptrodes*, especially in the long-acuminate floral bracts and the base of the lip midlobe truncate. It is easily distinguished by other *Sarcoglottis* species at BHNP by the combination of mostly green flowers with lateral sepals nonreflexed, the free portion curved, and the margins wavy-undulated, and the midlobe of the lip basally truncate. Pupulin (2002) and Dressler (2003) did not include *S. sceptrodes* among the species of the genus in Costa Rica. However, the type of *Spiranthes sceptrodes* is undoubtedly from "Guanacarta" (Guanascaste) in Costa Rica, even though erroneously referred by the collector to the Nicaraguan region of Segovia.

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, 10°05'41.71"N, 85°18'59.58"W, 370 m, premontane moist, transition to tropical moist forest, terrestrial in secondary mature vegetation along a seasonal stream with high trees, 23 February 2012, *F. Pupulin 8193 & D. Bogarín* (JBL-spirit). Same locality, *F. Pupulin 8194 & D. Bogarín* (JBL-spirit), *F. Pupulin 8195 & D. Bogarín* (JBL-spirit), *F. Pupulin 8196 & D. Bogarín* (JBL-spirit).

24. *Scaphyglottis* Poepp. & Endl., Nov. Gen. Sp. Pl. 1: 58. 1835[1836].

TYPE: *Scaphyglottis graminifolia* (Ruiz & Pav.) Poepp. & Endl.

Plants cespitose or repent, epiphytic herbs, with definite pseudobulbs or thickened, simply or distichous, superposed stems, often producing 1 to several new shoots at the apices of older shoots. *Leaves* 1–3, conduplicate to semiterete, thin to coriaceous, persistent. *Inflorescence* terminal racemose, or at the nodes of the stem, appearing fasciculate, 1- to few-flowered. *Flowers* small green, tan, red, or white. *Sepals* and *petals* subequal, spreading, the lateral sepals more or less adnate to the column foot. *Lip* articulated with the column foot, straight to geniculate, with or without a claw, entire or 3-lobed. *Column* short, provided with wings or auricles or wingless, usually with a short to prominent foot, usually a distinct nectary on the column foot. *Anther* terminal, operculate, incumbent. *Pollinia* 4 or 6, laterally compressed, ceraceous.

A Neotropical genus of about 55 species, distributed from Mexico to Brazil, Bolivia, and the West Indies. The majority of species occur in Costa Rica and Panama. About 35 species in Costa Rica, 2 in BHNP.

KEY TO SPECIES OF *SCAPHYGLOTTIS*

1a. Pseudobulbs not prolific, inflorescence racemose elongate ..... *S. micrantha*
1b. Pseudobulbs prolific, inflorescence shortly racemose appearing fasciculate ..... *S. stellata*

24a. ***Scaphyglottis micrantha*** (Lindl.) Ames & Correll, Bot. Mus. Leafl. 10(4): 85. 1942. Fig. 13E, 48.

Basionym: *Hexadesmia micrantha* Lindl., Edwards's Bot. Reg. 30: Misc. 2. 1844. TYPE: GUATEMALA. Without locality, collected by Skinner and cultivated by *Messrs. Loddiges catalogue no. 389* (Holotype: K).

Homotypic synonyms: *Pseudohexadesmia micrantha* (Lindl.) Brieger, Die Orchideen 8(2932): 489. 1976. *nom. inval.*

Plants epiphytic, caespitose, erect, to about 16 cm tall, with abbreviated rhizome. *Roots* filiform, slender, glabrous, with green vegetative apex. *Pseudobulbs* fusiform, stipitate,

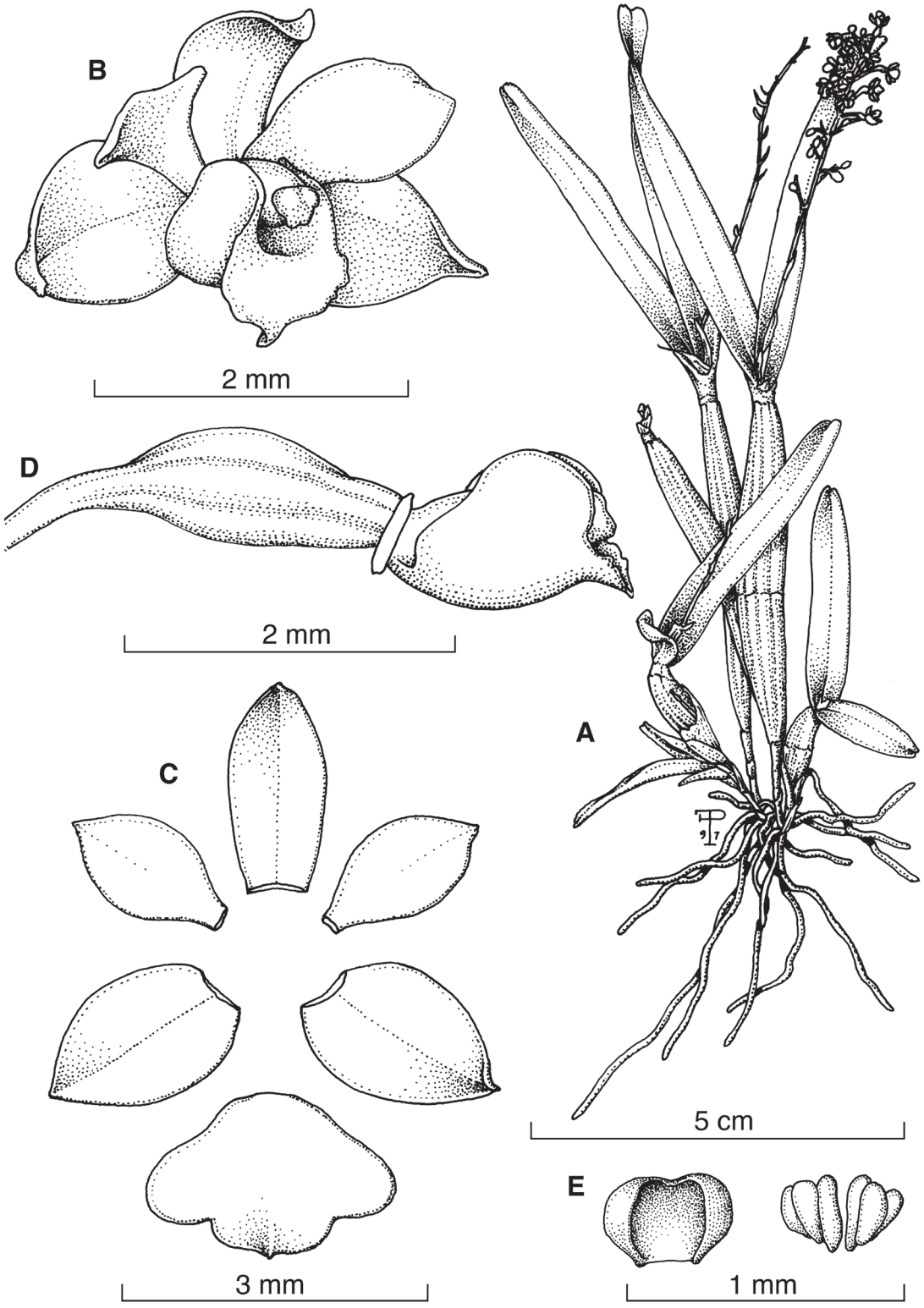

FIGURE 48. *Scaphyglottis micrantha* (Lindl.) Ames & Correll. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 377* (JBL).

somewhat curved, unbranched, diphyllus, subtended by many scarious, imbricating, whitish sheaths, sulcate, to 7 × 0.8 cm. *Leaves* linear, conduplicate, membranaceous, obliquely retuse, to 4.0–8.4 × 0.6–0.8 cm. *Inflorescence* apical, racemose, many-flowered, to 8.5 cm long; peduncle filiform, provided with several spreading sheaths, subtended by several scarious sheaths. *Ovary* pedicellate, linear, abruptly thickened at apex, 9 mm long, including the pedicel. *Floral bracts* linear-lanceolate, acuminate, scarious. *Flowers* very small, inconspicuous, hyaline, resupinate, with white sepals and petals, and green lip and column. *Dorsal sepal* elliptic-obovate, obtuse to slightly apiculate, concave, 2 × 1 mm. *Lateral sepals* obliquely broadly ovate-elliptic, apiculate, forming an inconspicuous mentum, 1.9 × 1.4 mm. *Petals* obliquely elliptic, rounded and apiculate at apex, slightly crenulate, 1.7 × 0.9 mm. *Lip* 3-lobed, subreniform-flabellate, 1.6 × 2.5 mm; the lateral lobes obliquely elliptic, broadly rounded at apex, erect and surrounding the column in natural position, attached to the column foot; the midlobe transversally elliptic to subquadrate, apiculate, with minutely crenulate margins. *Column* short, terete, slightly arcuate, 1.2 mm long. *Pollinia* 6, on a short caudicle. *Anther cap* subcordate, cucullate, 2-celled.

Distribution: from Guatemala to Panama.

Distribution in the Park: widespread along the main trails toward Bosque de Piedra, Cerro Barra Honda, Las Delicias, Las Cascadas, and La Palma, and pastures and secondary forest surrounding the park.

Etymology: from the Greek *micro*, "little, small," and *anthos*, "flower," in allusion to the tiny flowers.

Habitat and ecology: plants grow epiphytically in tropical moist and wet forest, seasonal warm lowlands along the Pacific coast, and the seasonal areas of Valle Central under 1500 m of elevation. It was observed on *Plumeria rubra* (Apocynaceae), *Spondias mombin*, *Syderoxylum capiri* (Sapotaceae), and *Brosimum aliscastrum* (Moraceae).

Phenology: from March to July.

Discussion: they are characterized by caespitose plants with fusiform, shortly stipitate, and not prolific pseudobulbs with 2 ligulate leaves at apex. The inflorescence is apical, racemose with several tiny white flowers less than 3 mm in diam. The other species of *Scaphyglottis* at BHNP, *S. stellata,* is distinguished by the larger, prolific plants and the larger, white-pink flowers in a shorter, racemose, few-flowered inflorescence.

Additional specimens examined: BHNP, Sendero Ceiba, sector de Las Cascadas, 10°11'15.0"N, 85°20'36.1"W, 210 m, bosque húmedo premontano transición a basal, epífitas en árbol caido de *Ficus* sp. (Moraceae), 11 julio 2005, *D. Bogarín 1672 y F. Paniagua* (JBL-spirit). BHNP, Cerros Barra Honda, Bosque de Cactus hacia una loma rocosa, al lado derecho, en dirección a La Mantequilla, 10°10'34.6"N, 85°21'20.7"W, 421 m, bosque húmedo premontano transición a basal, epífitas en *Plumeria rubra* (Apocynaceae), 21 febrero 2006, *D. Bogarín 2603* (JBL-spirit). BHNP, sendero hacia el Mirador Nacaome, 10°09'56.7"N, 85°21'39.3"W, 388 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario a orillas del sendero, 20 marzo 2010, *D. Bogarín 7471* (JBL-spirit).

24b. ***Scaphyglottis stellata*** Lodd. ex Lindl., Edwards's Bot. Reg. 25: misc. 44. 1839. Fig. 13F, 49.

TYPE: [Guyana]. It is a native of Demerara, whence it was obtained by *Messrs. Loddiges* (Holotype: K).

Homotypic synonym: *Ponera stellata* (Lodd. ex Lindl.) Rchb. f., Ann. Bot. Syst. 6: 454. 1862.

Heterotypic synonyms: *Ponera amethystina* Rchb.f. in W.W. Saunders, Refug. Bot. 2(1): 93. 1872. TYPE: [PANAMA]. Sent from Santa Fé de Veraguas, by the late Mr. Skinner, to W. Wilson Saunders, *G. Skinner s.n.* (Holotype: W).

Scaphyglottis amethystina (Rchb.f.) Schltr., Beih. Bot. Centralbl. 36(2): 456. 1918.

Scaphyglottis brachiata Schltr., Repert. Spec. Nov. Regni Veg. 9: 432. 1911. TYPE: COSTA RICA. [Guanacaste]. In den Wäldern von Nicoya, blühend in Dezember 1899, *A. Tonduz* [s.n. (Herb. Instit. physico-geogr. nat. costaricensis] *13729* (Holotype: B, destroyed; Lectotype: designated by Pupulin et al., 2016: US).

Plants epiphytic, caespitose, erect or pendent, to about 40 cm tall, usually with superimposed pseudobulbs. *Roots* filiform, slender, glabrous, emerging from the rhizome, or at the connection of old and new pseudobulbs. *Pseudobulbs* fusiform, distinctly stipitate, to 12.0 × 0.5 cm, bearing 2 leaves (rarely 1-leaved), laterally flattened, each pseudobulb usually producing 1 to several new shoots at the apices of older shoots emerging from imbricating, papyraceous sheaths. *Leaves* linear-lanceolate to narrowly elliptic, obliquely retuse, conduplicate, subcoriaceous, to 12.0 × 0.8 cm. *Inflorescence* few-flowered, racemose, abbreviated, and appearing fasciculate, borne at the apex of each internode of the stem. *Ovary* pedicellate, linear, to 5 mm long. *Floral bracts* ovate-elliptic, acute, imbricate, scarious. *Flowers* small, with white sepals and petals, the lip rose-purple striped with purple; column and anther deep purple. *Dorsal sepal* lanceolate-elliptic, acute, slightly concave toward the apex, 7.0 × 2.5 mm. *Lateral sepals* connate at the base, forming a short mentum, obliquely linear-lanceolate, acute, 8.0 × 2.5 mm. *Petals* ligulate, slightly constricted toward the apex, then rounded and apiculate, 7.0 × 1.5 mm. *Lip* clawed, the blade 3-lobed, obovate-flabellate; lateral lobes large, rounded, erose at apex, inserted at the middle of the lip; midlobe subquadrate, obtuse to emarginate; entire lip 7 × 5 mm between the lateral lobes. *Column* terete, slightly arcuate, with 2 narrowly triangular stelidiar arms toward the apex, 3 mm long. *Pollinia* 4, on short bifid caudicles. *Anther cap* cucullate, rounded, 4-celled.

Distribution: Costa Rica to Bolivia and Brazil.

Distribution in the Park: common at Cerro Barra Honda, along the main trails and at Las Cascadas.

Etymology: from the Latin *stellatus*, "stellate, star-like, with spreading rays," in allusion to the spreading sepals and petals.

Habitat and ecology: epiphytic in tropical wet and moist forest from 0 to 1000 m of elevation along the Pacific lowlands from Península de Nicoya to Península de Osa. It was observed on *Brosimum aliscastrum, Ficus* sp. (Moraceae), and *Plumeria rubra*.

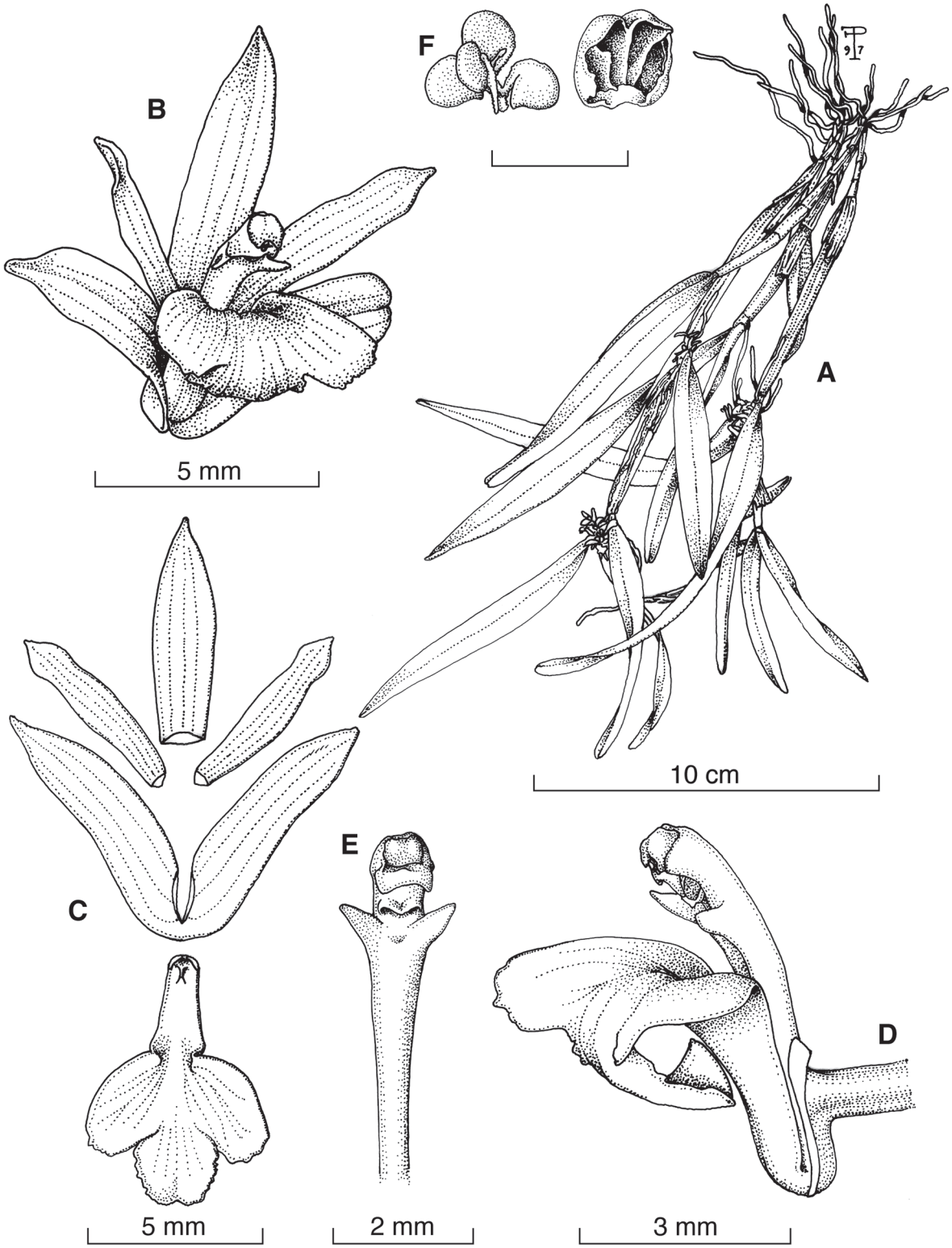

FIGURE 49. *Scaphyglottis stellata* Lodd. ex Lindl. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 300* (JBL).

Phenology: plants flower throughout the year but mostly from May to July.

Discussion: it is distinguished by the thick pseudobulbs produced in chains, the oblong leaves, the white-pink flowers in a short inflorescence developed at the base or at the apex of each pseudobulb, and the column with 2 stigmatic arms. *Scaphyglottis micrantha* has linear leaves, a nonprolific habit, and smaller white flowers produced apically in an elongate racemose inflorescence, and the plants are comparatively shorter than *S. stellata*.

Additional specimens examined: BHNP, Sendero Ceiba, sector de Las Cascadas, 10°11'15.0"N, 85°20'36.1"W, 210 m, bosque húmedo premontano transición a basal, epífitas en árbol caido de *Ficus* sp. (Moraceae), 11 julio 2005, *D. Bogarín 1673 y F. Paniagua* (JBL-spirit).

25. *Sobralia* Ruiz & Pav., Fl. Peruv. Prodr. 120. 1794.
TYPE: *Sobralia biflora* Ruiz & Pav.

Plants terrestrial or epiphytic, small or large herbs, with foliaceous, reed-like stem, rarely branching. *Leaves* distichous, sessile, pergameneous, plicate. *Inflorescence* a terminal raceme, often 1-flowered. *Flowers* showy, large, spread, fugacious, usually lasting 1 day or up to 3 days, often showing synchronous flowering in gregarious species. *Sepals* and *petals* subequal, sometimes shortly connivent at the base, spreading, the petals usually broader than sepals. Lip prominent, trumpet-like, not clawed, entire or 3-lobed, usually concave, the basal margins enfolding the column at the base, commonly retuse or bilobed, the disc smooth or lamellate, generally with an inconspicuous to conspicuous callus at the base made up of keels, toothed crests or bristles. *Column* elongate, fragile, usually ventrally provided with a strong keel, footless, often with a pair of falcate angles at the summit. *Anther* incumbent, 2-celled. *Pollinia* 8 or 4 in each cell, granular or subceraceous.

A Neotropical genus of about 130 species, widespread from Mexico to Peru, Bolivia, southern Brazil, and the West Indies. About 35 species in Costa Rica. One species recorded in BHNP.

Sobralia fenzliana Rchb.f., Bot. Zeitung (Berlin) 10: 714. 1852. Fig. 13G, 50.
TYPE: PANAMA. Chiriqui Cordilleren 1–2000', *J. Warszewicz s.n.* (Holotype: W).
Heterotypic synonyms: *Sobralia neglecta* Schltr., Repert. Sp. Nov. Regni. Veg. Beih. 19: 161. 1923. TYPE: COSTA RICA. Lisière des bois au Maderal de San Mateo, 450–500 m. 1922. *A. M. Brenes 279* (Holotype: B, destroyed; Isotype: AMES).

Plants epiphytic or rarely terrestrial, erect to pendent, to about 2 m tall. *Roots* fleshy, glabrous, to 5 mm in diam. Stem reed-like, slender, covered with amplexicaul, black-warty, hispidulous, tubular leaf sheaths, sometimes branched, lepidote. *Leaves* 3–7, distichous, plicate-veined, lanceolate to lanceolate-ovate, acuminate, coriaceous, to about 15–20 × 2.3–5.5 cm. *Inflorescence* apical, sessile, a 1-flowered raceme produced among several imbricating bracts. *Ovary* glabrous, to 3 cm long. *Flowers* large, fragile, fugacious often lasting 1 day, not wholly spreading, sepals and petals rose-purple with margins and tips white, the lip purple darker with the center red-purple and the base yellow, rarely white. *Dorsal sepal* lanceolate to oblong-elliptic, free, acute, slightly concave, conduplicate, recurved apically, about 4.5–6.0 × 1.6–1.9 cm. *Lateral sepals* obliquely lanceolate, acute, conduplicate, concave, and recurved toward the apex, 4.5–6.0 × 1.4–1.9 cm. *Petals* elliptic-lanceolate to elliptic-obovate, apically slightly conduplicate, acute, wider than sepals, 4.5–5.7 × 1.5–2.2 cm. *Lip* obovate, cuneate, obtuse to minutely retuse, deeply concave, trumpet-like, the basal margins tubular-involute, enclasping the column, the apex deflexed, spread, with slightly lacerate-crenulate margins, 6.5 × 3.6 cm; callus at the base of the lip formed by 2 low, slender, divergent carinae and numerous minute lamellae from the base toward the apex. *Column* elongated, subterete, slender, abaxially keeled, to 3.5 cm long, with a pair of falcate arms at the apex's sides, galeate in the middle. *Pollinia* 8, granular. *Anther cap* cucullate, bifid at the base, about 3 mm long.

Distribution: Nicaragua, Costa Rica, and Panama.

Distribution in the Park: a plant was found growing at La Jaralosa in Zona Protectora Cerros de Jesús, 6 km from BHNP in the humid evergreen forest. It is likely found at Los Mesones and Las Cascadas.

Eponymy: after the Austrian botanist Eduard Fenzl (1808–1879), professor of botany, director of the Imperial Botanical Cabinet, and member of the Vienna Academy of Sciences, who presented this species to H. G. Reichenbach.

Habitat and ecology: epiphytic in humid, warm, tropical moist and wet forest, premontane moist forest basal belt transition on both Caribbean and Pacific lowlands from 0 to 600 m of elevation. Plants were observed on *Syderoxylum capiri* (Sapotaceae).

Phenology: from January to July.

Discussion: distinguished by the epiphytic plants with branching, leafy, elongated stems bearing several plicate leaves and the rose-purple flowers with a trumpet-like lip, lasting 1 or 2 days.

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, ascenso por el sector de La Jaralosa, 10°05'58.1"N, 85°19'11.7"W, 436 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario sobre un yurro con árboles altos, 14 julio 2005, *D. Bogarín 1693, F. Villalobos, C. Aguilar, O. Durán, F. Paniagua* (JBL-spirit).

26. *Specklinia* Lindl., Gen. Sp. Orchid. Pl. 8. 1830.
TYPE: *Specklinia lanceola* (Sw.) Lindl.

Plants epiphytic, rarely lithophytic, caespitose, or repent. *Stem* enclosed by tubular, imbricating sheaths, with an annulus. *Leaf* coriaceous, elliptic, oblong, orbicular to obovate, acute to obtuse, usually petiolate. *Inflorescence* racemose, sometimes flexuous. *Flowers* small, relatively inconspicuous, resupinate, rarely nonresupinate. *Sepals* triangular, ovate, acute or obtuse, elliptical, often caudate, or transversely ovate and cucullate, the lateral sepals free or variously connate to form a synsepal. *Petals* elliptical to

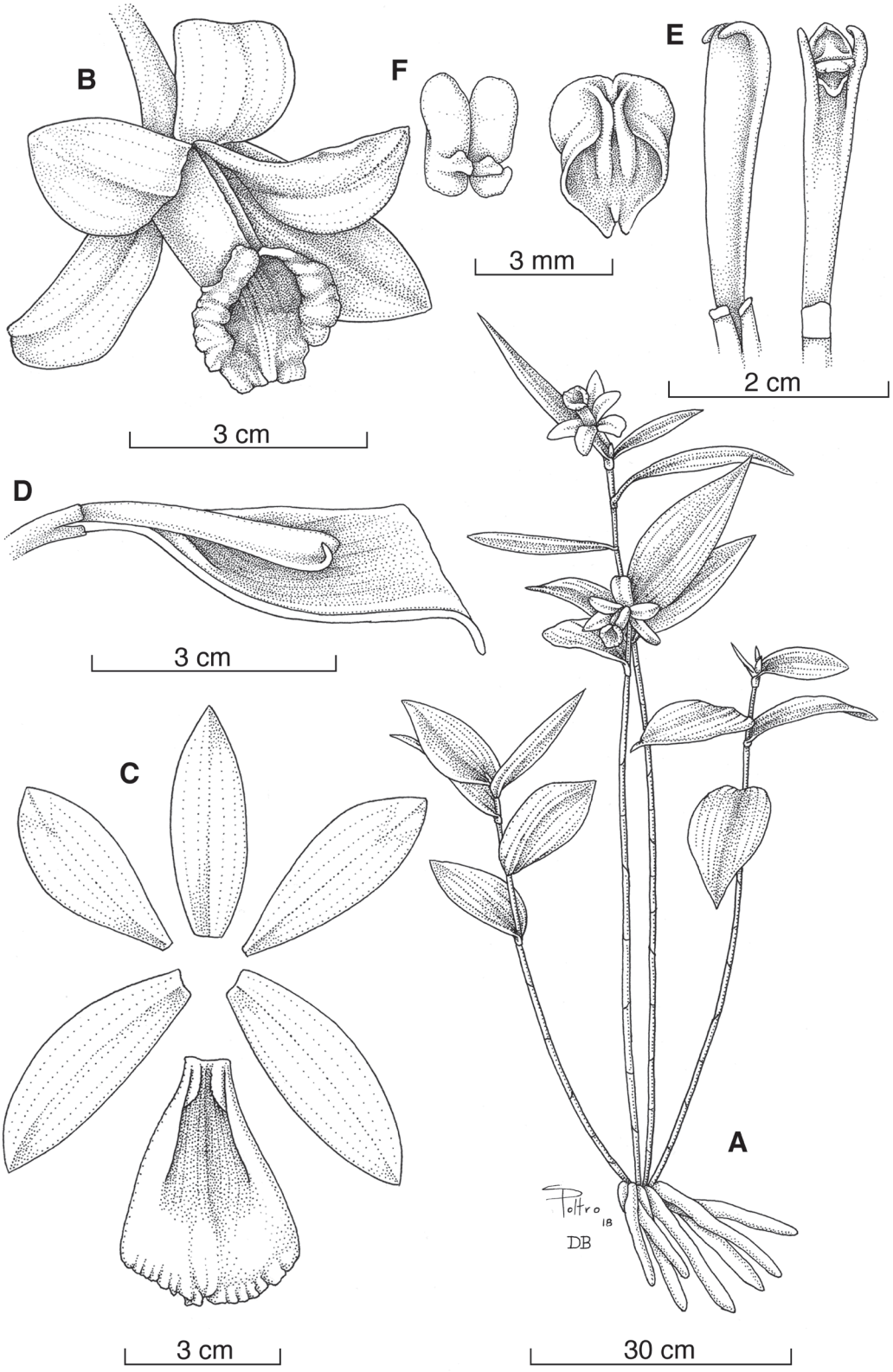

FIGURE 50. *Sobralia fenzliana* Rchb.f., **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip (longitudinal section), side view. **E,** Column, side and ventral view. **F,** Pollinarium and anther cap. Drawn by D. Bogarín and S. Poltronieri from *Bogarín 16*93 (JBL).

oblong or spathulate, acute to obtuse, entire to fimbriate or lacerate. *Lip* simple or trilobed, elliptical to pyriform and subpandurate, acute to rounded, sometimes fimbriate, base usually hinged to column foot. *Column* semiterete, usually winged, with a foot. *Anther* apical, incumbent; *pollinia* 2; *stigma* entire. *Capsule* globose, elliptical to obovoid, sometimes verrucose or echinate.

A genus of nearly 200 species from Mexico to Bolivia, Brazil, and the West Indies. About 40 species in Costa Rica, 2 at BHNP.

KEY TO SPECIES OF *SPECKLINIA*

1a. Plants cespitose, erect, leaves smooth, not superposed . . . . . *S. grobyi*
1b. Plants prostrate, creeping, appressed to the substrate, leaves granulose, superposed . . . . . *S. panamensis*

26a. ***Specklinia grobyi*** (Bateman ex Lindl.) F. Barros, Hoehnea 10: 110. 1983 [1984]. Fig. 13H, 51.

Basionym: *Pleurothallis grobyi* Bateman ex Lindl., Edwards's Bot. Reg. 21: t. 1797. 1835. TYPE: [GUYANA. Demerara] "A native of Demerara, whence it was imported by Mr. Bateman," *J. Bateman s.n.* (Holotype: K). *Specklinia grobyi* (Bateman ex Lindl.) Pridgeon & M.W. Chase, Lindleyana 16(4): 258. 2001, isonym.

Plants epiphytic, caespitose, up to 3 cm high. *Roots* thin, to 1 mm in diam., grayish white with greenish-reddish tips. *Rhizome* distichous, covered by imbricate scarious bracts. *Ramicauls* slender, erect, to 1 cm long, enclosed by 2–3 whitish, imbricate, scarious, tubular sheaths. *Leaves* narrowly obovate-elliptic, oblong or suborbicular, erect, fleshy, coriaceous, lenticular, obtuse, conduplicate, emarginate with a small apicule beneath, stained with purple spots or lines on the underside, 1.0–2.2 × 0.6–1.1 cm, the base narrowly cuneate into a petiole 0.5–1.1 cm long. *Inflorescence* apical, racemose, distichous, lax, somewhat fractiflex, producing 3–7 flowers, longer than leaves, up to 6 cm long; peduncle filiform, to 3 cm long; rachis to 3 cm long. *Ovary* cylindrical, ridged, less than 2.0–2.5 mm; pedicel, 2.5–3.0 mm long. *Flowers* small, less than 5 mm in diam., resupinate, somewhat tubular, yellow, sometimes stained with red-purple at the apex of the sepals and striped with the same color along the lip and petals. *Dorsal sepal* ovate to elliptic, concave, conduplicate, acute, 4.8 × 1.8 mm. *Lateral sepals* connate up to the apex into an ovate synsepal forming a shallow mentum below the column foot, concave, conduplicate, subacute to obtuse, retuse, 4.7 × 2.5 cm. *Petals* oblanceolate-obovate, membranaceous, oblique, acute, 1.8 × 0.8 cm. *Lip* oblong, obtuse, somewhat arcuate basally, with a central depression and a callus with 2 light keels on both sides, the truncate base hinged to the column foot, 2.0 × 0.8 mm. *Column* oblong with 2 apical arms, the foot provided with 2 lobes on both sides at the base, the anther and stigma ventral, 2.0 × 0.7 mm. *Pollinia* 2, ovoid. *Anther cap* cucullate.

Distribution: widespread from Mexico to Brazil.

Distribution in the Park: found at Las Cascadas, BHNP, and La Jaralosa in Zona Protectora Cerros de Jesús, 6 km from BHNP in the humid evergreen forest.

Eponymy: Mr. Bateman named it in honor of Lord Grey of Groby, a British orchid enthusiast of the 19th century.

Habitat and ecology: epiphytic in seasonal tropical moist forest and premontane moist forest basal belt transition along the Caribbean and Pacific lowlands from 0 to 1000 m of elevation.

Phenology: from December to April.

Discussion: characterized by the caespitose, erect, small (less than 4 cm tall) plants without pseudobulbs, and the distichous inflorescences that produce tiny yellow flowers less than 6 mm long. The other species of *Specklinia* at BHNP have similar flower morphology. However, it could be easily distinguished by the creeping or repent plants, shorter petioles less than 5 mm long (vs. up to 1.1 cm long in *S. grobyi*) with prostrate, superposed, granulose-verrucose leaves (see description and discussion below).

Additional specimens examined: Guanacaste: Nicoya, Mansión, Zona Protectora Cerros de Jesús, ascenso por el sector de La Jaralosa, 10°05'58.1"N, 85°19'11.7"W, 436 m, bosque húmedo premontano transición a basal, epífitas en bosque secundario sobre un yurro con árboles altos, 14 Julio 2005, *D. Bogarín 1697, F. Villalobos, C. Aguilar, O. Durán, F. Paniagua* (JBL-spirit).

26b. **Specklinia panamensis** (Schltr.) Bogarín & Pupulin, *comb. nov.* Fig. 13I, 52.

Basionym: *Pleurothallis panamensis* Schltr., Repert. Spec. Nov. Regni Veg. 17(8–12): 140. 1921. TYPE: PANAMA. Auf Pampasbäumen in der Provinz Chiriqui und Veragua, blühend im Apr 1858, *M. Wagner 24* (Holotype: B, destroyed; Lectotype: designated here, tracings of Schlechter's drawings of the holotype: AMES 22755).

Plants epiphytic, creeping, prostrate, attached to the substrate, with overlapping leaves, forming large aggregations or mats on the branches and trunks. *Roots* thin, to 1 mm in diam., grayish white with green-reddish tips. *Rhizome* distichous, fractiflex, repent, covered by imbricate, scarious bracts. *Ramicauls* slender, horizontal, prostrate, to 5 mm long, enclosed by 2–3 imbricate, whitish, scarious tubular sheaths. *Leaves* oblong-elliptic, widely ovate or suborbicular, distichous, prostrate, verrucose or granulose in both sides, coriaceous, superposed, fleshy, lenticular, subacute, shallowly conduplicate, shallowly emarginate with a small apicule beneath, abaxially with purple spots on the verrucae, 1.0–2.2 × 0.6–1.1 cm, the base narrowly cuneate into a petiole less than 5 mm long. *Inflorescence* apical, racemose, distichous, lax, somewhat fractiflex, producing up to 5 flowers, longer than leaves, up to 8.5 cm long; peduncle filiform, to 4.0–4.5 cm long; rachis 3–4 cm long. *Ovary* cylindrical, widened apically, ridged, to 3 mm; pedicel, to 8 mm long. *Flowers* small, to 1 cm in diam., resupinate, somewhat tubular, yellow, the dorsal sepal striped with red-purple along the main veins, the petals with a red-purple stripe in the middle, the lip yellow stained with

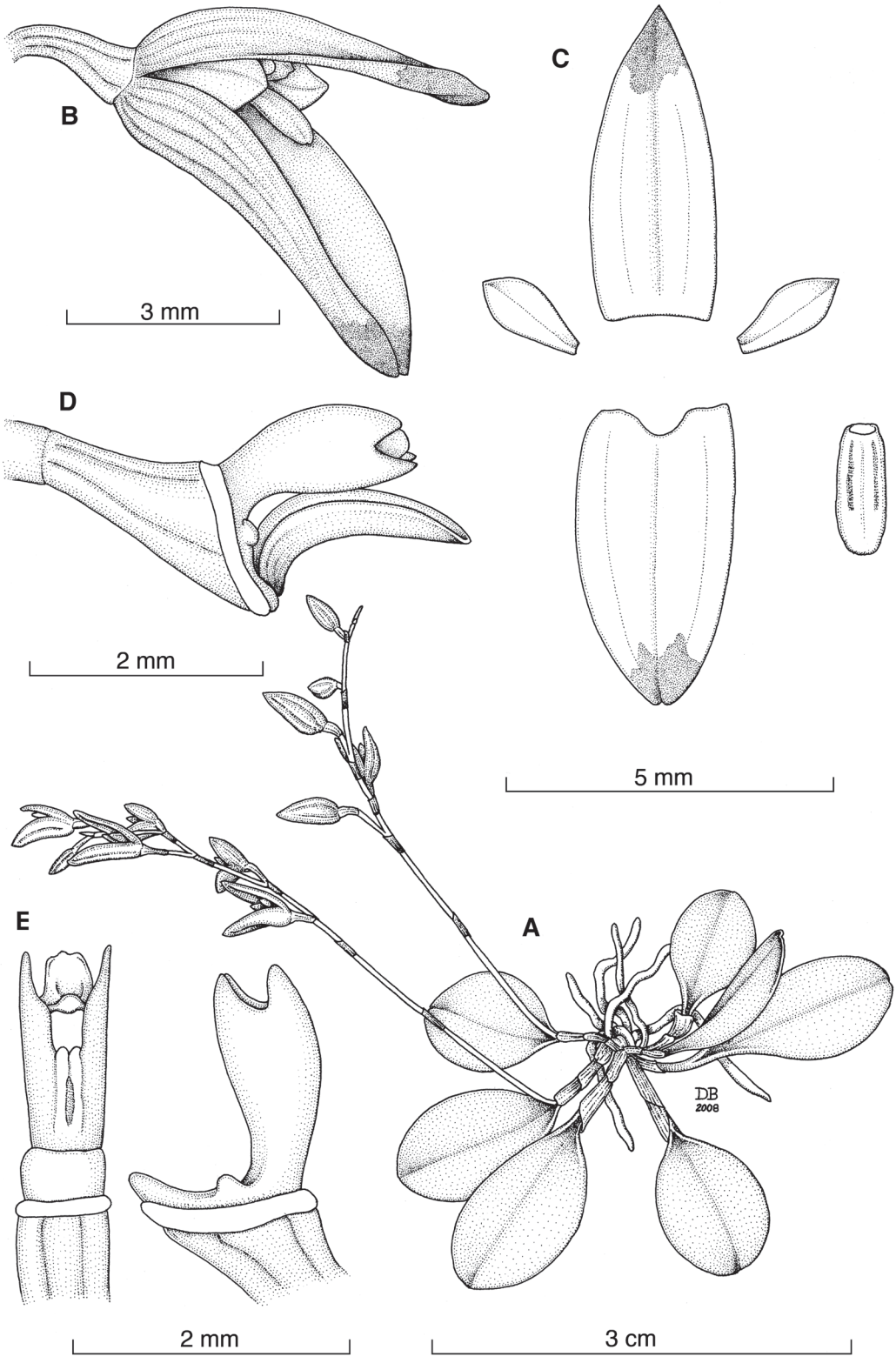

FIGURE 51. *Specklinia grobyi* (Bateman ex Lindl.) F. Barros. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, side and ventral view. Drawn by D. Bogarín from *Bogarín 1697* (JBL).

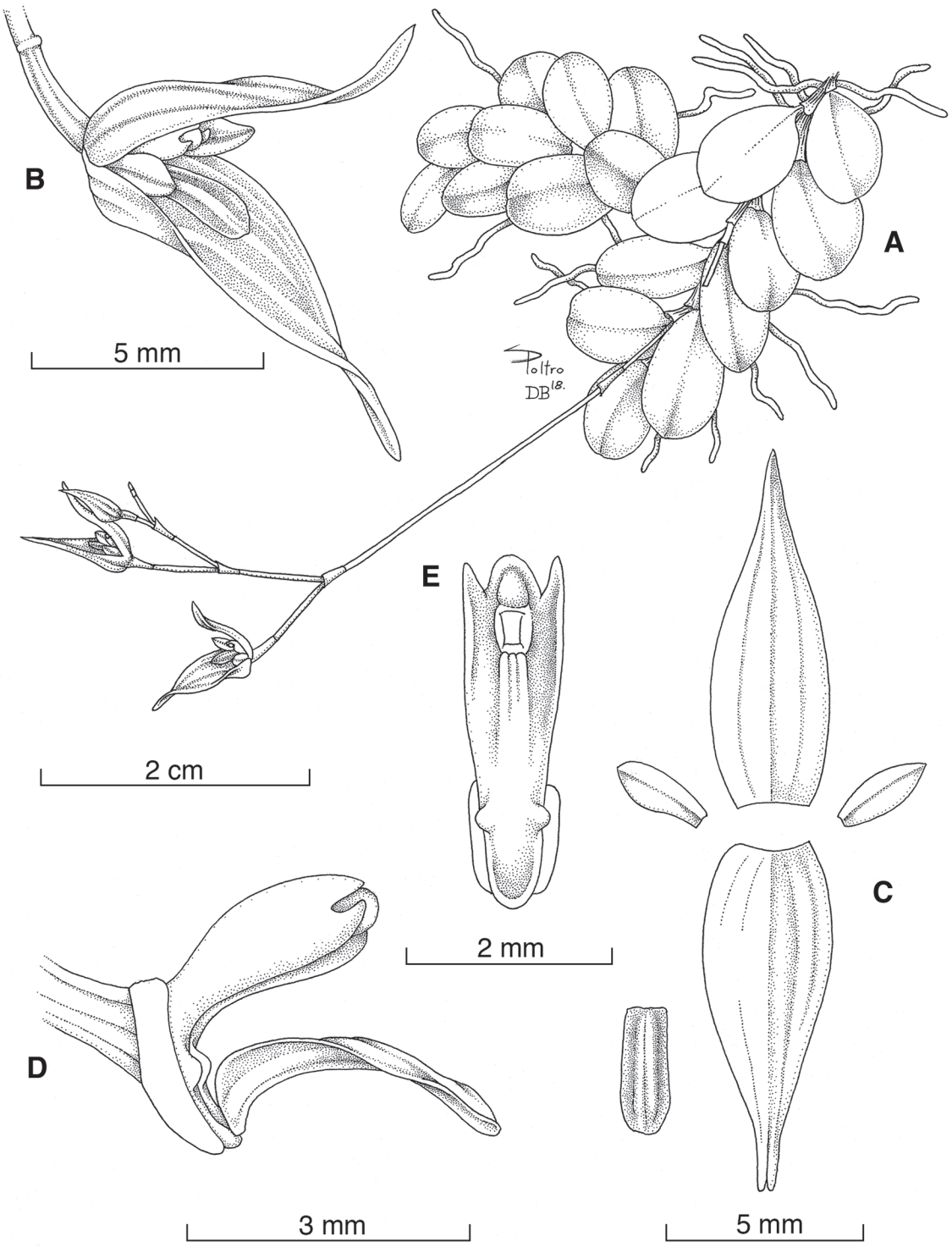

FIGURE 52. *Specklinia panamensis* (Schltr.) Bogarín & Pupulin. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. Drawn by D. Bogarín and inked by S. Poltronieri from *Bogarín 1688* (JBL).

red-purple on the keels, the column yellow. *Dorsal sepal* ovate, concave, conduplicate, acute to acuminate, 9.3 × 3.0 mm. *Lateral sepals* connate up to the apex into an ovate synsepal forming a shallow mentum below the column foot, concave, conduplicate, subacute to obtuse, bifid, 9.0 × 3.5 cm. *Petals* oblanceolate-obovate, membranaceous, oblique, acute, 2.5 × 1.0 cm. *Lip* oblong, obtuse, somewhat arcuate basally, with a central depression and a callus with 2 light keels on both sides, the truncate base hinged to the column foot, 3.0 × 1.5 mm. *Column* oblong with 2 apical arms, the foot provided with 2 lobes on both sides at the base, the anther and stigma ventral, widened apically, 3.1 × 0.9 mm. *Pollinia* 2, ovoid. *Anther cap* cucullate.

Distribution: known from Costa Rica and Panama.

Distribution in the Park: common around the main trails at Cerro Barra Honda, Las Cascadas, and Las Delicias, and on tall trees, branches, and main tree trunks.

Etymology: named after Panama, the country where Moritz Wagner collected the type specimen in 1858.

Habitat and ecology: epiphytic in tropical moist forest, premontane moist forest basal belt transition on branches or main tree trunks, mostly on exposed full sunlight.

Phenology: from March to June.

Discussion: the species complex around *Specklinia grobyi-microphylla* has been challenging to interpret because of the similar flower morphology and small size. We were unable to locate the type specimen of *S. microphylla*. However, a drawing of the type (AMES 57908) shows a plant with erect leaves and 2 flowers on each inflorescence, as noted in the protologue by Richard and Galeotti (1845). The specimens of BHNP differ from *S. microphylla* in the creeping plant habit (vs. caespitose), shorter petioles less than 5 mm long (vs. up to 1.1 cm long), prostrate, granulose-verrucose leaves (vs. erect, smooth), and inflorescences with up to 5 flowers (vs. 2). Among the synonyms assigned to *S. microphylla* (Luer, 2006), we found a species named by Schlechter (1921) as *Pleurothallis panamensis* that matches the specimens collected in BHNP. *Specklinia panamensis* is distinguished by the creeping, repent plants with prostrate, superposed, rounded, granulose-verrucose leaves with lax inflorescences. The flowers are yellow with red stripes on the dorsal sepal, the petals and lip are stained red-purple. Flower morphology of *S. panamensis* is similar to *S. grobyi*; however, it has rounded, prostrate, granulose-verrucose leaves (vs. pedicellate, smooth, elliptic), larger flowers up to 1 cm in diam. (vs. less than 5 mm), and the synsepal and the dorsal sepal acuminate and longer—up to 9 mm long (vs. acute and smaller—less than 5 mm long in *S. grobyi*). Inflorescences are also comparatively longer, with peduncles up to 4.5 cm long (vs. less than 3 mm) and pedicels up to 8 mm long (vs. 3 mm long). This species ranges from Costa Rica (Guanacaste, Alajuela, Puntarenas) up to Panama (Chiriquí). The specimens collected in BHNP and treated here as *S. panamensis* differ from the drawing published by Luer (2006) as *S. microphylla,* which shows a repent habit but erect, smooth leaves and different flower shape (i.e., pandurate lip vs. oblong). Specimens with those characteristics have been collected in the Caribbean lowlands of Costa Rica.

Additional specimens examined: BHNP, Sendero Ceiba y Mirador, 10°10'06.1"N, 85°21'47.4"W, 430 m, bosque húmedo premontano transición a basal, epífita sobre *Spondias mombin*, en bosque secundario, 12 julio 2005, *D. Bogarín 1688 y F. Paniagua* (JBL-spirit).

27. *Trichosalpinx* Luer, Phytologia 38: 393–394. 1983.
TYPE: *Trichosalpinx ciliaris* (Lindl.) Luer.

Plants epiphytic, rarely lithophytic or terrestrial, caespitose, ascending to long-repent, erect, or pendent. *Stem* enclosed by tubular or infundibular lepanthiform sheaths, often proliferating, with an annulus. *Leaf* coriaceous, elliptical, oblanceolate to obovate, acute to obtuse, petiolate, conduplicate, sometimes suffused with purple. *Inflorescence* racemose, rarely single-flowered. *Floral bracts* tubular or infundibular. *Flower* small, resupinate, or nonresupinate. *Sepals* elliptical to ovate, often caudate and pubescent, entire or ciliate, the lateral sepals free or connate into a synsepal. *Petals* smaller than sepals, elliptical to oblong or triangular, acute to rounded entire, dentate, pubescent. *Lip* simple and oblong or trilobed, ciliate, the base flexibly hinged to column foot. *Column* terete or semiterete, winged or hooded, with a foot. *Anther apical*, incumbent. *Pollinia* 2, ovoid with a granular caudicle. *Stigma* entire. *Capsule* ellipsoid or obovoid.

A genus of more than 100 species ranging from Mexico to the West Indies, Bolivia, Venezuela, and Brazil. About 25 species in Costa Rica, 1 at BHNP.

Trichosalpinx reflexa Mel. Fernández & Bogarín, Phytotaxa 38: 42. 2011. Fig. 14A, 53.
TYPE: COSTA RICA. Guanacaste: Nicoya, San Antonio, Barra Honda National Park, Ceiba trail, area of Las Cascadas, 10°11'15"N, 85°20'36.1"W, 210 m, basal transition to premontane wet forest, epiphytes in fallen *Ficus* sp. (Moraceae) tree, 11 July 2005, *D. Bogarín 1674 y F. Paniagua* (Holotype: JBL; Isotype: CR).

Plants epiphytic, caespitose, erect to suberect, up to 10 cm tall. *Roots* slender, flexuous, to 2 mm in diam. *Ramicauls* slender, pendulous, terete, 1.5–5.5 cm long, enclosed by 2–7 tubular bracts, adpressed at the base, ribbed, minutely ciliate at the margins, brown, 0.8–1.4 cm long. *Leaves* narrowly elliptical to narrowly obovate, apiculate, erect, fleshy, coriaceous, green suffused with purple beneath, 2.7–5.4 × 0.7–1.4 cm, the cuneate-attenuate base narrowing into a petiole up to 0.7 cm long. *Inflorescence* distichous, a successively 4- to 8-flowered raceme, 1.2–1.6 cm long including the peduncle 4 mm long, produced at the base of the leaf from a small, conduplicate, linear-ovate, acute spathe. *Floral bracts* cuneiform, conduplicate, 1 × 1 mm. *Pedicels* 1 mm long, persistent. *Ovary* cylindric, 1 mm long. *Flowers* with the sepals white suffused with dark purple toward the apex, petals translucent white, the lip blackish purple, the column, and anther white. *Dorsal sepal* erect, oblong, obtuse, convex toward the apex, 3.5–4.5 × 2.0–2.5 mm, 3-veined. *Lateral sepals* connate into an ovate-oblong, retuse, entire synsepal, concave at the base, and reflexed toward the apex, 3–4 × 2.0–2.5 mm, 3-veined. *Petals* oblong, acute, entire or minutely serrate, the apex

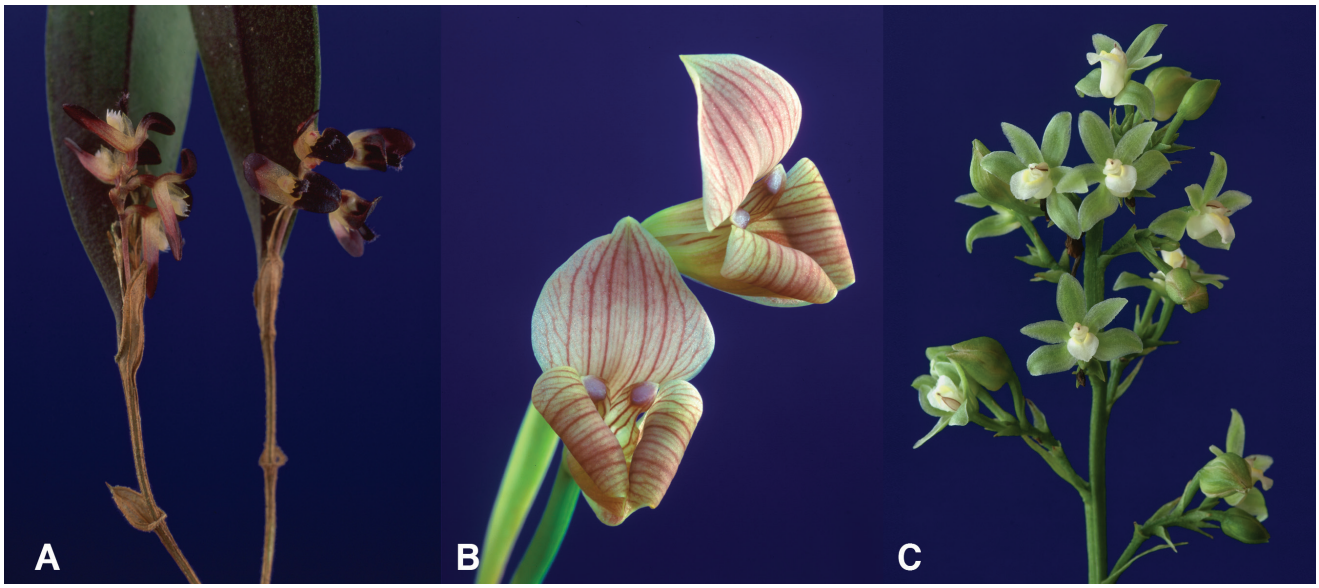

FIGURE 14. **A–C.** Orchid species found at Barra Honda National Park. **A,** *Trichosalpinx reflexa* (*Bogarín 1674*, JBL). **B,** *Trigonidium egertonianum* (*Pupulin 8200*, JBL). **C,** *Tropidia polystachya* (*Bogarín 11025*, JBL). Photographs by the authors.

erose, 1.8 × 1.0 mm. *Lip* oblong, obtuse, ciliate, 2.0–3.0 × 1.5 mm, the disc with a central carina in the basal third, divided into 2 low keels close to the second third, the basal lobes erect. *Column* short, semiterete, deeply erose-fimbriate at the apex, broadly winged near the apex, 2 mm long, the clinandrium apical, the stigma ventral. *Anther cap* incumbent, ovate, emarginate. *Pollinia* 2, pyriform, on a cellular, oval viscidium.

Distribution: known only from Costa Rica. It could be found in southwestern Nicaragua.

Distribution in the Park: found growing in the gallery forest at Las Cascadas.

Etymology: from the Latin *reflexus,* "reflexed," in reference to the characteristic reflexed synsepal of the flowers.

Habitat and ecology: it is restricted to the lowland semideciduous forests of the northern Pacific lowlands of Costa Rica. Plants inhabit tropical wet, very wet, and transitional premontane forests, between 100 and 500 m elevation. They were recorded growing on *Ficus* sp. (Moraceae) and the main tree trunks of *Anacardium excelsum*, mostly along riverbanks under shady conditions.

Phenology: plants flower from September to December.

Discussion: Plants are epiphytic without pseudobulbs, with stems covered by lepanthiform bracts and the leaves tinged with purple on the underside. The inflorescence comes under the leaf with several purple-white flowers. *Trichosalpinx reflexa* is similar to *T. memor* (Rchb.f.) Luer but differs mainly by the narrow elliptic-lanceolate leaves, glabrous sepals, the erect dorsal sepal, and the synsepal reflexed toward the apex (Fernández and Bogarín, 2011).

Additional specimens examined: BHNP, Ceiba trail, area of Las Cascadas, 10°11'15"N, 85°20'36.1"W, 210 m, basal transition to premontane wet forest, epiphytes in fallen *Ficus* sp. (Moraceae) tree, 11 July 2005, *D. Bogarín 1674 y F. Paniagua*.

28. *Trigonidium* Lindl., Edwards's Bot. Reg. 23: t. 1923. 1837.

TYPE: *Trigonidium obtusum* Lindl.

Plants epiphytic, caespitose, rhizomatous, erect to scandent herbs. *Pseudobulbs* sulcate, 2- to 5-foliate at the apex. *Leaves* conduplicate, linear or elliptic, subcoriaceous, acute, persistent. *Inflorescence* a simple, short to usually elongate, erect, raceme from the bases of pseudobulbs, 1-flowered. *Flowers* relatively large, tubular, erect, trigonous, yellow to greenish, or cream with purplish stripes. *Sepals* subequal, the bases connivent forming a tube that encloses the petals, labellum, and column, the apex spreading. *Petals* smaller and narrower than sepals, with an apical, glossy brown callus. *Lip* 3-lobed, the lateral lobes erect, the midlobe thickened, the disc with a ligular callus. *Column* short, semiterete, footless, with terminal, incumbent anther. *Pollinia* 4, waxy.

A Neotropical genus of some 12 species, ranging from Mexico to Brazil. Only 3 species in Costa Rica, 1 at BHNP.

Trigonidium egertonianum Bateman ex Lindl., Edwards's Bot. Reg. 24: misc. 73–74. 1838. Fig. 14B, 54.

TYPE: A native of the Bay of Dulce in Honduras, where it was discovered by *G. U. Skinner s.n.* (Holotype: K).

Plants epiphytic, caespitose, forming large clumps, to 50 cm long. *Roots* fleshy, glabrous, to 2 mm in diam. *Pseudobulbs* ovate, somewhat laterally compressed, sulcate, to 3.5–7.0 × 1.5–3.2 cm, basally covered by 2–3 papyraceous sheaths, bifoliate at the apex (rarely monophyllous). *Leaves* narrowly oblanceolate to linear, arching, acute, to about 28.4–38.0 × 1.7–2.4 cm. *Inflorescence*s basal, erect, slender, single-flowered scape to 20 cm long, covered by many closely appressed, tubular, papyraceous sheaths. *Flowers* rather showy, pale yellow to pale orange striped and reticulated with purple, the petals provided with metallic blue to mauve blotch near the apex. Sepals free, appressed

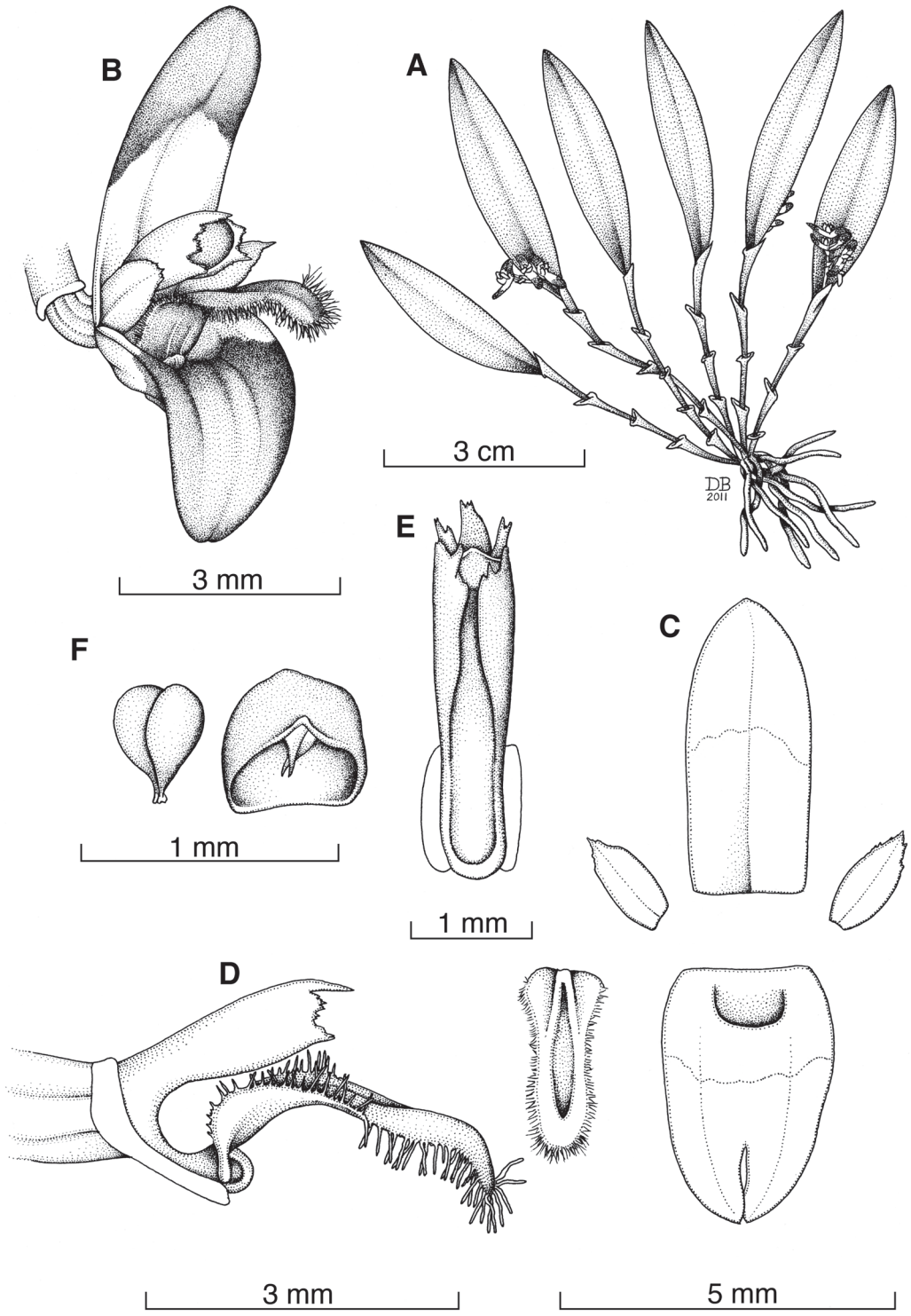

FIGURE 53. *Trichosalpinx reflexa* Mel. Fernández & Bogarín. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by D. Bogarín from *Bogarín 1674* (JBL).

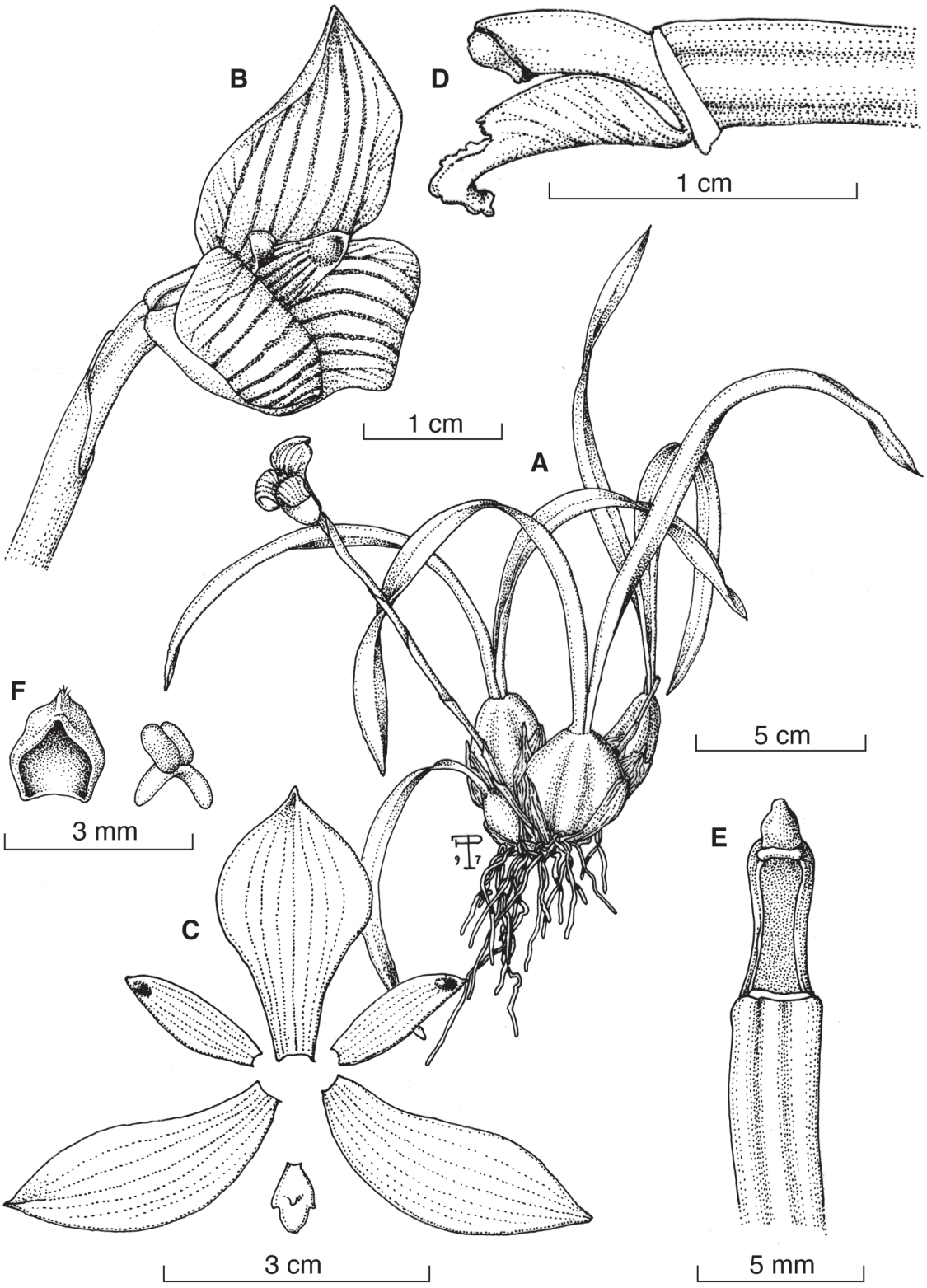

FIGURE 54. *Trigonidium egertonianum* Bateman ex Lindl. **A,** Habit. **B,** Flower. **C,** Perianth flattened. **D,** Column and lip, side view. **E,** Column, ventral view. **F,** Pollinarium and anther cap. Drawn by F. Pupulin from *Pupulin 368* (JBL).

toward the base forming a tube, then abruptly expanded and reflexed at the apex. *Dorsal sepal* shortly unguiculate, elliptic oblanceolate, acute, 3.3 × 1.8 cm. *Lateral sepals* obliquely elliptic-lanceolate, acute, 3.4 × 1.3 cm. *Petals* lanceolate, acute, about 1.8 × 0.6 cm. *Lip* 3-lobed, articulate with the base of the column; lateral lobes erect and parallel to the column, acute; the midlobe ovate, acute to obtuse, somewhat fleshy, verrucose; disc with a fleshy ligulate callus as long as the lateral lobes; entire lip 8 × 5 mm wide between lateral lobes. *Column* subterete, about 7 mm long. *Pollinia* 2, elliptic, on a saddle-shaped caudicle. *Anther cap* cucullate, keeled.

Distribution: from Mexico to Colombia and Venezuela.

Distribution in the Park: found at Las Cascadas and Los Mesones in the humid evergreen forest.

Eponymy: named after Sir Philip de Malpas Grey Egerton, 10th Baronet FRS (1806–1881), an English paleontologist who introduced many tropical plants to England.

Habitat and ecology: common at lowland elevations from 0 to 900 m in both Caribbean and Pacific watersheds, forming large populations in the forest canopy. Mostly found on *Anacardium excelsum*, *Pachira fendleri,* and *Syderoxylum capiri*.

Phenology: plants flower throughout the year but mostly from January to May.

Discussion: plants are easily distinguished by the abbreviated rhizome, the bifoliate pseudobulbs with narrow-linear leaves, and the 1-flowered, elongate inflorescence with campanulate upward-facing flowers produced at the base of mature pseudobulbs. The sepals hide the shorter petals, lip, and column.

Additional specimens examined: BHNP, sector de Las Cascadas ingresando por Finca San Diego (Finca Los Trejos), 10°10'59.86"N, 85°20'17.41"W, 86 m, bosque húmedo premontano transición a basal, epífitas en bosque de galería sobre *Brosimum alicastrum* "Ojoche" (Moraceae) cercano a un curso de agua, 22 febrero 2012, *D. Bogarín s.n.* (unvouchered).

29. *Tropidia* Lindl. in Wall., Cat. n. 7386. 1831; Lindl., Bot. Reg. 19: sub. t. 1618. 1833.

TYPE: *Tropidia curcugiloides* Lindl.

Plants terrestrial, perennial, erect, leafy herbs, palm-like. *Roots* fibrous pubescent developed from a short rhizome with several secondary rootlets, sometimes with swollen nodules. *Stems* erect, with several leaves at the apex, branching. *Leaves* distichous, oblong-lanceolate to elliptic-lanceolate, membranaceous or chartaceous, strongly plicate. *Inflorescence* apical, a densely paniculate raceme with several subulate floral bracts, rarely occurring also in the axils of the leaves along the stem. *Flowers* small, numerous, inconspicuous, often self-pollinated. *Sepals* and *petals* oblong-elliptic, acute, concave, the lateral sepals connate at the base forming an inconspicuous mentum, petals elliptic-lanceolate. *Lip* cymbiform, strongly concave-saccate with the basal margin involute, sessile, entire, oblong, canaliculate, parallel to and partly embracing the column in natural position. *Column* short, straight. *Anther* dorsal. *Stigma* apical. *Pollinia* 2, granulose, sectile. *Capsule* spreading, 6-ridged.

A Pantropical genus of about 40 species ranging from India to southeast Asia, northeast Australia, and the South Pacific Islands (Fiji and Samoa). *Tropidia polystachya* is the only species outside of Asia, ranging from Florida through the Antilles, Central America, Venezuela, and the Galapagos Islands. This is the first record in Costa Rica and BHNP.

Tropidia polystachya (Sw.) Ames, Orchidaceae 2: 262. 1908. Fig. 14C, 55.

Basionym: *Serapias polystachya* Sw., Prodr. 119. 1788. TYPE: JAMAICA. Hispaniola, *O. Swartz s.n.* (Holotype: not located).

Homotypic synonyms: *Neottia polystachya* (Sw.) Sw., Fl. Ind. Occid. 3: 1415. 1806.

Stenorrhynchos polystachyon (Sw.) Spreng., Syst. Veg. 3: 710. 1826.

Tomotris polystachya (Sw.) Raf., Fl. Tellur. 2: 89. 1837.

Chloidia polystachya (Sw.) Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 644. 1863.

Corymborkis polystachya (Sw.) Kuntze, Revis. Gen. Pl. 2: 658. 1891.

Plants erect, leafy, palm-like, up to 45 tall, with a short rhizome. *Roots* slender, fibrous, coarse, pubescent, about 2 mm in diam. *Stems* often branched, with 3–4 lateral branches up to 30 cm long. *Leaves* several, distichous, oblong-elliptic to elliptic-lanceolate, acute to long-acuminate, 7-veined, 9.4–17.0 × 4.3–7.3 cm, thin, plicate, chartaceous, petiole 2.0–3.5 cm long, nervose, involving the stem. *Inflorescence* densely paniculate, with a slender, ridged peduncle, 3.8 cm long, flowers rarely occurring also in the axils of the leaves along the stem, rachis 9.5 cm long, about 14 lateral branches 0.2–1.3 cm long with 2–6 helicoid flowers on each branch. *Floral bracts* subulate to ovate-lanceolate, conduplicate, acute to acuminate, 3.0–3.5 × 2.0–2.5 mm, the bracts subtending each branch of the inflorescence much longer, narrowly lanceolate, acute or acuminate, peduncle bracts 1.7–3.0 × 0.2–0.3 cm, basal bracts of the lateral branches of rachis 1.7 × 0.2 cm. *Ovary* cylindrical, 9 mm long. *Flowers* greenish white, spread, self-pollinated. *Dorsal sepal* oblong-elliptic, strongly concave, acute, slightly apiculate, 7.6–2.6 mm. *Lateral sepals* obliquely oblong-elliptic to rarely linear-oblong, acute or subacute, conduplicate or concave at the apex, gibbous at the base, subfalcate, 7.2–2.5 mm. *Petals* elliptic-lanceolate, curved, acute, 6.7–2.1 mm. *Lip* cymbiform, strongly concave-saccate with the basal margins involute, thickened and with a median groove at the base, lightly constricted at about the middle, with the anterior half thin and somewhat expanded, broadly rounded and often retuse with an apicule in the sinus; disc pubescent at about the middle, with 2 intramarginal ridges that converge near the apex, 5.5 × 2.1 mm. *Column* terete, 3.5 × 1.2 mm, anther dorsal, stigma apical. *Anther cap* oblong, acute, dorsally keeled. *Capsule* oblong-ellipsoid, prominently 6-ribbed, becoming dark brown or black at maturity, about 1 cm long.

Distribution: from Florida to northern South America and the Antilles.

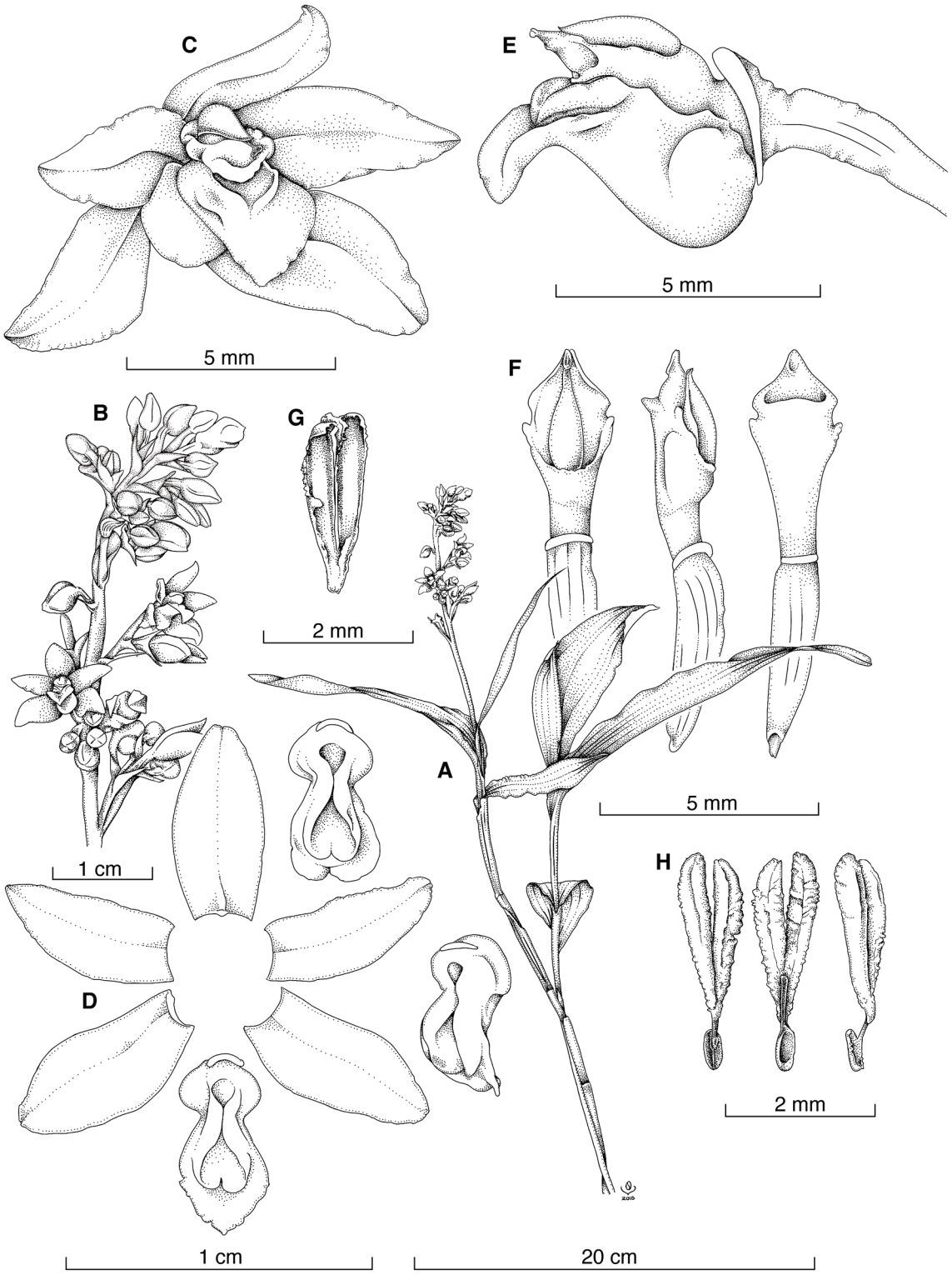

FIGURE 55. *Tropidia polystachya* (Sw.) Ames. **A,** Habit. **B,** Portion of the inflorescence. **C,** Flower. **D,** Perianth flattened. **E,** Column and lip, side view. **F,** Column, dorsal, lateral and ventral view. **G,** Anther cap. **H,** Pollinarium, front, ventral and side view. Drawn by F. Pupulin and L. Oses from *Bogarín 11205* (JBL).

Distribution in the Park: rare in the Park. We found only 1 population of 8 plants just before the beginning of Sendero Ceiba.

Etymology: from the Greek *poly*, "many," and *stachys*, "spike," referring to the several branches of the inflorescence.

Habitat and ecology: terrestrial in humus on shaded hills in secondary forest, premontane moist forest, basal belt transition in the lowlands of Península de Nicoya in Guanacaste, at around 350 m of elevation.

Phenology: September to November.

Discussion: plants are terrestrial with branching stems and plicate, chartaceous, dark-green leaves, similar to other species of *Corymborkis* Thouars and *Palmorchis* Barb. Rodr. The inflorescences are paniculate with somewhat inconspicuous greenish-white flowers, often self-pollinated. The lip is thickened, cymbiform, and concave-saccate. In the understory forest, they can be confused with small palms. Within BHNP, they are the only terrestrial species without pseudobulbs or corms bearing persistent plicate, chartaceous leaves and branching stems. This is the first record of the genus *Tropidia* in Costa Rica.

Additional specimens examined: BHNP, camino principal de la estación al Sendero Ceiba, parte alta antes de llegar al parqueo, 10°10'21.53"N, 85°21'42.50"W, 342 m, bosque húmedo premontano transición a basal, terrestres a orillas del camino, bosque secundario, 7 noviembre 2011, *D. Bogarín 9424* (CR). Same locality, *D. Bogarín 9426* (USJ); *D. Bogarín 9426 and 9427* (JBL-spirit). Same locality, 3 octubre 2014, *D. Bogarín 11205, N. Belfort & A. Karremans* (JBL).

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