

A Highly Threatened New Species of Vanilla From Costa Rica

Adam P. Karremans and C. Patricia Lehmann/Photographs unless otherwise noted by Adam P. Karremans

ABSTRACT A new species of *Vanilla* is described and illustrated from the southeastern tip of Costa Rica, close to the border with Panama. *Vanilla karen-christianae* was found in a region of the country that has no protected areas and very little original forest cover. The unexpected discovery highlights the importance of continued and sustainable conservation efforts across all life zones and ecoregions, underlining the importance of the public sector in biodiversity research and protection. The new species belongs to subgenus *Xanata*, which includes all the fragrant *Vanilla* species used in commerce. *Vanilla karen-christianae* is easily distinguished from all other Central American species by the combination of very narrow leaves, with a recurved apex, the green-and-white flowers and the appendages on the lip, a feature found otherwise only in the closely related *Vanilla helleri*, *Vanilla insignis* and *Vanilla odorata*.

KEY WORDS Biodiversity conservation, Costa Rica, Christiana Figueres, new species, threatened, *Vanilla karen-christianae*

INTRODUCTION The vast majority of novel plant species are discovered either by exploring remote areas or by carefully re-examining previously collected specimens. It is expected that most of those novelties belong to groups that are of lesser interest, are of complicated taxonomy or are intrinsically highly diverse. A several-meter-tall new species of *Vanilla* Plum. ex Mill., found growing along the Pan-American highway close to the border crossing between Costa Rica and Panama, meets none of these expectations. However, it perfectly fits the category of a rare (as defined by Pupulin and Karremans 2017) and highly threatened orchid.

The pantropical genus *Vanilla* is probably the most well known and widely appreciated of orchids because of the famous vanilla flavoring that is found in its fruits (Bouétard et al. 2010). *Vanilla* species, nonetheless, represent a severe challenge for conservation throughout the tropics (Soto Arenas and Cribb 2010). Their natural populations have been depleted not only through habitat destruction, but



also collection for medicinal and culinary purposes. The genus includes just over 100 species in its broad distribution (Cameron 2003, 2009), and about a dozen have been reported from Costa Rica (Soto Arenas and Dressler 2010; Azofeifa-Bolaños et al. 2017). During the preparation of a monographic treatment of the genus, specimens of an unknown entity were discovered in Corredores, a municipality in the southeastern tip of Costa Rica. The

- [1] *Vanilla karen-christianae* Karremans & P.Lehm. by A.P. Karremans from the type.
 [2] *Vanilla karen-christianae* Karremans & P.Lehm. A. Nectaries on the inflorescence. B. Nectaries on the apex of the ovary. C. Penicillate callus of the lip. D. Appendages on the lip apex. E. Ants feeding on the extrafloral nectaries. Photograph 2E by C. Patricia Lehmann.

plants were found growing on trees along a small creek and main highway in an area that is under high pressure because of agricultural and developmental activities, and has no protected areas or conserved forests nearby.

Costa Rica is renowned for being a leader in the conservation of natural resources and its climate change adaptation and mitigation policies. We hope to draw attention to the importance of publicly funded biological research in pointing out the necessity for and supporting the continued and sustainable conservation efforts throughout the country. These should be inclusive and attempt to cover all life zones and ecoregions so that species such as the one described here do not fall through the cracks. The discovery of *Vanilla karen-christianae* Karremans & P.Lehm., in addition to three new species belonging to genus *Monstera* Adans. (Araceae) recently found in the same region (Zuluaga and Cameron 2018; Cedeño Fonseca et al. in preparation), stress the necessity of the protection of the biodiversity of this particular area. Nothing would be more tragic than the loss of elements of the national biodiversity before they have even been recognized to exist.

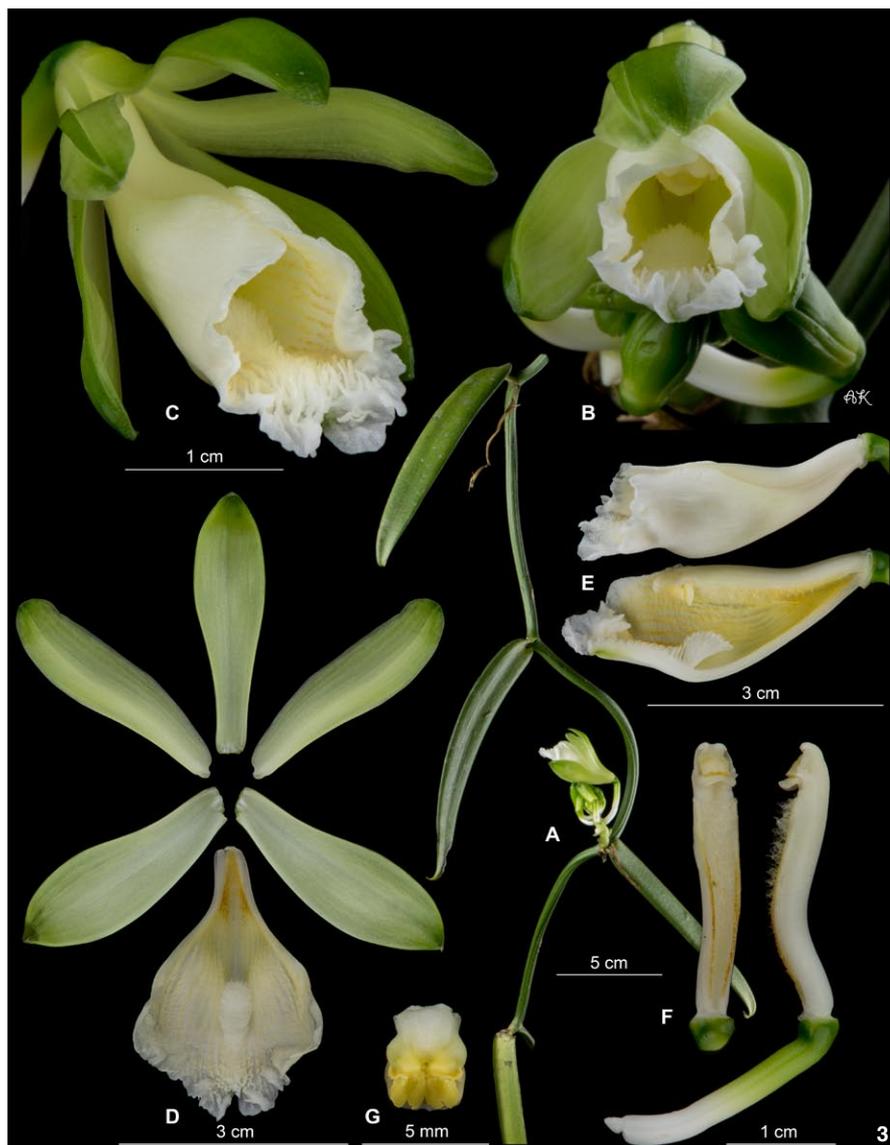
TAXONOMIC TREATMENT

Vanilla karen-christianae Karremans & P.Lehm., sp. nov.

TYPE Costa Rica. Puntarenas: Corredores. Canoas, 27 septiembre 2017, A.P. Karremans et al. 8087 (holotype: USJ; isotypes: JBL-spirit, CR).

The overall flower color and presence of appendages on the lip of *Vanilla karen-christianae* are reminiscent of *Vi. insignis* Ames; however, the new species may be easily distinguished by the narrow, obliquely ensiform leaves (vs. oblong-elliptic), the apex conspicuously incurved (vs. extended), the nonspreading flower segments (vs. conspicuously spreading), the white callus (vs. yellow), the significantly smaller flowers (sepals and lip ca. 4 vs. ca. 7 cm long), and the crenate margin of the lip (vs. lacerate). The plant habit is similar and easily confused with that of *Vi. odorata* C.Presl.; however, the new species is distinguished by the green and white flowers (vs. yellowish-cream), the crenate lip margin (vs. fimbriate) and the dense tuft of appendages on the lip (vs. a few scarce papillae).

Hemiepiphytic, branching, leafy vine, up to several meters high. *Stems* flexuous, subterete, with a conspicuous groove along the entire internode, dark to olive green, ca. 6–7 mm thick; internodes,



7–12 cm long. *Aerial roots* semicylindric, ca. 2–3 mm wide. *Leaves* subsessile; blade obliquely ensiform, margins slightly revolute, the shortly acuminate at the apex conspicuously recurved, coriaceous, 10.5–16.5 × 1.5–2.5 cm. *Inflorescence* appearing singly in each axis, producing many flowers, up to +25 flowers per raceme; *peduncle* abbreviated, fleshy, subterete, ca. 1 cm long; *rachis* up to 5 cm long. *Floral bracts* sessile, small, ovate, obtuse, concave, fleshy, ca. 4–8 mm long, with an external nectary close to the base, aligned with the midvein. *Flowers* successive, one open at a time, ephemeral, segments not spreading, basal half of the ovary white, apical half green, sepals and petals light green, shiny, lip white with the side veins and appendages dull yellow, penicillate callus white, column white; fragrance weakly citric. *Ovary* subterete, smooth, arcuate, 30–33 mm long, 3–4 mm thick; with three external,

[3] Lankester composite digital plate of *Vanilla karen-christianae* Karremans & P.Lehm. A. Habit. B. Inflorescence. C. Flower. D. Dissected perianth. E. Column and lip lateral view. F. Column in ventral and lateral view. G. Anther cap and pollinia. By A.P. Karremans from the plant that served as type.

apical nectaries, aligned with the midvein of each sepal. *Dorsal sepal* oblanceolate, apex acute, somewhat concave, fleshy, ca. seven-veined; 39–45 × 9–11 mm. *Lateral sepals* obliquely oblanceolate, apex acute, fleshy, ca. 12-veined, 37–44 × 11–14 mm. *Petals* obliquely linear to lanceolate, somewhat arcuate, apex acute, with a very conspicuous, elevated dorsal keel; ca. seven-veined, 37–44 × 5.5–10 mm. *Lip* fused to the column along the margins for ca. 2.5 cm, tubular, concave, inflated near the middle, becoming deeply saccate; the apex emarginate, with a recurved



tip; when spread out 39–45 × 20–35 mm; unguiculate, the claw papillose, ca. 1 cm long; the blade approximately obovate in outline, obscurely trilobed, ca. 20-veined, the veins thickened forming low, papillose-verruculose keels, taller towards the apex; lateral lobes obtuse, the central lobe bilobed, margins irregularly crenate, revolute; *penicillate callus* 2.5–3.0 cm from the base, extending for about 1.5 cm to the apex, 6–7 mm tall, gradually lowering towards the apex; made up of reclined, flabellate, densely lacerate-laciniate scales. *Column* elongate, slender, terete, 25–30 mm long, 4–5 mm wide; ventral surface densely covered by trichomes below stigma; apex with three wings. *Stigma* trilobed, lateral lobes erect, small, rostellum a large, transversely oblong, convex blade. *Anther cap* basally hinged to the column, movable, subquadrate, 6 × 4 mm. *Pollen* not forming a clear pollinarium but a sticky, granular mass. *Fruit* not seen; they are expected to be fragrant.

OTHER SPECIMENS STUDIED Costa Rica. Puntarenas: Corredores. Canoas, floreció en cultivo de P. Lehmann el 16 abril 2017, *A.P. Karremans 8123* (JBL-spirit!).

EPONYMY The epithet honors Karen Christiana Figueres Olsen, an internationally recognized Costa Rican leader on global climate change. As executive secretary of the United

Nations Framework Convention on Climate Change she spearheaded the negotiations that led to the 2015 Paris Agreement. Her optimistic and energetic approach to the worldwide climate change issue was instrumental for this achievement. Climate change adaptation and mitigation efforts are badly needed to maintain species like the one described here. A similar approach for conservation of natural resources, in which goals are reached through the combination of technological innovations, broad participation of all sectors of society and clear economic benefits of conservation efforts, is likewise a necessity.

PHENOLOGY Plants were observed to flower from February to April.

DISTRIBUTION Endemic to Costa Rica, where it is known only from a few locations separated by about a 2-km distance in the southeastern municipality of Corredores, very close to the border with Panama.

HABITAT AND ECOLOGY The only known specimens of this species were found growing on trees along a small creek and main highway in an area that is under high pressure of agricultural and developmental activities, and which has no protected areas or conserved forests nearby. Several tree species have been identified as hosts for *Vi. karen-christianae* at the locations studied, including *Lonchocarpus guatemalensis* Benth.

and *Inga vera* Willd. (Fabaceae), *Apeiba tibourbou* Aubl. (Malvaceae), *Guatteria lucens* Standl. (Annonaceae), *Genipa americana* L. (Rubiaceae), *Cedrela odorata* L. (Meliaceae), *Vochysia guatemalensis* Donn. Sm. (Vochysiaceae), *Spondias mombin* L. (Anacardiaceae), *Hieronyma alchorneoides* Allemão (Anacardiaceae), and especially the African oil palm *Elaeis guineensis* Jacq. (Arecaceae) which is a common crop in the region. The exact location of the populations of *Vi. karen-christianae* have been intentionally concealed to avoid further pressure on the already threatened new species.

RECOGNITION The very narrow leaves and presence of a conspicuous tuft of appendages on the lip distinguish *Vi. karen-christianae* immediately from the other Costa Rican species. *Vanilla odorata* is the only other species found in the country that shares such narrow leaves; however, that species has a yellowish flower, the lip is fimbriate and it lacks the appendages. *Vanilla helleri* A.D.Hawkes has similar appendages on the lip, but has a broader leaf and white flowers with a bright yellow lip. Other Central American species like *Vi. insignis* also share this particular lip feature but that species has a much larger, spreading flower and a lacerate lip margin. The Brazilian *Vanilla capixaba* Fraga & D.R.Couto and *Vanilla ribeiroi* Hoehne share the narrow leaves and white lip with a dense tuft of

appendages, and although very distantly distributed are likely to be close relatives. The former can be easily distinguished by the nonrecurved apex of the leaf, the broader, acute sepals and petals, the transversally oblong midlobe of the lip and the larger appendages disposed in distinct rows (Fraga et al. 2017). The type specimen and illustration of the latter show nonoblique lanceolate leaves, an oblong dorsal sepal, and especially a smaller, narrower lip with a prominently long-fimbriate apex, quite distinct from *Vi. karen-christianae*.

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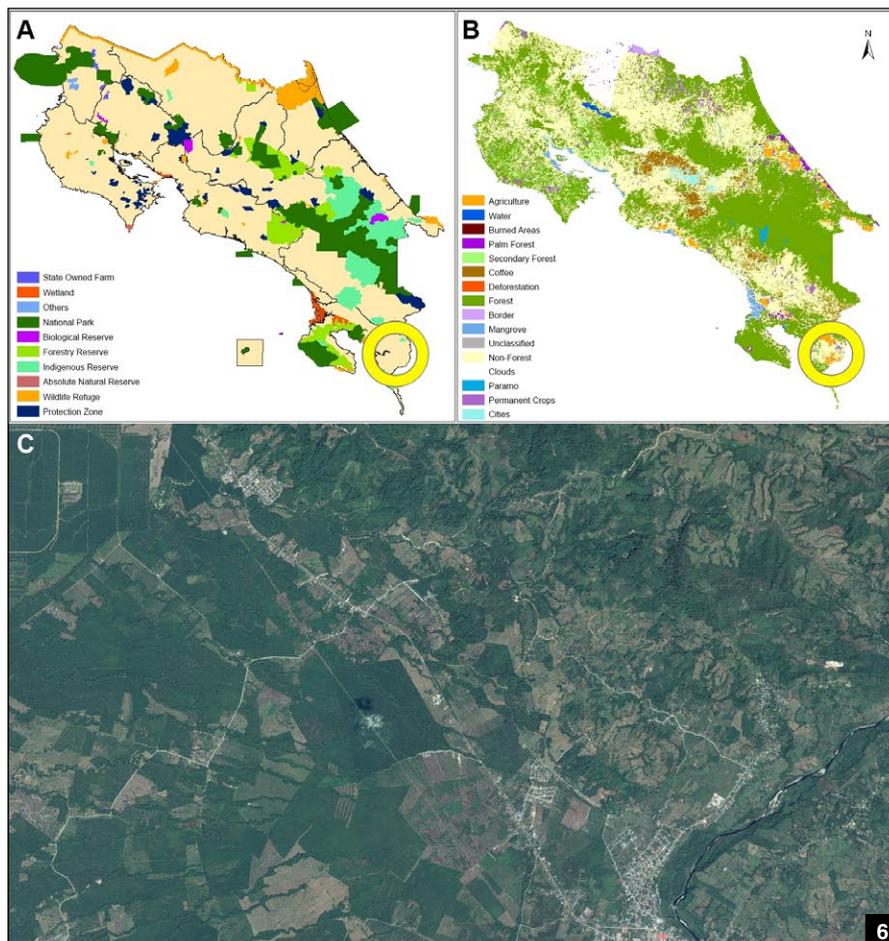
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[4] Location where *V. karen-christianae* Karremans & P.Lehm. was found for the first time. A. Farm showing pastures and a few trees. B. Solitary trees in the middle of the farm. C. Remnant trees along a creek on the farm. D–F. *Vanilla karen-christianae* plants growing on a few of the scattered trees.

[5] Type location of *V. karen-christianae* Karremans & P.Lehm. A. View of the Pan-American highway, which is currently being widened. B, C. *Vanilla karen-christianae* plants growing on the side of the road, including the nonnative African oil palms.

[6] Maps of Costa Rica, highlighting the type location of *Vanilla karen-christianae* Karremans & P.Lehm. A. Protected areas. B. Most recent (2005) classification of land use. C. Google Earth aerial photograph of the area where the new species grows, evidencing the patchy forest cover. A and B have been adapted by the authors from the Spanish version created by SINAC, SIREFOR and the Ministry of Agriculture.

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