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A new species of mule-ear oncidium with straw-yellow flowers (Orchidaceae: Oncidiinae, *Lophiaris*) from central Panama

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Abstract

Lophiaris silverarum Carnevali & Cetzal, known from two localities in central Panama, is herein proposed as a new species. It is related to *L. crispiflora* and *L. carthagenensis* from which it is easily distinguished by its larger flowers of a straw-yellow color with many laxly arranged, non-confluent reddish-brown spots. The new species is described and illustrated and distributional maps are provided. Furthermore, a table and a key comparing the new species against close relatives are included. The conservation status of *L. silverarum* is assessed as EN by the IUCN criteria.

Key words: Coclé, *Lophiaris silverarum*, *Trichocentrum* clade, Veraguas

Introduction

Lophiaris Rafinesque (1836: 40–41) consists of 25 species and three described natural hybrids that are distributed from southern Florida in the United States of America, the West Indies, and from northern Mexico to southern Brazil and northern Argentina (Cetzal-Ix & Balam 2012). The genus is most diverse in Megaméxico (Rzedowski 1991) where 17 species occur, of which 15 are endemic (Balam *et al*. 2011). The genus belongs in clade C of the Oncidiinae (Chase *et al*. 2009; Neubig *et al*. 2012), characterized, among other features, by unifoliate pseudobulbs clothed by sheaths that lack foliar blades, succulent leaves and low chromosome numbers for the Oncidiinae (2n = 26–36). According to our interpretation of generic limits, clade C consists of six genera, namely, *Saundersia* Reichenbach (1866: 120), *Grandiphyllum* Docha Neto in Docha-Neto & Batista (2006: 75), *Lophiarella* Slazchetko, Mytnik & Romowicz (2006: 53), *Cohniella* Pfitzer (1889: 194), *Lophiaris*, and *Trichocentrum* Poeppig & Endlicher (1838: 11). The first two genera comprise a clade, with the last four in a sister clade. The latter four genera are the *Trichocentrum*-clade (Carnevali *et al*. 2013). The generic circumscriptions within clade C have been the subject of a long standing discussion but there is now convincing support to the notion of recognizing four genera instead of a broadly defined but undiagnosable single genus in the *Trichocentrum*-clade (e.g. Carnevali *et al*. 2010, Cetzal-Ix *et al*. 2012, Carnevali *et al*. 2013), albeit other authors disagree (e.g. Neubig *et al*. 2012). The most recent key to the genera of this clade was published in Carnevali *et al*. (2013).

Plants of *Lophiaris* differ from those of other members of clade C by their short, elongate pseudobulbs, succulent, conduplicate leaves with 2–7 papillae per epidermal cell, mostly flexuous, short to elongate, often paniculate inflorescences, the sepals and petals with reticulate venation, and the papillose outer surface of the perianth (Balam 2007, Cetzal-Ix *et al*. 2008). The systematics of the genus have been complicated by the superficial similarity, both vegetative and floral, of the species and by two centuries of involvement by horticulturists, who often proposed new taxa based on poorly documented plants. The flowers of many species are superficially similar and preserve poorly in the herbaria. Characters used to distinguish species in *Lophiaris* are mainly floral, such as the size and color of the flowers, shape and position of the lateral lobes of the labellum, the shape and emargination of the apex of the central lobe of the labellum, the number, shape, and position of the teeth

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of the callus, and the column wings. In addition, geographical patterns of distribution have been used to identify species (Cetzal-Ix & Balam 2012). Following this protocol, our research group (Cetzal-Ix *et al*. 2008, 2012, Balam *et al*. 2010, 2011, Balam & Cetzal-Ix 2012, Cetzal-Ix & Balam 2012) has resolved the circumscription of most of the species and a workable systematic revision was completed (Balam 2011; Balam *et al*. in preparation).

Recently, plants representing a hitherto unknown species of the genus were collected in both the Veraguas and Coclé provinces, Panama. Although these plants superficially resemble *Lophiaris carthagenensis* (Jacquin 1760: 30) Braem (1993: 17) and *L. crispiflora* (Schlechter 1922: 85) Balam & Cetzal (2012: 14), they differ conspicuously in floral color, larger flowers, and details of the callus. These plants occur in an area where no other *Lophiaris* species has been collected, although this area largely falls within the general range of *L. crispiflora*. We herein propose this entity from Veraguas and Coclé as a new species.

Material and methods

The description was mostly prepared from live or freshly pickled material, which was preserved in a 70:25:5 ethanol:water:glycerine solution. However, some of the reference material for the comparisons was studied in the herbarium. Flowers from herbarium material were soaked in concentrated ammonium hydroxide for about one minute for rehydration, then rinsed in water until soft and ready for study under a dissecting microscope. Flowers thus pretreated were temporarily preserved as above for further study and eventually returned to herbarium sheets. Pictures of live flowers were taken with a SONY Cybershot DSC-W120. Additional iconography of the new species was prepared with the use of an HP Scanjet 3570c and latter edited and arranged in composite plates with Adobe Photoshop 6.0.1 (Adobe Systems Inc, San Jose, CA). Distributional maps for the *Lophiaris* species dealt with in this contribution were produced by plotting locality data taken from available live and herbarium specimens. In addition, data points from reliable literature information also were plotted (discussed in Cetzal-Ix & Balam 2012). Cartography was produced on a DIVA-GIS base map (Hijmans *et al.* 2004) yielding a shades of gray relief map; furthermore, an image data "shaded and colored SRTM elevation model" (NASA/JPL/NIMA 2002) was produced using ArcView 3.2 (ESRI 1999); these maps were later edited with Adobe Photoshop 6.0.1. Species are defined following the unified species concept of de Queiroz (2007).

Taxonomy

Lophiaris silverarum Carnevali & Cetzal, *sp. nov.* (Fig. 1)

A species of *Lophiaris* related to *L. crispiflora* and *L. carthagenensis* but easily distinguished by its larger flowers (25–30 mm diameter across the spread dorsal sepal and labellar apex) that are straw-yellow colored with non-confluent, laxly arranged pale reddish-brown spots.

Type:—PANAMA. Veraguas: Distrito de La Mesa, Palo Verde, Río Subí, Costa Pacífica, 8°13'N, 81°10'W, approx. 180 m, December 2005, vegetación primaria a orillas del río, *Silvera & Rodríguez s.n.* (holotype: PMA!; isotypes: AMES!, CICY!).

Epiphytic erect herbs, shortly creeping to cespitose; rhizome short, thick; roots 2–4 mm wide, white; pseudobulbs 8–10 mm long, 17 mm wide, subcylindrical to broadly ovoid, apically 1-leaved, totally enclosed by 3 imbricate sheaths; leaves 15–47 cm long, 3–10 cm wide, thickly fleshy coriaceous, conduplicate, entirely green but paler toward base, some extremely faint pale purple mottling evident in the underside of a few leaves, oblong-elliptical, thickly fleshy-coriaceous; inflorescences solitary from the base of the pseudobulbs, 79–94 cm long, a 15–110-flowered panicle; peduncle and rachis green, darker towards the base, peduncle somewhat erect to arching; bracteole minute, triangular and acute; flowers resupinate, sepals and petals straw-yellow colored, the whole surface lax and heterogeneously covered with non-confluent pale reddish-brown spots, 0.7–1 mm diameter, the claws paler and those of the petals lacking spots, labellum same colored but with denser spotting (and spots confluent) on the midsection of the lateral lobes, disc darker straw- yellow, callus pale straw-yellow with pale reddish-brown spots on top of the teeth, column pale yellow, the ventral surface darker and with confluent pale red-brown blotches; the stigmatic surface dark red-brown, the column wings pale pink; the anther white or exceedingly

pale pink; flowers 25–30 mm diameter across the spread apices of the dorsal sepal and the labellar apex, with perianth parts widely spreading and with undulate margins, the petals and sepals somewhat reflexed; ovary with pedicel 25–30 mm long, 0.9–1.2 mm thick; sepals basally clawed, spreading or somewhat reflexed with undulate

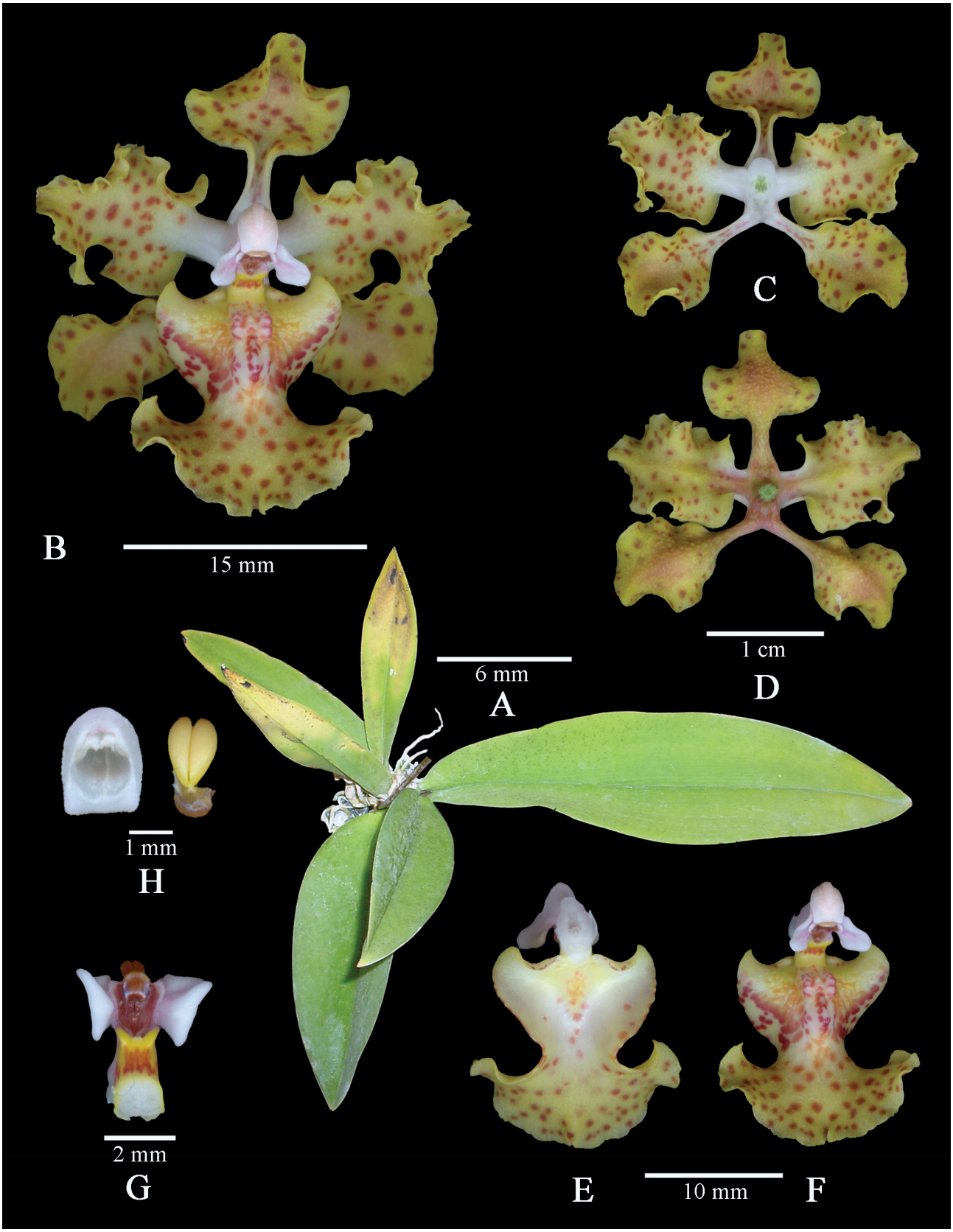

FIGURE 1. *Lophiaris silverarum.* **A**. Habit. **B**. Whole flower, front view. **C–D**. Sepals and petals, front and back view. **E–F**. Labellum and column, front and back view. **G**. Column, front view. **H**. Anther cap and pollinia. (based on *Silvera & Rodríguez s.n.* CICY).

margins, 5–7 nerved, dorsal sepal 12–14 mm long, 8–11 mm wide, obovate to suborbicular, concave in the upper half, abaxial surface papillose, apex obtuse and minutely apiculate; lateral sepals 11–14 mm long, 7–9 mm wide, similar to the dorsal but partially fused at the very base, then free; petals 10–12 mm long, 9–8 mm wide, ovoid to elliptical, somewhat oblique in natural position; labellum 3-lobed, 15–16 mm long from the base to the apex of the central lobe, 11–12 mm wide across the apices of the lateral lobes, the lateral lobes in the same plane as the central lobe and ± perpendicular to it; central lobe 6–8 mm long, 14–15 mm wide, transversely subquadrate, slightly emarginated, basally produced into a short isthmus that is 0.5–1 mm long and 5–6 mm wide; lateral lobes 3.5–4.0 mm long, 4–6 mm wide, erect-patent, subtriangular to semiovate with entire margins, somewhat inflexed in natural position; the callus consisting proximally of two lateral, divergent, upwardly dentate (3-teethed) keel, and distally of two lateral, upward, divergent teeth that are conical; the laterally compressed central keel runs parallel to the distal teeth and is bi or tri-dentate; column 4–5 mm long, 1.5–2.0 mm wide, oblong, the ventral surface in the same plane as the labellum lobes, tabula infrastigmatica longitudinally channeled, stigmatic cavity obovate, lilac pink; column wings divergent, 3.0–3.5 mm long, 2.0–3.0 mm wide, lobes unequal in size, superior lobe shorter and narrower than the inferior, white with pale pink spots; anther cap 2–3 mm long, 1.8–2.0 mm wide, ellipsoid; pollinarium 1.8–2.0 mm long, 0.9 mm wide, composed of two obovate-elliptic pollinia, laminar stipe and a short, roughly hippocrepiform viscidium; capsule not seen.

Etymology:—This new species honors Gaspar Silvera and his daughter Katia who collected the plants and provided us with material, iconography, and ecological data. Gaspar is a well-known orchid nurseryman from Panama who has reproduced and raised many orchid species, including this one, from seeds. Katia is a specialist in the evolution of physiological mechanisms in epiphytes, particularly of CAM in orchids. The specific epithet was constructed in accordance to article 60C.1 (McNeill *et al*. 2012), which specifies that when honoring more that one person in an epithet whose name ends in "a", the correct plural form should be constructed with the addition of -rum; thus "silvera-rum", after the Silveras.

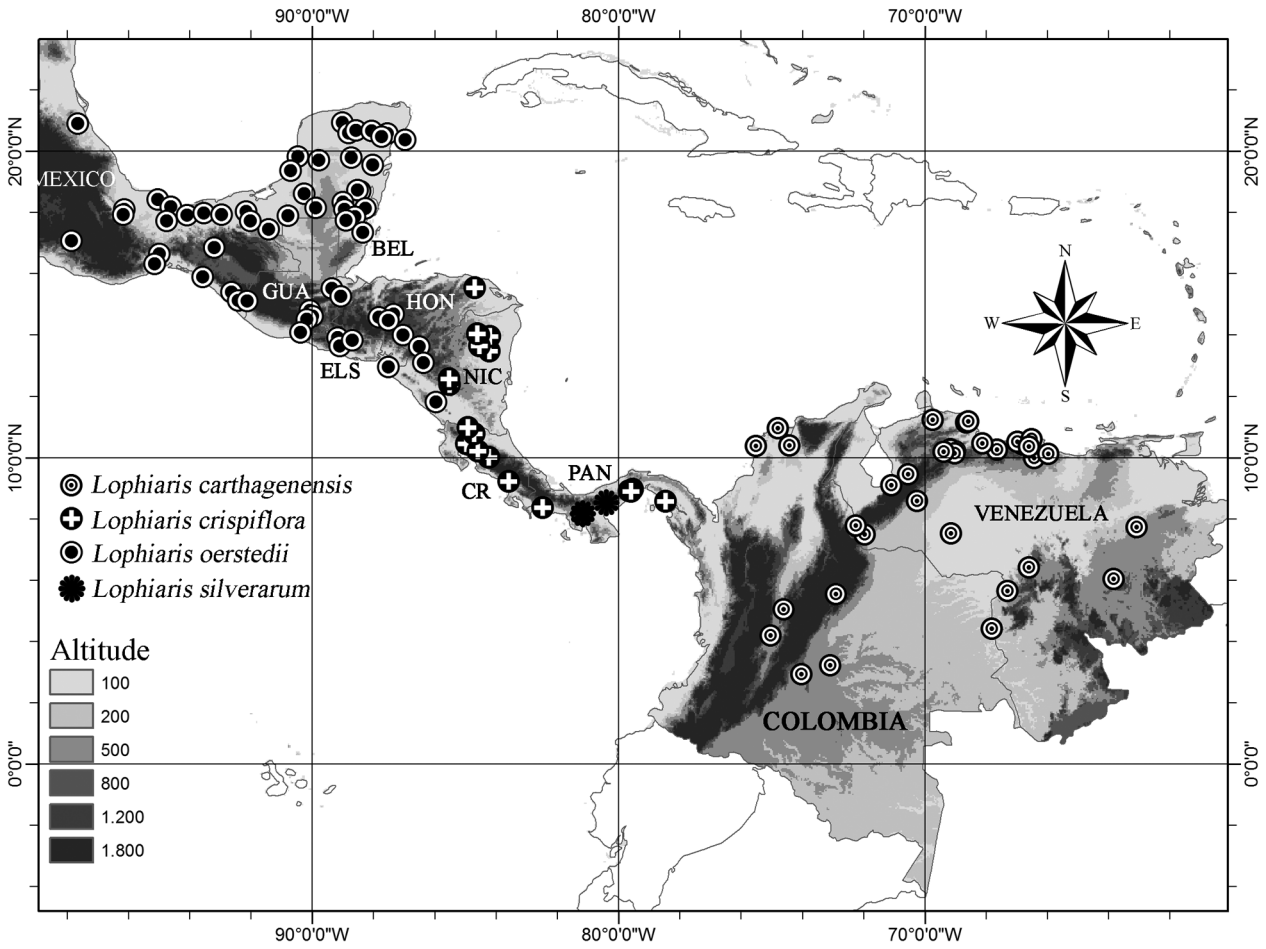

FIGURE 2. Distribution of *Lophiaris silverarum* and related species.

Distribution and ecology:—*Lophiaris silverarum* is currently only known from two localities in central Panama, 115 km apart from each other, one in the Veraguas Province (the type collection) and another in the Coclé Province (Figs. 2, 3). We have not seen material from the second locality. The collectors of the species state that the type locality is at ca. 200 m and albeit they refer to it as Tropical Dry Forest ("Bosque seco tropical"), local precipitation approaches 2000 mm. The area topography is predominantly flat with few low-elevation hills in the vicinity. Also, according to the collectors, natural vegetation is very disturbed and seasonally burned with little forest coverage; soils are poor in nutrients. The plants were collected at the margins of the Subí River, where several orchid species are common on old remnant trees. These include *Aspasia epidendroides* Lindley (1832: 139), *Lockhartia amoena* Endrés & Reichenbach (1872: 666), *Camaridium ochroleucum* Lindley (1824: t. 844), *Cohniella helicantha* (Kränzlin 1922: 281) Cetzal & Carnevali (2010: 210), *Oncidium isthmii* Schlechter (1922: 84), *Epidendrum coronatum* Ruíz & Pavón (1798: 242), and *Sobralia decora* Bateman (1841: t. 26). Plants of *Lophiaris silverarum* are fairly frequent yet widely scattered in the area, where they commonly occur on a species of legume.

FIGURE 3. Distribution of *Lophiaris silverarum.*

The second locality, Cabuya in Coclé Province, is at an elevation of approximately 400 m, where *Lophiaris silverarum* also grows on large trees in shady spots at margins of local streams and rivers. The topography of this area is predominantly hilly with most of the original vegetation also gone. Here, precipitation approaches 2500 mm and the vegetation is described by the collectors as dry-subtropical ("… seca subtropical …"). The collectors reported the species as locally rare and mention that it was absent from collections of orchid aficionados in the area.

The collectors of the species mention that according to their experience, there are phenological attributes that help separate *Lophiaris silverarum* from partially sympatric *L. crispiflora*. Whereas *L. silverarum* flowers locally in November-December, *L. crispiflora* blooms in April–May. After pollination, capsules of *L. silverarum* take eleven months to dehisce whereas in *L. crispiflora* they do so after six months. The evidence gathered by the collectors also indicate that, at least regionally, *L. silverarum* grows at slightly higher elevations (200–400 m) as opposed to the lowland, mostly coastal areas where *L. crispiflora* usually grows. Whether *L. silverarum* is actually sympatric with *L. crispiflora* is currently unknown at this time and more evidence is required to address this question.

Diagnostic features:—*Lophiaris silverarum* is similar to several other species of *Lophiaris*, particularly *L. carthagenensis* and *L. crispiflora* (Fig. 4, Table 1), the first for Colombia and Venezuela, the second from Honduras through Panama. However, it is easily distinguished from these two species by the larger flowers (25–30 mm diameter across the spread dorsal sepal and labellar apex vs. 16–23 mm in both *L. carthagenensis* and *L. crispiflora*). The color of the flowers is also strikingly different. In *L. silverarum* the background color of the flowers is pale straw-yellow with many, minute (< 1mm diameter) non-confluent, laxly arranged pale reddish-brown spots. On the other hand, in the two aforementioned allied species (and other taxa related to *L. oerstedii*), the base color of the tepals may be either straw-color or pale pink to pale purple, but the spots are much larger (> 1.5 mm) and always confluent. Furthermore, the isthmus of the labellum is wider (5 mm) in *L. silverarum* than it is in *L. carthagenensis* and *L. crispiflora* (2.5–4 mm). The calli of these three species are also different between each other, as indicated in the key provided herein and in Figure 4 and Table 1.

TABLE 1. Morphological comparison of *Lophiaris silverarum* and related species.

Characters	*L. oerstedii*	*L. crispiflora*	*L. silverarum*	*L. carthagenensis*
Flowers size (mm)	16–21	16–23	25–30	17–20
Dorsal sepal (mm)	7–9 × 4–7	8–10 × 4–6	12–14 × 8–11	7–8 × 4–6
Petals (mm)	5–8 × 4–5	8–10 × 5–7	10–12 × 8–9	6–8 × 5–6
Sepals and petals (color)	White with pink to pale pink spots	White with red brown, magenta or pale pink spots	Yellow with red or brown spots	White or greenish with red brown, wine-red or magenta spots
Spots on the surface of the sepals and petals	Heterogeneously dispersed over the whole surface, confluent, often into conspicuous transversal bands; individual spots > 1.5 mm diameter	Confluent, with a continuous, homogeneous pattern, often covering almost the whole surface; individual spots > 1.5 mm diameter	Heterogeneously dispersed over the whole surface, always non-confluent, minute (0.7–1 mm diameter)	Heterogeneously dispersed over the whole surface, mostly confluent; individual spots > 1.5 mm diameter
Labellum length (mm)	8–10	9–11	15–16	7–9
Lateral lobes of the labellum (color)	White with dark orange spots	White with red brown to pale pink or magenta spots	Yellow with red brown spots	White or green with wine or magenta spots
Central lobe of the labellum (color and position)	White with pink to pale pink spots on almost the entirety of its surface	White with a red brown, magenta or pale pink spots in 2/3 of its surface	Yellow with red or brown spots dispersed across its surface	White or greenish with red brown, wine or magenta spots dispersed across its surface
Central lobe of the labellum (mm)	2.5–4.0 × 3.5–8.0	3.5–5.0 × 7.5–10.0	6–8 × 14–15	3.5–5.0 × 6.5–8.5
Isthmus width (mm)	2–3	2.5–3.5	5	3–4
Apex of the proximal teeth (surface)	Smooth	With 6 small, globose teeth	With 3 small, globose teeth	With +10 small, conical and irregular teeth
Central keel of the callus (position)	Parallel to distal teeth	Parallel to distal teeth	Parallel to distal teeth	Parallel to proximal and distal teeth
Number of teeth on the central keel of the callus	1-tooth	1 or 2-teeth	1-tooth	6-teeth or more
Lateral margins of the disc	With a compressed, rugose keel	Smooth	Smooth	Smooth

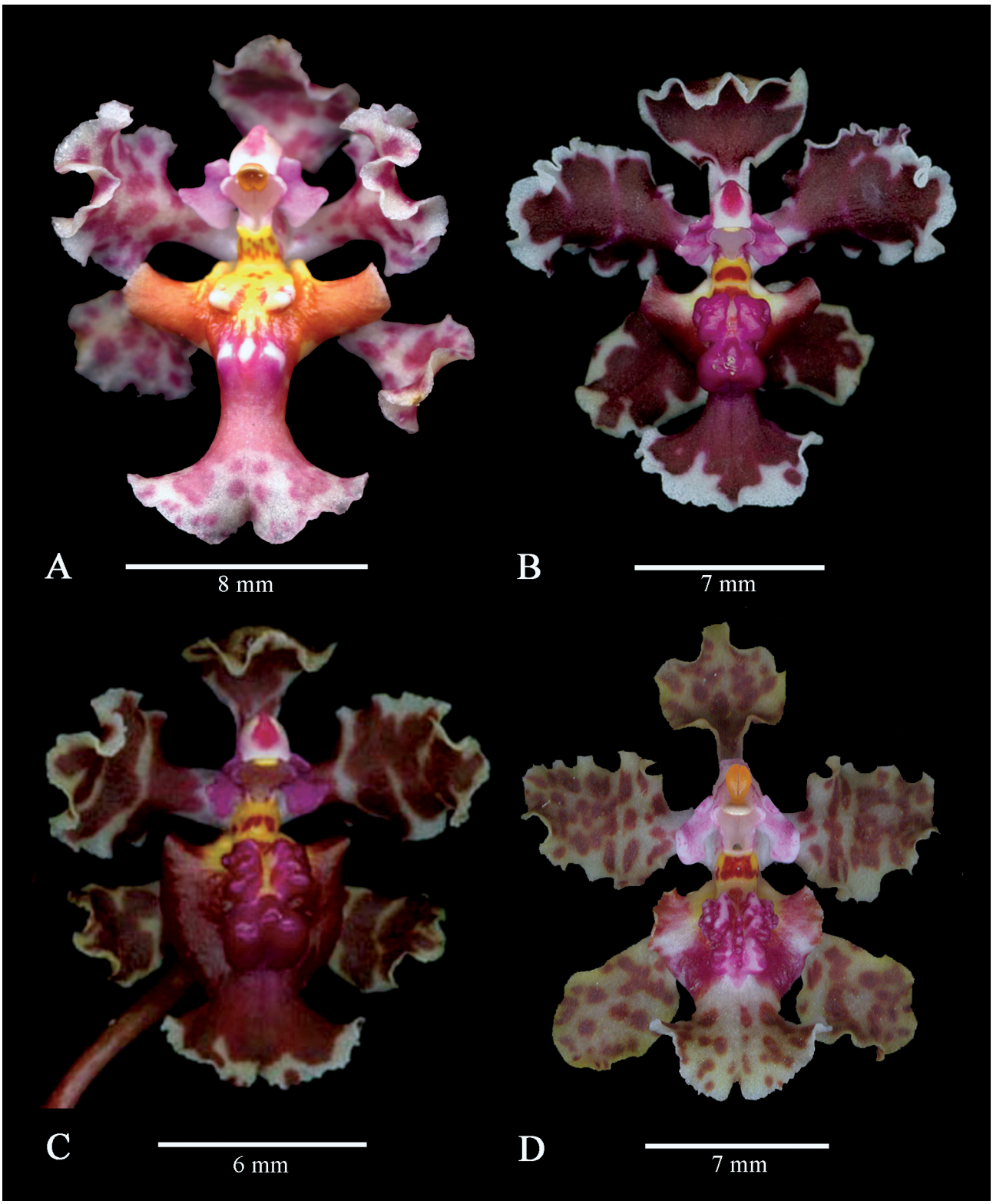

FIGURE 4. Whole flowers, front views. **A**. *Lophiaris oerstedii* (based on *Balam et al. 98*, CICY). **B–C**. *Lophiaris crispiflora* (*Bogarin & Pupulin 2228*, JBL; *Pupulin 5913*, JBL). **D**. *Lophiaris carthagenensis* (*Noguera-Savelli et al. 712*, VEN).

IUCN conservation category:—EN. We have no population data on this species beyond anecdotal comments by the collectors. Thus, we have relied upon the set of B criteria of the IUCN (2010). However, in view of the fact that the revision of hundreds of *Lophiaris* exsiccatae and other information from Panama, Costa Rica, and northwestern South America has yielded no additional records of the new species, we have to assume that it is either rare or only locally common. It is not impossible that *Lophiaris silverarum* may have been more common in

the past before rampant anthropogenic disturbing of its habitats happened, but the species is nowadays likely confined to isolated large trees in pastures or along rivers. The new species is known from an area of approximately 2500 km^2, which is severely fragmented and likely to become even more so in the foreseeable future. Since *L. silverarum* is currently known from only two localities, the species meets criteria B1ab of the IUCN (2010) and should be considered as Endangered (EN).

Key to *Lophiaris silverarum* and morphologically similar species

1. Flowers 25–30 mm diameter; perianth segments straw-yellow with red or brown small spots (0.7–1 mm diameter) that are always non-confluent and heterogeneously dispersed over the whole surface; dorsal sepal 12–14 × 8–11 mm; isthmus of the labellum 5 mm width; plants from western Panama ..... *L. silverarum*
– Flowers 16–23 mm wide (usually under 20 mm) diameter; perianth parts white or greenish (more rarely straw-yellow or pale rose) with red-brown, wine-colored or magenta spots, these larger (> 1.5 mm) and confluent or not, often so dense as to cover most of the surface of the perianth segments; isthmus of the labellum 2–4 mm width; plants from southern Mexico to northern South America 2
2. Callus low, not prominent, composed of clearly defined proximal and distal sections, proximal teeth of the callus conical with a smooth surface to the apex; central keel of the callus with one tooth; plants from northeastern Mexico to southwestern Honduras and Nicaragua ..... *L. oerstedii*
– Callus prominent, high, not composed of clearly defined proximal and distal sections but instead divided by a longitudinal ridge into right and left sections; central keel of the callus with 1-6-or more teeth; plants from northeastern Honduras to Venezuela 3
3. Central keel of the callus with 6 -or more conical, irregular teeth, dividing both distal and proximal sections of the callus in left and right parts; plants from Colombia and Venezuela on the eastern side of the Andes or in extreme northern Colombia ..... *L. carthagenensis*
– Central keel of the callus with only 1–2 globose teeth, dividing only the distal section of the callus into left and right portions; plants from northeastern Honduras to Panama ..... *L. crispiflora*

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