



ENCYCLIA NARANJAPATENSIS DODSON (ORCHIDACEAE), A NEW RECORD FOR THE PERUVIAN FLORA

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Abstract

Background: *Encyclia*, is a genus with more than 200 species in the Neotropics, eight of which have been previously reported from Peru. During the evaluation of the orchid flora in the forests of the Sicchez district, a small population of an *Encyclia* species was found that could not be unequivocally matched to any previously known species in the country.

Questions: Will the recent explorations of Northern Peru result in the reporting of new taxa for the country?

Studied species: Orchidaceae, Laeliinae, *Encyclia* Hook, *Encyclia naranjapatensis* Dodson.

Study site and dates: Sicchez District, Ayabaca Province, Piura Department, Peru, 2022-2023.

Methods: Specimens were collected and determined by consulting botanical collections available online, taxonomic treatments, checklists, and specialized literature. The conservation status was assessed according to IUCN methodology.

Results: We report a novelty for Peru, *Encyclia naranjapatensis*, and an updated description including morphological information on relevant structures that will be used to diagnose this entity. In addition, *E. naranjapatensis* is part of a basal clade referred to as the *E. diurna* species group. The conservation status assessment results in Endangered and the species is linked to the Seasonally Dry Tropical Forest, an endangered ecosystem throughout the Neotropics.

Conclusions: The recent entity located in Peru correspond to *Encyclia naranjapatensis*. This discovery allows us to investigate the geographical limits, discuss the phylogenetic and ecological affinities, update the original description, and evaluate its conservation status.

Keywords: Ayabaca, *Encyclia chloroleuca*, Laeliinae, floristic novelty, Piura, Sicchez

Resumen

Antecedentes: *Encyclia*, es un género con más de 200 especies en el Neotrópico, ocho de las cuales han sido reportadas previamente del Perú. Durante la evaluación de la flora de orquídeas en los bosques del distrito de Sicchez, se encontró una pequeña población de una especie de *Encyclia* que no pudo ser emparejada inequívocamente con ninguna especie conocida previamente en el país.

Preguntas: ¿Las recientes exploraciones del norte de Perú resultarán en el descubrimiento de nuevos taxones para el país?

Especies de estudio: Orchidaceae, Laeliinae, *Encyclia* Hook, *Encyclia naranjapatensis* Dodson.

Sitio y años de estudio: Distrito de Sicchez, Provincia de Ayabaca, Departamento de Piura, Perú, 2022-2023.

Métodos: Los especímenes se recolectaron y determinaron mediante la consulta de colecciones botánicas disponibles en línea, tratamientos taxonómicos, listas de control y bibliografía especializada. El estado de conservación se evaluó según la metodología de la UICN.

Resultados: Reportamos una novedad para Perú, *Encyclia naranjapatensis*, y una descripción actualizada para incluyendo información morfológica sobre estructuras relevantes que serán utilizada para diagnosticar esta entidad. *E. naranjapatensis* forma parte de un clado basal denominado como Grupo de especies de *E. diurna*. La evaluación del estado de conservación resulta en En Peligro y la especie está ligada al Bosque Tropical Estacionalmente Seco, un ecosistema en peligro en el Neotrópico.

Conclusiones: La reciente entidad localizada en Perú corresponde a *Encyclia naranjapatensis*. Este descubrimiento nos permite investigar los límites geográficos, discutir las afinidades filogenéticas y ecológicas, actualizar la descripción original y evaluar su estado de conservación.

Palabras clave: Ayabaca, BTES, Laeliinae, novedad florística, Piura, Sicchez.

Encyclia Hook. is a genus of Neotropical orchids distributed from northern Mexico and south Florida to northern Argentina, including the Antilles (van den Berg & Carnevali 2005, Leopardi-Verde *et al.* 2016), and currently represented by 213 species, of which 179 are formally described, and 25 are of possible hybrid origin (Carnevali *et al.* 2022).

Most species are found in seasonally dry forests, at altitudes below 1,500 m. However, some species, complexes, or clades, prefer higher altitudes, such as the *Encyclia adenocaula* (Lex.) Schltr., *E. tuerckheimii* Schltr., and the possibly extinct in the nature *E. lorata* Dressler & G.E.Pollard (Leopardi-Verde *et al.* 2016, Carnevali *et al.* 2022, Tamayo-Cen 2022). Although *Encyclia* species are found throughout much of the Neotropics, three main centers of diversity have been recognized. The first most diverse area is Northern Megamexico (*sensu* Rzedowski 1991a, b), the second the Antilles, and the third encompasses southeastern South America, including the Atlantic Forest, the Cerrado, the Chaco, and the Caatingas (Carnevali *et al.* 2022).

Peru has a great diversity of orchids (Ulloa Ulloa *et al.* 2017) associated with the diversity of its ecosystems (MINAM 2019). Although *Encyclia* is poorly represented in the country, eight species have been reported, viz: *E. chloroleuca* (Hook.) Neumann, *E. cyperifolia* (C.Schweinf.) Carnevali & I. Ramírez, *E. microtros* (Rchb.f.) Hoehne, *E. pilosa* (C.Schweinf.) Carnevali & I. Ramírez, *E. randii* (Barb.Rodr.) Porto & Brade, *E. rhizomatosa* Tamayo-Cen, Carnevali & G.A.Romero, *E. thrombodes* (Rchb.f.) Schltr. and *E. yauaperyensis* (Barb.Rodr.) Porto & Brade (Tamayo-Cen *et al.* 2020).

Recently, explorations in northern Peru resulted in the discovery of a species not reported in this country before. Here, we present the first record of *E. naranjapatensis* Dodson for Peru, through a collection made in the District of Sicchez, Province of Ayabaca, department of Piura.

Materials and methods

Botanical material. The material studied was collected in an area located in the District of Sicchez, Province of Ayabaca, department of Piura, under permit RD N° D000148-2022-MIDAGRI-SERFOR-DGGSPFFS-DGSPF, granted by the Servicio Nacional Forestal y de Fauna Silvestre (SERFOR), and as a result of the project “Orquídeas en el Distrito de Sicchez, Ayabaca-Piura” overseen by one of the authors (KAP). Morphological and ecological data of the specimens were recorded *in situ*. The collected specimen was prepared for the herbarium (Hágsater 1978) and deposited at USM (acronyms according to Thiers 2023, continuously updated). Additionally, the flowers were preserved in a solution of 5 % glycerin, 25 % distilled water and 70 % alcohol (Calatayud 2005) for the subsequent study of floral structures.

Description and additional information. The collected material was compared with the descriptions and drawings of *Encyclia* species documented in Dodson (1977, 2001), Dodson & Dodson (1980), and Dodson & Luer (2010). Likewise, *Encyclia* vouchers available online (AMES, GH, K, MO, and SEL) and those deposited in the USM, HOXA, HUT and CPUN herbaria were consulted. Based on the collected material and the protologue of *E. naranjapatensis*, the occurrence of this species in Peru is confirmed and an updated description of the species is presented (modified from Dodson 1977). Taxonomic comments on the species and its phylogenetic relationships are also included. Additionally, photographs, information on geographic distribution, and ecology are presented. Furthermore, a map of occurrences for *E. naranjapatensis* in Ecuador and Peru is provided, using ArcGIS pro software v. 3.0.3. The botanical terminology followed Beentje (2016) and Stearn (2004).

Conservation status. The conservation status of *Encyclia naranjapatensis* was assessed using the IUCN Red List criteria (IUCN 2022). Since data for the species were generally only available from herbarium vouchers and published reports in articles and books, we relied primarily on B criteria, geographic distribution assessed as either B1 (extent of occurrence) or B2 (area of occupancy), both implemented in GeoCAT v. 3.1 (Bachman *et al.* 2011).

Results

Encyclia naranjapatensis Dodson, Selbyana 2(1): 50. 1977. **Type.** Ecuador. Bolivar: Naranjapata, km 107 on railroad from Duran to Riobamba, alt. 700 m, 10 April 1961, C.H. Dodson 397 (Holotype: SEL) ([Figures 1-2](#)).

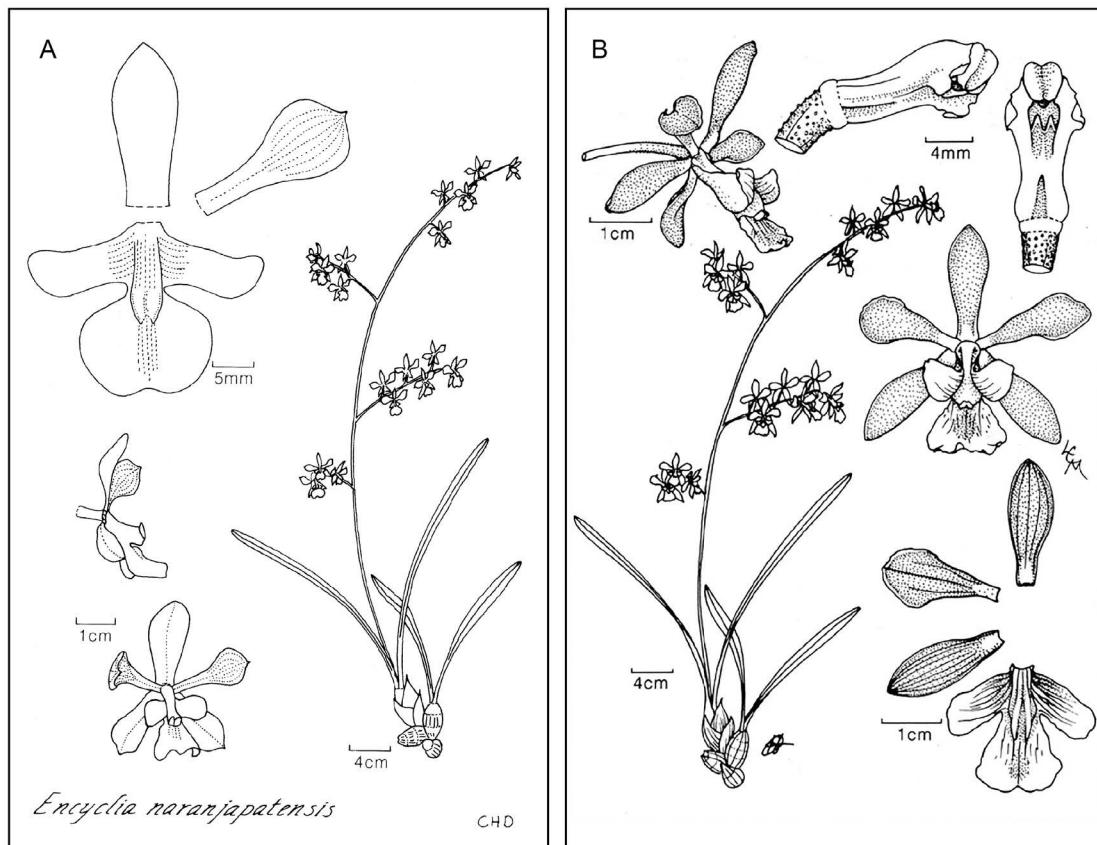


Figure 1. Illustrations of *Encyclia naranjapatensis* Dodson. A. Drawing by Lisa Megahee, from Dodson CH. 1977. B. Drawing by Calaway Dodson, from Dodson CH & Dodson PM, 1980: pl. 69. Courtesy, Marie Selby Botanical Gardens.

Epiphytic plant, up to 70 cm tall. Pseudobulbs ovoid-cylindrical, apically 2- or 3-foliate, 4.5-10.5 cm long, 4-6.5 cm in diameter, smooth when well hydrated or have recently developed, rough with time or dehydration. Leaves conduplicate, coriaceous, oblong-linear, obtuse, proximally three-jointed, slightly falcate, 30-60 × 1.1-3.6 cm. Inflorescence apical, starting from the mature pseudobulb, suberect to somewhat arching, paniculate, up to 90 cm long, with up to 30 flowers; peduncle cylindrical, up to 50 cm long, with 4 internodes; rachis cylindrical, up to 40 cm long; floral bract triangular, acute, 2.8-3 × 3.8-4 mm. Ovary pedicellate, green, paler on the pedicel, straight to sigmoid or arched, cylindrical, distally dilated, slightly verruculose, more noticeable distally, 2.5-2.8 cm long. Flowers with green sepals and petals, reddish-brown starting approximately 1/4 distal without covering the edge of the segment, leaving a clear green edge, the sepals with a dark spot at the apex that merges with the reddish-brown, white lip with red nerves at the base of the lateral lobes and the central lobe (approx. 8, the central one most prominent), greenish from base to middle of callus, column pale green, becoming white at the apex, yellow anther. Sepals arched forward, lanceolate, acute, revolute, minimally mucronate, 17-20 × 5.5-6.0 mm, 7-veined; lateral sepals slightly oblique, concave. Petals arched forwards, slightly concave, spatulate-obovate, sub-acute, revolute, 17-20 × 7-10 mm, 6-veined. Lip slightly adnate at base with the column, deeply trilobed, 18-20 × 18-20 mm expanded; lateral lobes embracing the column in natural position, recurved, oblong, obtuse, basally oblique, 9-11 × 3.5-4 mm, 5-6 veined; mid lobe slightly concave, sub-quadrangular, undulate, emarginate, 11-12 × 10-11.5 mm; callus sub-rhombic, elevated, formed by two keels, broadly parallel, basally close, forming a groove which becomes an oval depression in the central part, subsequently emerges a central elevated keel, so the callus ends trifid (in 1/3 of the central lobe), 6-6.5 × 3.5 mm long. Column claviform, forming an angle of almost 120° with the ovary, dorsoventrally compressed, broadened towards the apex, somewhat curved upward at the midpoint, 10-11 mm long, the base with concave margins in dorsal view, ventral

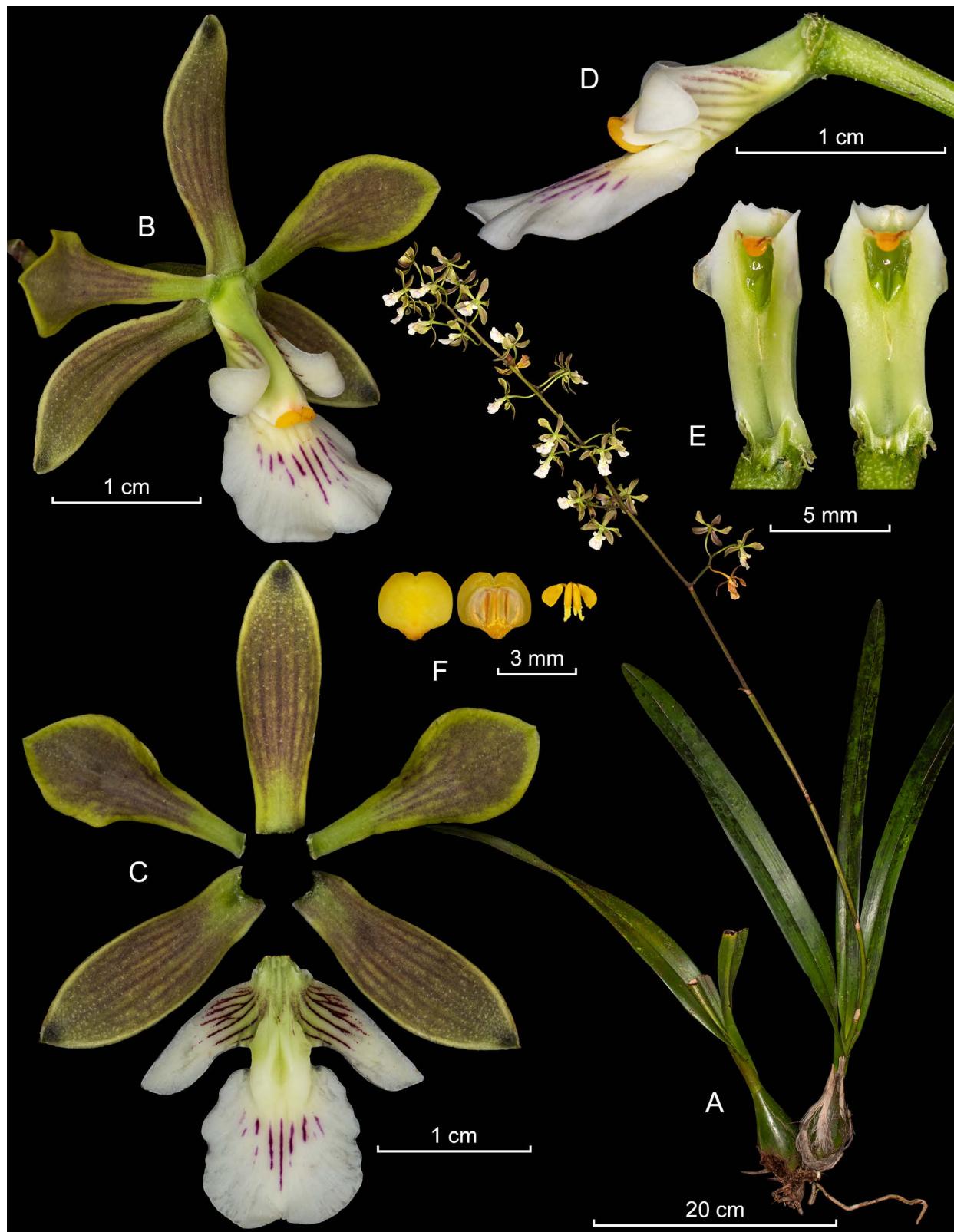


Figure 2. Composite plate of *Encyclia naranjapatensis* Dodson. A. Habit. B. Flower. C. Dissected perianth. D. Lip, column, and ovary, lateral view. E. Column, ventral and three quarters-views. F. Anther cap and pollinarium. Prepared by L. Ocupa-Horna.

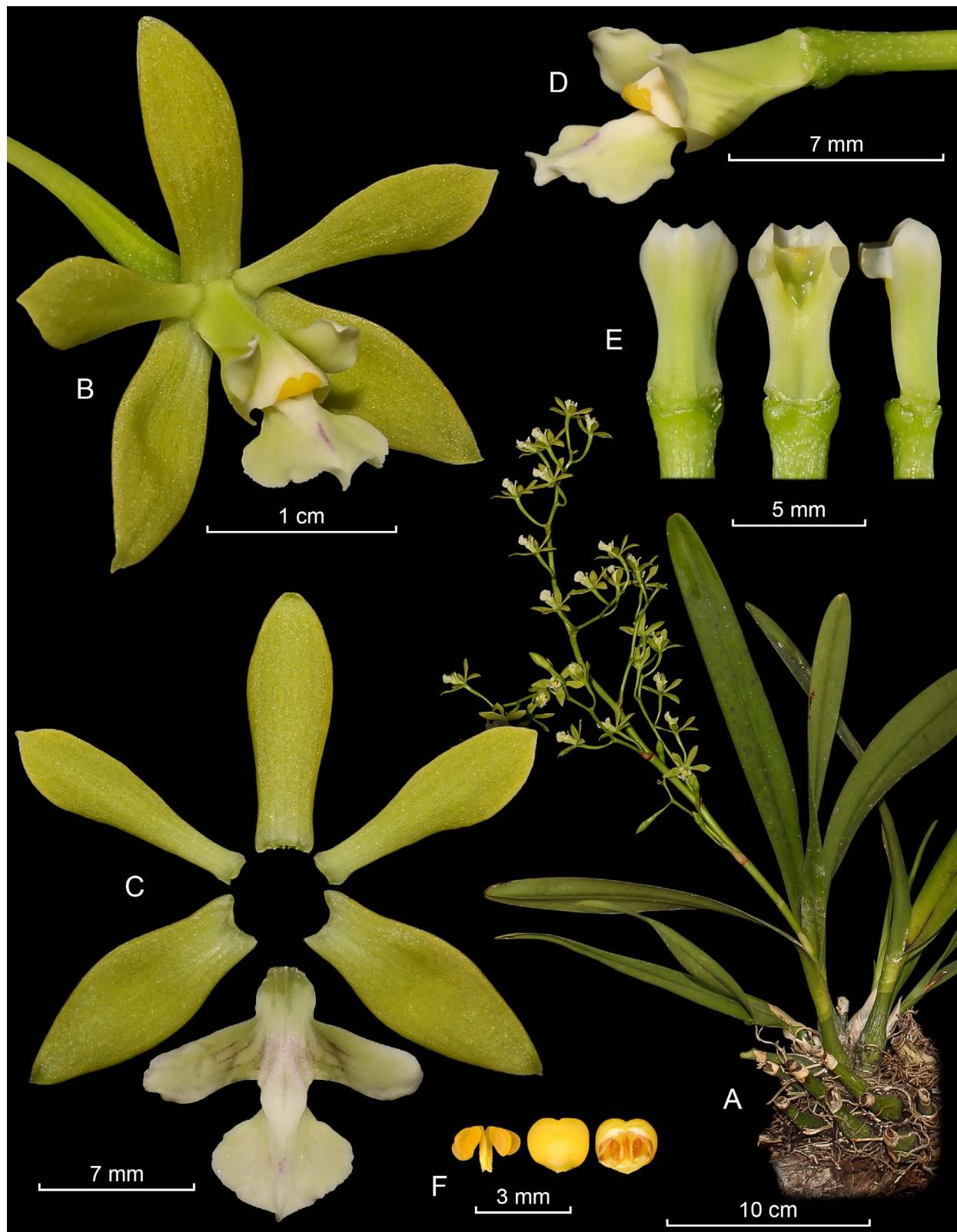


Figure 3. Composite plate of *Encyclia chloroleuca* (Hook.) Neumann. A. Habit. B. Flower. C. Dissected perianth. D. Lip, column, and ovary, three quarters view. E. Column, dorsal, ventral and laterals views. F. Anther cap and pollinarium. Prepared by L. Ocupa-Horna.

view canaliculated at the base, where the cuniculus is formed, clinandrium superficially tridentate with larger lateral teeth, with a pair of subquadrate unciform stelidia. Anther cordate, pollinia 4, in two pairs, each pollinia ca. 9 mm long, obovoid, strongly compressed laterally, bright yellow, with granular caudicles about the same length as the pollinia. Capsule dark brown, with white warts, fusiform, trilocular.

Taxonomic notes. According to Dodson (1977), *Encyclia naranjapatensis* is morphologically similar to *Encyclia osmantha* (Barb. Rodr.) Schltr. but this last differs by deltoid (vs. sub-quadrangular), slightly emarginate (vs. strongly emarginate), and flat (vs. slightly concave) lip. However, in phylogenetic analyses, *E. naranjapatensis* is retrieved as sister to *E. elegantula* Dressler, an entity which we consider has a wide distribution from South America (Colombia; Tamayo-Cen, *com. pers.*), Central America, and the southeast of Megaméxico. In addition, both are nested in a clade consisting mainly of northern South American species such as *E. diurna* (Jacq.) Schltr., *E. garciae-esquivelii* Carnevali & I.Ramírez and *E. profusa* (Rolle) Dressler & G.E.Pollard (Carnevali *et al.* 2022, Tamayo-Cen 2022). Among the species belonging to this clade, *E. naranjapatensis* shows greater morphological similarity to *Encyclia diurna* but it differs by its mostly green petals and sepals, sometimes with light shades of brown (vs. distinctly brown petals and sepals), the central lobe of the lip orbicular and ends with a clear apiculus (vs. sub-quadrangular and without apiculus), and distributed only in northern Venezuela (Carnevali *pers. comm.*) (vs. distributed in the Pacific slope of Ecuador and Peru).

For example, among Peruvian *Encyclia* species, *E. naranjapatensis* is recognized by its short rhizome, minimally verruculose ovary, yellow anther, and white lip. The other *Encyclia* species reported for Peru (Tamayo-Cen *et al.* 2020) are very different vegetative and florally. For example, *E. pilosa* has a yellow lip (vs. white); *E. microtos* and *E. rhizomatosa* have conspicuously warty ovaries and reddish anthers (vs. minimally verruculose ovary and yellow anthers). Other species such as *E. cyperifolia* are easily distinguished by their non-resupinate flowers (vs. resupinate) flowers with purple staining on most segments (vs. without purple stains), and linear leaves (vs. oblong-linear), and *E. randii* can be distinguished by short, few-flowered (vs. long, abundant-flowered), racemose inflorescence (vs. paniculate), and larger flowers (vs. median flowers) with the central lobe of the lip flat (vs. slightly concave), orbicular (vs. sub-quadrangular), and with an extensive purplish spot (vs. without purplish spot).

On the other hand, *Encyclia naranjapatensis* was previously reported for Peru by Valenzuela Gamarra *et al.* (2022). However, the flower shown in Figure 146 from which this report was based, corresponds to *Encyclia chloroleuca* (Hook.) Neumann ([Figure 3](#)), an entity distantly related to *E. naranjapatensis*. *Encyclia chloroleuca* is one of the few species of *Encyclia* with North and South American distribution; it is also characterized by being morphologically variable (*e.g.*, Bastos *et al.* 2018). This species has been recorded from several departments of Peru (*e.g.*, San Martín, Loreto, Huánuco, and Pasco) and is easily differentiated from *E. naranjapatensis* by its plants up to 35 cm tall (vs. 75 cm tall), oblong-lanceolate sepals, 12-15 mm long (vs. narrowly obovate, 18 mm long), oblong-oblanceolate petals, 11-14 mm long (vs. spatulate-obovate, 18-20 mm long), and the central lobe of the lip ovate to sub-orbicular, with a conspicuous apiculum (vs. sub-quadrangular, emarginate, not apiculate) ([Figure 3](#)). The picture shown by Valenzuela Gamarra *et al.* (2022) corresponds to a dull maroon form of *E. chloroleuca* (Tamayo-Cen *et al.* 2020). The polymorphic colors in flowers of the same species can be driven by the presence of anthocyanin and carotenoid pigments in the flowers (Narbona *et al.* 2014).

Distribution and habitat. *Encyclia naranjapatensis* was described from a specimen collected in the locality of Naranjapatá, between Riobamba and Durán, Province of Bolívar, Ecuador, growing as an epiphyte in dry valleys in rain shadow at elevations of 700 to 1000 m (Dodson 1977). It was subsequently found in other localities such as the Cañar River Valley (Cañar Province), in an area near Zaruma (Dodson & Dodson 1980), and in the forests around Piñas (both in El Oro Province), where it was last found in 1986 (Endara *et al.* 2017) ([Figure 4](#)). In Peru, *Encyclia naranjapatensis* has been found in Ayabaca province, Department of Piura, growing as an epiphyte in a remnant of secondary forest located within agricultural areas (MINAM 2019). These areas of transitory or permanent crops, together with the rest of the disturbed areas, cover 9.6 % of the surface of the Peruvian territory, and are present in many departments, such as Piura ([Figure 4](#)).



Figure 4. Occurrence map of *Encyclia naranjapatensis* Dodson. Prepared by A. Chorres-Arica.

Conservation status. *Encyclia naranjapatensis*, previously known to be endemic to Ecuador, was classified as endangered (EN, B1) because grew in a very restricted area, where agriculture predominates (Endara *et al.* 2017). Subsequently, it was classified as Vulnerable (VU) (Fernández-Fernández *et al.* 2018), based on records from two localities in El Oro Province, available online.

In Peru, only a few individuals of *E. naranjapatensis* have been found growing on branches of trees that were felled, so its population local is probably very small and dispersed. Here, the habitat is severely threatened by fragmentation due to agricultural and cattle ranching developments, extraction of valuable timber species, and unregulated housing construction (Agurto-Palomino, *pers. comm.*). However, in the Sicchez orchidarium, there are specimens in cultivation (Figure 5), collected from the surrounding area, and they could be reproduced to ensure the *ex situ* survival of the species and conservation of germplasm native from Peru.

Currently, the information available online on the localities of *Encyclia naranjapatensis* in the wild is limited (Figure 4). Using the GeoCAT tool and IUCN methodology (Bachman *et al.* 2011), this species is classified as EN (Endangered), as it meets IUCN criteria B1a (i, iii, iv) (2022), and has an extent of occurrence (EOO) of 3,625.709 km² and an area of occurrence (AOO) of 20.000 km² (with a cell size of 2 km). With this new report for Peru, the extension of the natural distribution of *Encyclia naranjapatensis* also implies an increase in habitats and populations of the species.

Although an evaluation of the categorization of the species was made in the present work, the results do not evidence any significant change in its categorization status from that previously proposed by Endara *et al.* (2017).

Phenology. *Encyclia naranjapatensis* flowers between July and August.



Figure 5. *Encyclia naranjapensis* Dodson cultivated in the orchidarium of Sicchez, in Peru. A. Cluster of flowers. B. Close up of the pseudobulbs. C. Habit. Photos by A. Chorres-Arica (A) and K. Agurto-Palomino (B-C).

Specimens examined. PERU. Piura: Prov. de Ayabaca, Distrito de Sicchez, en un bosque secundario a 1.2 km al sur de Sicchez, $4^{\circ} 34' 51.25''$ S $79^{\circ} 45' 54.68''$ W, 1515 m, 15 September 2022, K. Agurto P. & A. Chorres A. 001 (USM).

Additional specimens examined. ECUADOR: El Oro: Piñas, 2125 m., 04 May 1981, C. Dodson 8424A (SEL) ([Figure 6](#)). [unknown location], collected by Steve Pruyn & Richard Emery, 1991, Ex Hort. C. L. Withner 34 (GH).

Discussion

With the report of *Encyclia naranjapensis*, there are now nine species of the genus recognized in Peru. *Encyclia naranjapensis* was previously considered restricted to Ecuador, in the provinces of Bolívar and El Oro, and was categorized as an Endangered species. However, the evaluation of the Extent of Occurrence (EOO) and Area of Oc-

Encyclia naranjapatensis



Figure 6. Paratype of *Encyclia naranjapatensis* Dodson (SEL 030412). Courtesy, Marie Selby Botanical Gardens.

cupancy (AOO) for *E. naranjapatensis* in both countries reveals that *E. naranjapatensis* should continue to be considered endangered, according to IUCN criteria.

This report broadens our distributional knowledge about *Encyclia naranjapatensis*, a rare-scare species in nature. Also, this entity is linked to Seasonally Dry Tropical Forests, a fragile and extensive ecosystem in the Neotropics. The phylogenetic reconstructions can be a tool for decision-making in conservation aspects (Eguiarte *et al.* 1999); *E. naranjapatensis* and *E. elegantula* are basal grades in a particular clade of *Encyclia*, so the conservation of *E. naranjapatensis* would be considered by their evolutionary information. In addition, these data are essential for ongoing work on the genus as a model for predicting how encyclias have been distributed in space-time.

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