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Taxonomic notes on *Vanilla odorata*, *Vanilla fimbriata* and related species (Orchidaceae)

Guy R. Chiron[1*], Aurélien Sambin[2, 3] & Amauri H. Krahl[4]

1. Herbiers, Université Claude Bernard Lyon I, Villeurbanne (France)
2. Jardin botanique de Guyane, 2802 savane Césarée, 97355 Macouria (French Guiana)
3. Herbier du Jardin botanique de Guyane, Macouria (French Guiana)
4. Programa de Pós-Graduação em Botânica, Departamento de Botânica, Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2936, CEP: 69.060-001, Manaus, Amazonas (Brazil)
* Corresponding author g.r.chiron@wanadoo.fr

Abstract

Nine *Vanilla* taxa, members of the morphogroup "*Vanilla planifolia*" characterized by narrow leaves, are discussed. We first resume the data contained in the various protologues and in the associated type-material. Several taxa being poorly known, we search the characters both discriminating and available in all the taxa (or almost all). Comparing these characters within the set of taxa leads us to precise the relationships between them. New synonymies are proposed. Finally five taxa proved to be recognized species: *Vanilla odorata, V. ensifolia, V. fimbriata, V. ribeiroi, V. labellopapillata*. For each one we provide a detailed description and distribution. For the first time, the presence of *V. fimbriata* and *V. labellopapillata* in French Guiana is documented. Finally a limited key to these five species is proposed to help separating them.

Résumé

Neuf taxons de *Vanilla*, membres du morphogroupe *Vanilla planifolia* caractérisés par des feuilles étroites, sont discutés. Dans un premier temps, nous reprenons toutes les données contenues dans les protologues et le

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matériel type. Plusieurs taxons étant mal connus, nous délimitons les caractères à la fois discriminants et disponibles. La comparaison de ces caractères au sein des neuf taxons nous amène enfin à définir les relations que ceux-ci présentent. *In fine*, cinq d'entre eux sont reconnus comme bonnes espèces : *Vanilla odorata, V. ensifolia, V. fimbriata, V. ribeiroi, V. labellopapillata*. Pour chacune, description détaillée et distribution sont données. La présence de *V. fimbriata* et de *V. labellopapillata* en Guyane française est ici documentée pour la première fois. Une clé d'identification est proposée pour aider à distinguer ces cinq espèces.

Key words: Alphataxonomy, Discriminating characters, New synonyms, Type material
Mots clés : Alphataxinomie, caractères discriminants, matériel type, nouveaux synonymes

Introduction

Since the creation of *Vanilla* C. Plumier ex P. Miller (1752), 196 names have been published in the genus at the specific level, among which 131 are treated as valid species by WCSP (2021). Soto Arenas & Cribb (2010) have proposed an infrageneric classification with two subgenera, *Vanilla* and *Xanata* Soto Arenas & Cribb (2010: 358), the latter being divided into two sections and several morphogroups. The goal of the present article is to deal with the morphogroup "*Vanilla planifolia*" and, more particularly, with two unclear species, *V. odorata* C. Presl (1830: 101) and *V. fimbriata* Rolfe (1901: 133).
A number of names have been placed into the synonymy of the former by various authors (in particular Garay, 1978; Dodson & Dodson, 1980; Hamer, 1984; Soto Arenas, 1993 [although with doubt]; Govaerts, 2003; Bellone & Chiron, 2003; Chiron & Bellone, 2005; Nelson Sutherland, 2008; Soto Arenas & Cribb, 2010; Soto Arenas & Dressler, 2010; Szlachetko *et al*., 2016; Karremans *et al*., 2020; Sambin & Ravet, 2021). All together: *V. ensifolia* Rolfe (1892: 141), *Epidendrum vermifugum* Sessé & Mociño (1894: 201), *V. uncinata* Huber ex Hoehne (1937: 269) and *V. denticulata* Pabst (1973: 109). However Damian (2020) did not agree with it; none of these names is placed into the synonymy of *V. odorata* in his thesis. And Szlachetko *et al*. (2012) treat *V. ensifolia* as a good species. *V. uncinata* having been placed into the synonymy of *Vanilla karen-christianae* Karremans & P. Lehmann (2018: 305) by Karremans *et al*. (2020), we have to deal with this last taxon as well, which presents, also, somewhat narrow leaves.

Hoehne (1945) notes, in his description of *Vanilla fimbriata*, that he would incline to think that it is idendical to *V. ribeiroi* Hoehne (1910: 28) if not the flower colour (fully white with yellow on the lip in the latter *versus* green outside and greenish white inside in the former) and the size of the sepals and petals (4-5 cm *versus* 2.7-3.1 cm). Recently A.K. Koch *et al.* (2013) proposed a new species showing some similarity with *V. fimbriata* and *V. ribeiroi*, *Vanilla labellopapillata* A.K. Koch, C.N. Fraga, J.U. Santos & A.L. Ilkiu-Borges (2013: 975): we will study these two species as well.

In the present work we aim first to put down all what is known about each of the nine above taxa, then to analyse the distinguishing characters specific to each of them and, finally, based on these evidences, to give our opinion on the relationships existing between them.

Material and methods

For this study we used exclusively protologues and corresponding type material, with an exception for *Vanilla odorata*. Following Kraenzlin (1919) and Ames (1925), who based their comments on the unique leaf narrowness of the species, we used the descriptions they proposed. Beyond the original publications, we also referred to a number of articles citing these taxa, published by more modern authors, just to have in mind their opinions but without necessarily following them in their conclusions. Preserved material has been examined from images e-published (or provided) by the following herbaria: AMES, BM, CAY, F, HB, HJBG, HUEFS, IAN, INPA, K, MA, MG, NY, P, PR, PRC, R, RB (acronyms according to Thiers, 2021).

Based on the data collected during this study we tried to define a number of morphological characters, either vegetative or floral, both available in this material and discriminating within the studied set. Available, of course, as a number of descriptions being somewhat vague, not all the relevant characters are known for each species. And discriminating because several features proved to be not much variable within this somewhat uniform group of species whereas other ones are not stable at the specific level.

Finally comparing these characters within the species led us to a number of conclusions on the relationships between them.

Results

Vanilla odorata C. Presl (1830)

1. C. Presl's concept

The name has been published in 1830 in *Reliquiae Haenkeanae* (Presl, 1830). The protologue (Fig. 1) is very brief, the Haenke's material being sterile. We can notably read: "Stem terete, foliate, rooting at nodes; leaf shortly petiolate, erect, linear-lanceolate, very acute, nerved, fleshy, 12.5-17.5 × 1.25-1.7 cm; inflorescence short; fruit sessile, linear-lanceolate, half a foot long or not very more."

VANILLA ODORATA. PRESL.

V. foliis lineari-lanceolatis acutis nervosis, capsulis lineari-lanceolatis longitudine foliorum.
Hab. in Guayaquil. ♃
Scapus teres, repens, foliosus, ad articulationes radicans. Folia brevissime petiolata, erecta, lineari-lanceolata, acutissima, nervosa, carnosa, 5-7 pollices longa, 6-8 lineas lata. Spica brevis, rhachi a floribus delapsis cicatrisata. Flores deperditi. Capsula sessilis, lineari-lanceolata, basi et apice attenuata, capitellata, semipedalis vel parum longior. Semina nigra nitida aptera.
A V. angustifolia et V. planifolia, quibus affinis videtur, foliis capsulisque differt.
Odorem aromaticum specificum triginta sex post ellapsis annis, quod specimina collecta fuerunt, capsulae nondum perdiderunt.

Fig. 1. Protologue of *Vanilla odorata*

T. Haenke collected his material in Ecuador, near Guayaquil, between September and December 1790. The preserved material is distributed onto four sheets conserved in the PRC and PR herbaria (Fig. 2-3).

PRC450948 (https://herbarium.univie.ac.at/database/detail.php?ID=490823). This sheet is labelled TYPUS and contains *Vanilla* fragments (an internode with leaf, an isolated leaf and a fruit in 3 parts) and another plant (on the right side of the sheet) identified as a *Dimerandra* member (Soto Arenas & Dressler, 2010), as well as a note saying that the material was purchased from the estate of Karel Presl whereas the basic part of the Haenke's collection is preserved in PR.

PR305751, PR305752 and PR305753 (courtasy of M.Sc. O. Šída, PR). None of these sheets contains a type mention. The last one contains a label (hand-written by Presl) "Vanilla odorata nov Sp" and has been treated as the holotype by Soto Arenas & Dressler (2010), both other ones being treated as isotypes. The last two sheets contain, again, one or two *Dimerandra* pieces.

When measured on this material, the leaves, slightly ensiform, are 13.8-18.8 cm long, with a length/width ratio (L/w) varying from 10 to 12. The two leaf-bearing internodes are respectively 12.8 cm long (with a 18.3 cm long leaf) and 11 cm (15.5 cm), that is to say internodes markedly shorter than leaves, with a internode length/leaf length ratio of 0.7 and 0.71.

Fig. 2. ***Vanilla odorata***

Type specimen PR305751
© National Museum of Czech Republic

Type specimen PR305752
© National Museum of Czech Republic

Fig. 3. ***Vanilla odorata***

Type specimen PR305753
© National Museum of Czech Republic

Type specimen PRC450948
© Charles University, Prague, Czech Republic

This taxon is only defined by its vegetative parts. At that time only 13 neotropical leafy *Vanilla* names had been published, all the corresponding taxa presenting wide leaves (2-3 times as long as wide). So that the characteristic L/w ~ 10 was sufficient to C. Presl be sure that the plant represented a new species.
Some authors tried to connect to this species specimens presenting the same trait. The first one was F. Kraenzlin, and soon after O. Ames. At their time, no neotropical leafy *Vanilla* with narrow leaves had been published but *V. ensifolia*. Hoehne (1945) and Schweinfurth (1958) follow their opinion, however they do nothing but replicate their descriptions, without any new information.

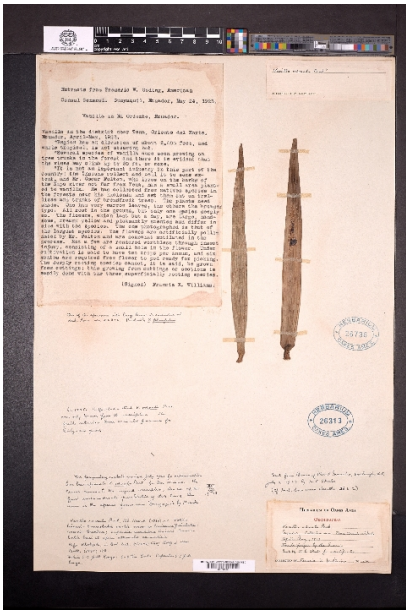
2. F. Kraenzlin's concept

Kraenzlin (1919) treated as *Vanilla odorata* a plant in cultivation at San José, near Balao, Ecuador, at about 70 km south from Guayaquil, and collected on 11/12/1899 by Dr. Preuss under the number 1952. We failed to find this specimen in any herbarium.
Kraenzlin gives the following description.
Stem 6-7 mm diameter, internodes 10-12 cm long; leaves very shortly petiolate, suboblique, scimitar-shaped, acuminate, thick, slightly fleshy, up to 20 cm long and 2 cm wide at base; inflorescence short, 3-4 cm long, bearing about 12 flowers; bracts oblong acute, up to 8 mm long, the lower ones slightly longer; sepals linear, acuminate, 4.5-5 cm long, the dorsal 3 mm wide, the laterals 2 mm; petals linear-lanceolate, equally long, 5-6 mm wide; lip overall 3.5 cm long, 1.3 cm wide through the lateral lobes, broadening from a cuneate base, apically trilobed, anterior margins crenulate-dentate, disc fully furnished with sinuate veins, just before the middle with a callus made of denticulate scales, lobes scarcely diverging, the midlobe shortly triangular at the apex, acute, reflexed; column straight, linear; flower greenish yellow.
Note that the floral segments as described by F. Kraenzlin are very narrow. It could be due to the material dryness (?). Leaves of this specimen are about 10 times as long as wide and internodes shorter than leaves.

3. O. Ames's concept

In July 1923 O. Ames received for study, from the Bureau of Plant Industry of the United States Department of Agriculture, among other material, a sample of a plant cultivated by Oscar C. Felton, sn, at Oriente del Norte,

near Tena, Ecuador. We could not locate for a certainty this plant in the visited herbaria. However there is a specimen, AMES02158522! (Fig. 4 left), https://s3.amazonaws.com/huhspecimenimages/JPG/02158522.jpg from the same place, collected in O.C. Felton's collection by F.X. Williams, sn, in April-May 1923. It consists of two leaves and was received by O. Ames for identification in July 1923. It is probably the same sample. Ames (1925) says that he could identify it as *Vanilla odorata* based on two traits: narrow leaves and use of fruit. To get flowers in good conservation state he received additional material in alcohol. Based on this material Ames (1925) gives a complete description (condensed below) and an illustration (Fig. 4 right) of *Vanilla odorata*.



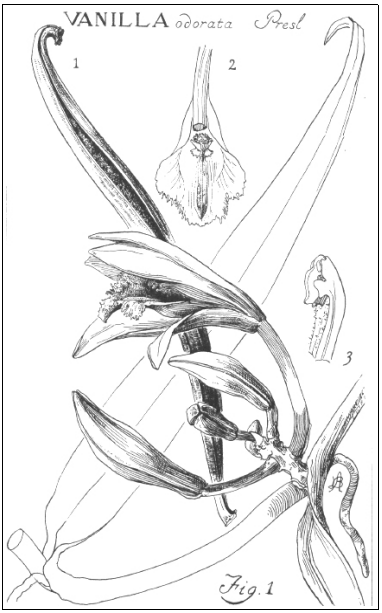


Fig. 4. *Vanilla odorata*

Specimen AMES02158522 plate from Ames (1925)

Stem thin [about 5-6 mm from the plate]; leaves coriaceous, up to 18.5 cm long, 1.5-2 cm wide near the base, about 2 mm thick when fresh, linear-lanceolate [slightly curved on the plate], acute [acuminate on the plate], apex sharply deflexed; [flower not very open from the plate]; sepals and

petals narrowly lanceolate, the lateral sepals somewhat spreading, 5 cm long, 1.3 cm wide, subacute, the median one 5.2 cm long, 1.1 cm wide; petals 5 cm long, 1 cm wide, obtuse, lightly carinate outside; lip 4.5 × 2.2 cm, united to the column into a tube in the basal half, expanded portion flabellate [somewhat trilobed according to the plate], lightly tricarinate, the keels rounded giving rise to several papilliform emergences near the distal end, anterior margin fimbriate; disc ornamented with a penicellate callus near the middle; column [ca. 37 mm long on the plate] densely glandulose [long-pubescent on the plate] on the anterior surface.
Ames refers to *V. odorata* two collections from Bolivia:
O.E. White 1821, Bolivia, Beni, 12/1921 (AMES02158520!)
O.E. White 1115, Bolivia, Ixiamas, 12/1921 (AMES02158519!)
They show linear-lanceolate, slightly ensiform, 16-20 cm long leaves (L/w ratio ca. 12-13) and internodes 0.6-0.75 time as long as leaves. Ames adds "capsules about 16 cm long" after a Bolivian specimen.

***Vanilla ensifolia* Rolfe (1892)**
R.A. Rolfe describes his taxon based on two samples of a specimen from Colombia collected by J. Goudot in the Cauca Province, at "Penol" or "Peñol" (not located) and another specimen collected at Patia, again in the Cauca Province and conserved in the herbarium of the Pharmaceutical Society of Great Britain (PHA). This specimen was presented to Rolfe by T. Hanbury in 1884. The collection date of the Goudot's specimen seems to be 08/1844. However, according to Palmer (1918), Goudot was in Paris from late 1842 to 1848 and worked to various naturalist publications: "Finally he reached Havre, France, in December, 1842. During the four years from 1843 to 1846 Goudot published a dozen papers […] According to Mulsant and Verreaux he returned to Colombia after 1848..."
The above specimens are preserved as follows:
Colombia, Cauca, Penol, *J.Goudot* "1844", labelled ISOTYPE: P00367037! - http://mediaphoto.mnhn.fr/media/14430890710031JmWcZ6S8Lqvgn4v (Fig. 5 left). It contains a *Vanilla* piece made of 4 internodes, 5 leaves and 1 inflorescence, together with 2 capsules.
Colombia, Cauca, Peñol, *Goudot*, without any number or date: K000463744! – http://specimens.kew.org/herbarium/K000463744 (Fig. 5 right). Although without any mention of type, it is treated as a syntype by Soto Arenas & Dressler (2010). A drawing of the following specimen by Miss Smith is added on the sheet.

Colombia, Patia, labelled “Leaves flower and seed of Vanilla – Patia. Presented by Mr. T. Hanbury 1884” (PHA). This specimen is treated as a syntype by Soto Arenas & Dressler (2010). The collections of PHA are said to have been transferred to CMM and K (Thiers, 2021). We failed to find this specimen.

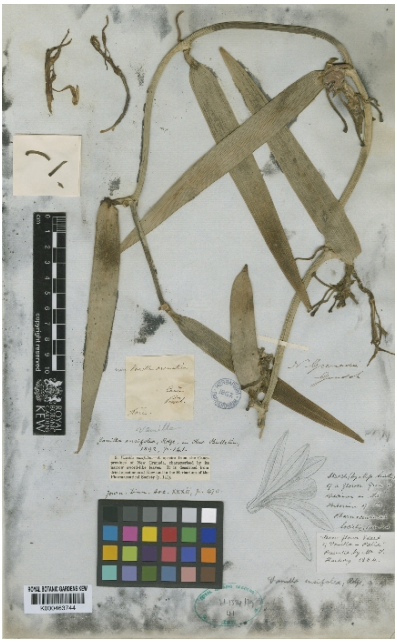


Fig. 5. ***Vanilla ensifolia***

Isotype specimen P00367037
© Muséum national d'Histoire naturelle, Paris
Plantes vasculaires

Syntype specimen K000463744
© the Board of Trustees of the Royal Botanic Gardens, Kew

According to the protologue: stems sulcate smooth; leaves petiolate, elongated-linear, acute, 10-20 × 1.25-2 cm, petiole 6-10 mm long; inflorescence short, flowers subfasciculate; bracts lanceolate-ovate, acute, 4-6 mm long; pedicel 25-32 mm long; sepals linear-lanceolate, acute, 50 × 6.25 mm; petals subsimilar to sepals, subfalcate, somewhat thickened along the median nerve; lip elliptic-oblong, crenulate; column 35 mm long; fruit not seen (he probably did not examine the specimen conserved at P).
Rolfe states that, the dried flower he examined being “imperfect”, he cannot give details for disc and crest.

Protologue and type specimens show leaves whose length varies from 10 to 20 cm, 8-10 times as long as wide and internodes shorter than leaves (ca. 0.7 time). The drawing on the sheet K463744 confirms that lip margins are almost entire, slightly crenulate or crispate and that petals are carinate. Lip is entire, as the protologue gives to understand.

***Epidendrum vermifugum* Sessé & Mociño (1894)**

The name has been published (p. 210) in the second edition of *Flora Mexicana*, published in 1894 at Mexico, after the Sessé & Mociño's writings. The protologue is very short:

"*Epidendrum scandens foliis oblongis, sessilibus, nervosis, caule radicante*".

Only the type material can give some precisions.

MA600496! - https://saco.csic.es/index.php/s/tXwFbaMF3JWjcYy. The type sheet (Fig. 6 left) contains plant fragments without flower. The material (*Sessé et al. 4358*) has been collected in Mexico during 1787, 1795 and 1804 expeditions.

The isotype sheet (Fig. 6 right) contains two pieces of the same plant: F848611(!) https://mm.fieldmuseum.org/83bd10a4-62ba-4dcb-b64f-1fd1bf4a5bbc accessed on 18/01/2021.

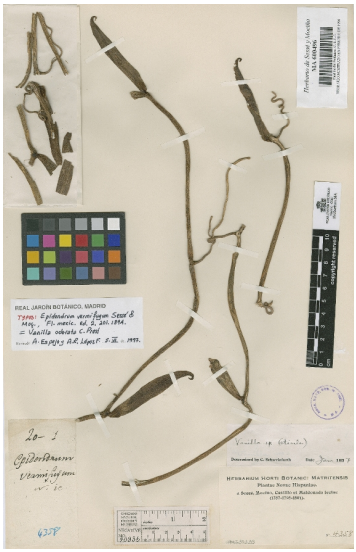
Based on the dried material, we can add: stem sulcate (at least this is evident on a number of stems), ca. 3-5 mm diam., internodes 13-14 cm long; leaves shortly petiolate, lanceolate-ligulate, slightly ensiform, apically acuminate and sharply recurved, 7.7-8 × 1-1.4 cm.

Leaves are somewhat wider than in *Vanilla odorata* (with a L/w ratio about 6-8) and, above all, distinctly shorter than internodes (the latter 1.7 time as long as the leaves).

Another plant (or part of the same?) collected by Sessé *et al.* in Mexico consists of an isolated inflorescence (Fig. 7) labelled "Epidendrum vermifugum de Mexíco absque foliis": BM000923775!

https://data.nhm.ac.uk/dataset/56e711e6-c847-4f99-915a-6894bb5c5dea/resource/05ff2255-c38a-40c9-b657-4ccb55ab2feb/record/2475775

We can see on this sheet several floral pieces untied from the peduncle, and, especially, a bud (top center), an opening flower (top left), a somewhat open flower (top right) and pedicels-ovaries of these two flowers. We can induce that sepals are ca. 32 mm long, lip is probably not deeply fimbriate and lip apical margins are slightly crenulate-ondulate, not at all fimbriate. Ovary is ca. 38 mm long.



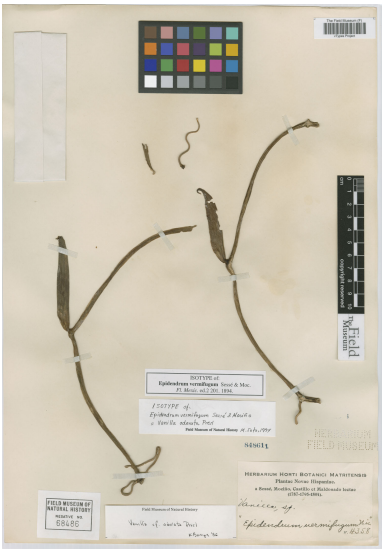


Fig. 6. ***Epidendrum vermifugum***

Type specimen MA600496
Herbario del Real Jardin Botánico, CSIC
© RJB-CSIC

Isotype specimen F848611
© Field Museum of Natural History
CC BY-NC

Fig. 7. ***Epidendrum vermifugum***

Entire sheet containing BM000923775 BM000923775 alone
© The National History Museum, London

***Vanilla fimbriata* Rolfe (1901)**

After the protologue, leaves shorter and flowers smaller than in *V. ensifolia*. Stems somewhat thick [ca. 6 mm as measured on the type specimen], internodes 7.5-14 cm long; leaves shortly petiolate, lanceolate or linear-oblong, acute or subacuminate, 6.5-14 × 1.4-2.2 cm, somewhat thick, petioles 4-6 mm long; inflorescence somewhat thick, 25-30 mm long, multiflowered; bracts ovate-oblong, obtuse, 6-8 mm long; pedicel 20-30 mm long; sepals and petals linear-lanceolate, subobtuse, 26-30 mm long; lip 24-28 mm long, long-adnate to the column margins, a narrow tube, limb 10 mm wide, obtuse, fimbriate; disc with slightly thickened veins and a penicellate callus; column slender, 20-22 mm long. Flowers noted as green outside, whitish green inside, and the lip whitish with yellow in the throat.

Type specimen: Guyana, Barima River, *Jenman 6771* (Fig. 8):
K000463746! - http://specimens.kew.org/herbarium/K000463746 and
K000463747! - http://specimens.kew.org/herbarium/K000463747

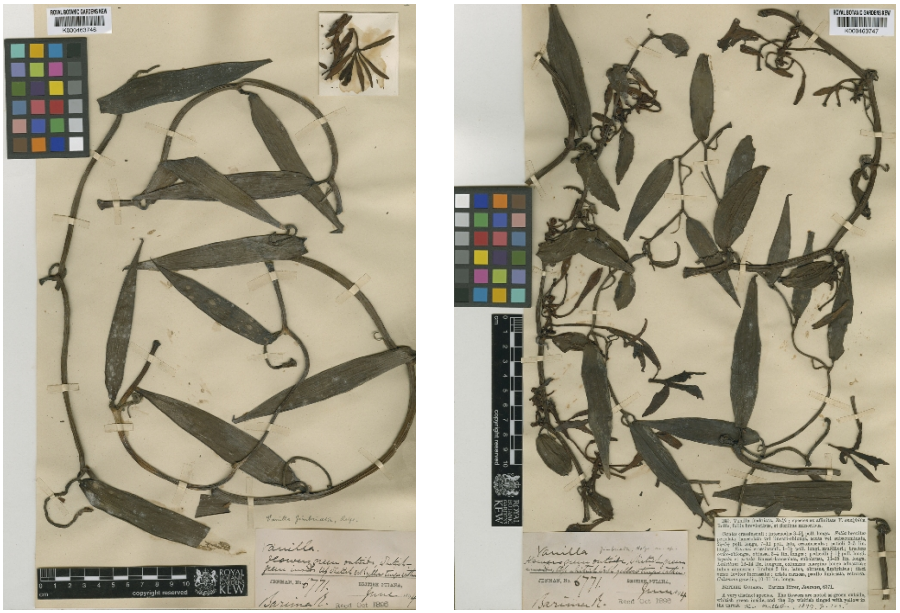


Fig. 8. *Vanilla fimbriata*

Type specimen K000463746 **Type specimen K000463747**

On this material we can see: stem about 6 mm diam.; shape and size of leaves as in the protologue; the flower of the first specimen also confirms the flower dimensions given by Rolfe, whereas flowers preserved on the second sheet have dorsal sepals distinctly longer, up to 48 mm. Rolfe does not specify whether the lip is entire or not. However the lip of the flower on the first sheet is clearly apically trilobed, the margins of the lateral lobes and sides of midlobe fimbriate, the midlobe apically rounded truncate with irregular margin. The drawing of it (Fig. 9) made by A. Krol (as published in Szlachetko *et al.*, 2016) confirms these observations. It also shows that the apical part of the lip is ornamented with an uniform callus – clearly visible on the type flower as well – and very few papillae.

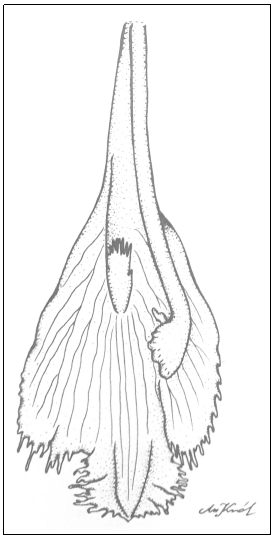


Fig. 9. Lip of the type specimen of *Vanilla fimbriata*
drawing Anna Krol. Courtesy of Prof. D.L. Szlachetko

***Vanilla ribeiroi* Hoehne (1910)**

According to the protologue, stem terete, elongate, thin, 5-6 mm diam.; leaves as long as or a bit longer than the internodes, 12-13 × 2.25-2.75 cm, ovate-oblong, acute, curved; petiole 6-8 mm long; inflorescence 2.5-3 cm long, bearing 5-12 flowers; bracts ovate obtuse, 6-7 mm long; flower white, lip disc yellow; ovary apically calyculate, 25 mm long; sepals and petals narrowly oblong, somewhat obtuse, sepals 4-4.5 × 1.3-1.4 cm; petals similar or a bit shorter and narrower, dorsaly carinate; lip basally adnate to the column, apically ovate-oblong, ca. 3.75 cm long, deeply fimbriate (fimbriae 2-4 mm long), crispate, ondulate, apically obtuse reflexed, disc in the middle ornamented with a penicellate callus rather pilose; column 2.75 cm long, minutely pilose on the ventral surface.

The plate (Fig. 10 left) going with the protologue shows a glabrous lip apical portion.

Type: Brazil, Mato Grosso, Matas do Rio Jaurù, perto do Barrancão, 09/1908, col. A. de M. Ribeiro, *Hoehne 997* (R0002512!). Fig. 10 right.

This specimen fully confirms the above data.

The description provided by Hoehne (1945) lightly enlarges the variability: leaves 10-15 × 1.5-3 cm, inflorescence 2.5-5 cm long, ovary 20-30 mm long and column 27-30 mm long. In this publication Hoehne states that the lip is not trilobed and has an apex rounded not or very lightly emarginate.

Fig. 10. ***Vanilla ribeiroi***

original plate **Type specimen R0002512**
© Museu Nacional, Brazil

***Vanilla uncinata* Huber ex Hoehne (1937)**

Hoehne published this name twice: first in *Archivos do Instituto Biologico* (São Paulo) in 1937, attributing it to J. Huber, then in 1945, in his *Flora Brasilica*. However none of these publications was validly published, the name thus remaining a *nomen nudum*.

Two specimens were cited by Hoehne (1945):

the type specimen, a cultivated plant attributed to J. Huber from a plant collected by A. Goeldi, Brazil, Para, Rio Purús, fl. 08/1906 (MG007302) – Fig. 11 left;

Brazil, Para, Rio Branco, Obidos, 14/09/1927, *A. Ducke s.n.* (RB260182). The plate (Fig. 11 right) published by Hoehne (1945) is based on this specimen.

Stem 5 mm diam., internodes ca. 10 cm long; leaves similar to those of *V. ensifolia*, apically recurved, linear-lanceolate or, more exactly, linear-ensiform, apically somewhat truncate rounded, 14-18 × 2 cm, pseudopetiole 10-15 mm long; inflorescence a 4-6 cm long raceme bearing 10-12 flowers; bracts ovate, obtuse, 5-10 mm long; flower greenish, lip white with small yellow spots; ovary 2.5-3 cm long; sepals lanceolate, acute, 45-50 × 8 mm; petals narrower, obtuse, 45-50 × 6-7 mm, dorsal median nerve carinate with a free apex; lip obovate, 40 × 20 mm, anterior margins ondulate crispate, apical inside surface ornamented with forked hairs, lip apex recurved, disc with a penicellate callus in the middle, basally pubescent; column 25 mm long, ventrally pilose.

On the plate the lip is rather obtuse, slightly emarginate; an apical callus is also visible.

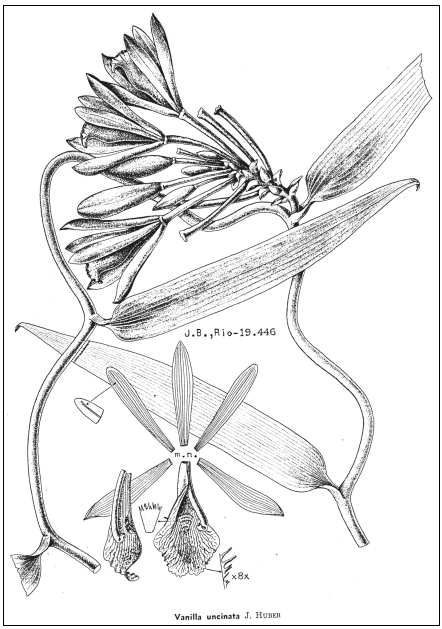


Fig. 11. ***Vanilla uncinata***

Type specimen MG007302 plate N°2, *Flora Brasilica* XII, II

***Vanilla denticulata* Pabst (1973)**

According to the protologue, stem rather terete, 5 mm diam.; leaves narrowly lanceolate, coriaceous, 10-11 × 2.5 cm, petiole short but distinct, 10 mm long; inflorescence short, few-flowered; bracts 6 mm long; ovary 35 mm long; flowers half-open, sepals and petals yellow-green, lip pale yellow; dorsal sepal narrowly lanceolate-obovate, asymmetrical, a bit acute, 45 × 8 mm; lateral sepals linear-lanceolate, obtuse, somewhat oblique, 42.5 × 7 mm; petals narrowly tongue-shaped, 40 × 6 mm; lip narrowly obovate, 35-40 mm long, apex rounded and unevenly denticulate, disc with a penicellate callus in the middle; column slender, 30 mm long.

Pabst provided a drawing of a dissected flower (Fig. 12) showing a lip barely trilobed with an apical margin fimbriate, an uniform apical callus and a glabrous column.

Type: Brazil, Pernambuco, Escada, *P. Ferreira 3767*, fl. in cultivation 28/09/1967 (HB57667) – Fig. 12.

The type specimen has internodes ca. 7.5 cm long and a lip apically slightly trilobed with a midlobe short and truncate.

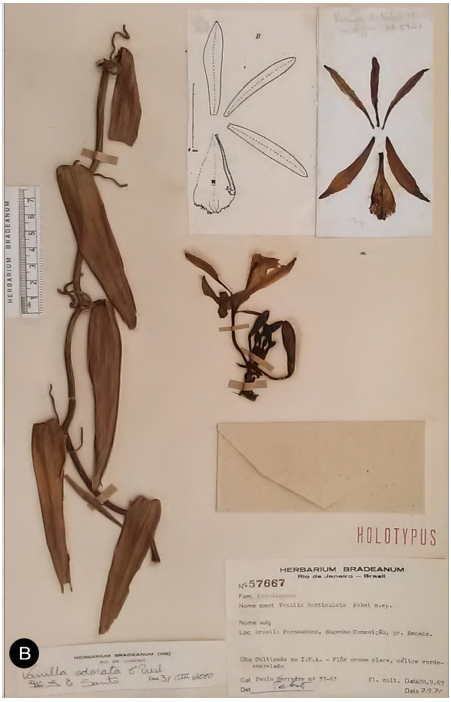


Fig. 12. *Vanilla denticulata*
Type specimen HB57667
© Herbarium Bradeanum, Rio de Janeiro

Pabst & Dungs (1975) add that the lip apex is glabrous or hardly carinate, however without any keel or papilla (in accordance with his type plate).

***Vanilla labellopapillata* A.K. Koch, C.N. Fraga, J.U. Santos & A.L. Ilkiu-Borges (2013)**

Stem terete, internodes 13-16 cm long; leaves linear-lanceolate, 8.4-8.6 × 1.4-1.6 cm, petiole 8-10 mm long, apex acute reflexed; inflorescence a 4-4.5 cm long 12-16 flowered raceme; bracts ovate, 4-5 mm long; flowers greenish

white inside, whitish green becoming paler with age outside, lip yellowish white, with yellow in the throat; pedicellate ovary 18-45 mm long; sepals oblanceolate, obtuse, the dorsal 47-49 × 8-11 mm, the lateral 46-49 × 8-11 mm; petals linear-lanceolate, obtuse, 47-49 × 9 mm, prominently carinate outside; lip 38 × 17 mm, long-clawed, tubular at base, apically trilobed, lateral lobes rounded, midlobe transversally oblong [however the plate illustrating the protologue shows a lip barely subtrilobed, apically truncate], margins fimbriate excepted the apical margin of the midlobe, disc furnished with a penicellate callus at about 23 mm from the base, apical part ornamented with a suborbicular tuft of trichomes covering almost the entire midlobe; column 29 mm long, with 2 small wings at apex, anterior surface glabrous; fruit linear-fusiform, 20 cm long, with strong vanilla aroma.
Type: Brazil, Para, Melgaço, Caxiuanã National Forest, 1°45'10'' S, 51°25'59'' W, 12/04/2010, *A.K. Koch & C. de Souza 226* (MG199985).

Vanilla karen-christianae **Karremans & P. Lehmann (2018)**
Stem sulcate, 6-7 mm diam., internodes 7-12 cm long; leaves subsessile, blade coriaceous, 10.5-16.5 × 1.5-2.5 cm, obliquely ensiform with a shortly acuminate reflexed apex; inflorescence many-flowered, up to 25 flowers, up to 6 cm long; floral bracts sessile, ovate, obtuse, ca. 4-8 mm long; flowers with non-spreading segments, sepals and petals light green, lip white with veins and appendages dull yellow, penicellate callus white; ovary 30-33 mm long; sepals oblanceolate, acute, the dorsal 39-45 × 9-11 mm, the laterals oblique, 37-44 × 11-14 mm; petals obliquely linear to lanceolate, acute, with a conspicuous dorsal keel, 37-44 × 5.5-10 mm; lip fused to the column margins for ca. 25 mm, tubular, apically emarginate recurved, 39-45 × 20-35 mm, 10 mm long clawed, blade obscurely trilobed, with some low papillose-verruculose keels, lateral lobes obtuse, midlobe bilobed, margins crenate; penicellate callus 25-30 mm from the base; column slender, 25-30 mm long, with a ventral surface densely covered by trichomes.
Type: Costa Rica, Puntarenas, Corredores, 27/09/2017, *A.P.Karremans et al. 8087* (holotype USJ, isotypes JBL, CR!).
Karremans *et al*. (2020) provide some extra data: internodes 6-12 cm long, leaves 9-23 × 1.1-2.5 cm, bracts 4-15 mm long, ovary 27-43 mm long, margins of the lateral lobes entire to slightly crenate, column 25-39 mm long, fruit 6.7-12 cm long.

Discussion

As we wrote it above, within this particular rather uniform group of species, several characters are steady, such as, for example, leaves shortly petiolate, stems (mature) with diameters more or less similar, inflorescences short and bearing several flowers, size of flowers (with a dorsal sepal 40-50 mm long, sometimes a bit shorter in *Vanilla fimbriata* or *V. karen-christianae*), lip fused to the column margins for about half its length, penicellate callus on the middle of the lip disc, apical callus more or less conspicuous.

The main discriminating characters as they can be deduced from the above descriptions are presented in Table 1.

They concern the vegetative features:

* stem terete *versus* sulcate,
* relative width of the leaves as measured by the ratio length/width (L/w),
* leaf straight *versus* more or less ensiform,

as well as the floral segments:

* pubescence of ventral face of the column, from glabrous to densely pubescent,

and particularly the lip details:

* lip apicaly trilobed *versus* entire or subentire,
* apex, acute/obtuse, rounded, truncate, more or less emarginate,
* apical margins, fimbriate or not, ondulate/crispate or not,
* apical (ventral) surface, from overall glabrous to covered with more or less long trichomes,
* shape of the apical callus (separate keels *versus* more or less uniform callus).

The relative length of the internodes and leaves as well as the flower colour and shape of the sepals (measured as the ratio length/width for the dorsal sepal) are also potentially useful features, which however should be cautiously used. On the other hand the lengths and shapes (ovate, elliptic, oblong or obovate) of the leaves as well as the apex of sepals and petals proved to be rather variable within a same taxon.

As a few taxa are not precisely known, we have to make hypotheses for some characters.

Table 1. Discriminating characters in the studied group of *Vanilla*

	Vanilla odorata	*Vanilla ensifolia*	*Epidendrum vermifugum*	*Vanilla fimbriata*
stem	terete	sulcate	sulcate	terete?
leaves (length/width)	≥ 10	~ 8-10	~ 6-8	~ 5-6,5
leaves (oblicity)	ensiform	ensiform	ensiform	straight
flowers (colour)	greenish yellow	?	?	whitish green lip whitish
dorsal sepal (length/width)	~ 4,5	~ 8	?	~ 7 ?
lip shape	trilobed	entire	subentire ?	trilobed
lip apex	acute to obtuse	rounded	?	rounded truncate
lip anterior margins	fimbriate not crispate	obscurely denticulate ondulate	likely minutely crenate not fimbriate	fimbriate not crispate
lip apical surface (except apical callus)	several papillae	?	?	very slightly papillose
lip apical callus	3 distinct keels	?	?	an uniform papillose mass
column ventral surface	densely glandulose	?	?	?
relative length internode/leaf	~ 0,5-0,7	~ 0,7	~ 1,7	~ 1-1,15

Table 1. continued

Vanilla ribeiroi	*Vanilla uncinata*	*Vanilla denticulata*	*Vanilla labellopapillata*	*Vanilla karen-christianae*
terete	?	terete	terete	sulcate
~ 4,7-6,7	~ 7-9	~ 4-4,5	~ 5,4-6	~ 7-9
straight	ensiform	rather straight	straight	ensiform
white lip yellow	greenish lip white	green yellow lip pale yellow	greenish white lip yellowish white	light green to greenish lip white
~ 3-3,5	~ 6	~ 6 or less	~ 5,3	~ 4,2
entire	subentire	somewhat trilobed	somewhat trilobed	subentire obscurely trilobed
obtuse truncate	obtuse a bit emarginate	rounded truncate	truncate	rounded ± emarginate
fimbriate crispate	not fimbriate crispate	denticulate-fimbriate not crispate	fimbriate (except the midlobe apex) not crispate	not fimbriate ± denticulate ± crispate
covered with long trichomes	with long hairs	glabrous	with a tuft of long trichomes	covered with long trichomes
not visible	present but unknown	discreet uniform	7 rows of tuberculate papillae	indistinct long-verrucose keels
minutely pilose	pilose	?	glabrous	densely pubescent
~ 0,9	~ 0,6-0,7	~ 0,7	~ 1,5-1,9	~ 0,7

Vanilla odorata. First of all, in our opinion, *Vanilla odorata* is characterized by its very narrow leaves, as described by Presl (1830), Kraenzlin (1919) and Ames (1925). Some authors placed in the synonymy of *V. odorata* taxa with much wider leaves, such as *V. denticulata* which has leaves only 4 times as long as wide. We do not accept this concept of *V. odorata*. A number of *Vanilla* plants referred to as *V. odorata* and presenting "wide" leaves (for example in Soto Arenas, 1993) are not members of this species and should be attributed to one or more different species. The present article is not the place to carry on this study, which will be presented later.
V. odorata is characterized by the conjunction of very narrow leaves, internodes much shorter than leaves, lip trilobed with fimbriate lateral margins, apical callus made of papillate keels and ventral face of the column densely glandulose.
On this basis, we can now evaluate the affinities between the studied taxa. However, before that, it is worth to devote a few words to *Vanilla insignis* Ames (1934: 101) as it is often referred to as belonging to the "*V. odorata* group" (Soto Arenas & Cribb, 2010; Soto Arenas & Dressler, 2010; Karremans *et al.*, 2020). *V. insignis* clearly differs from *V. odorata* by its more xerophytic habit, its sulcate stems, its broader leaves, and the appendages of its lip, more numerous and bigger.
As for the hypothesis of a conspecificity of this taxon to *V. fimbriata* we can easily rule it out. Besides its xerophytic habit, *V. insignis* differs from *V. fimbriata* by its leaves distinctly broader, internodes shorter, flowers much larger, with a dorsal sepal up to 75 mm long (*versus* less than 50 mm) and lip less deeply trilobed with an apical surface densely hairy furnished with a small semiorbicular callus limited to the apex of the midlobe.

Vanilla ensifolia. When thinking about separating narrowly-leaved taxa as listed above, we first observe that, as for the leaf width, there is a continuum from *V. uncinata*/*V. karen-christianae* (L/w ca. 7-9) and *V. odorata* (L/w ca. 10-13) through *V. ensifolia* (L/w ca. 8-10). Since Garay (1978) authors used to group the three taxa within one entity, *V. odorata*, notably, recently, Soto Arenas & Dressler (2010). However Karremans *et al*. (2020) separated them into two species, *V. odorata* and *V. karen-christianae*, sorting *V. ensifolia* into the synonymy of the former and *V. uncinata* in the synonymy of the latter.

We agree with these authors that two entities are distinguishable; however we desagree with them regarding the place of *V. ensifolia*. The first question to deal with in order to decide where to place *V. ensifolia* should be "can the concept of *Vanilla odorata sensu* Ames (1925) be equivalent to that of *Vanilla ensifolia*?". And the answer is certainly not. As for the vegetative parts, the leaves of the former are always at least 10 times longer than wide whereas, in the latter, they are always at the most 10 times longer; the stem of the former is not sulcate whereas it is sulcate in the latter. As for the floral parts, the lip of the former is distinctly trilobed with an acute-obtuse apex and anterior margins fimbriate whereas in the latter the lip is entire, apically rounded with margins entire or minutely crenate, probably ondulate, which is reminiscent of *Vanilla karen-christianae*. Another discriminating character is the presence/absence of a tuft of trichomes on the apical portion of the lip. Unfortunately, as Rolfe himself noted, the conservation state of the available flower did not allow to describe this feature. And, moreover, the drawing on the type sheet represents the flower in back view.
The weakness of the Rolfe's protologue and type material as well as the global similarity between the studied taxa do not allow to argue more. However the above discussed characters (sulcate stem, relative width of the leaves, lip shape, anterior margins, lip apex) clearly show that *V. ensifolia* is different from *V. odorata*. Furthermore we note that (a) Rolfe (1896) separated both taxa and (b) Ames (1925) did not mention the former when describing and discussing the latter, even though he certainly knew it. To conclude we consider *V. ensifolia* as a good species, different from *V. odorata*.

Vanilla uncinata. This taxon was treated as a synonym of *V. odorata* by Garay (1978) and several authors (Dodson & Dodson, 1980; Hamer, 1984 etc...) followed his opinion. However, as clearly stated by Karremans *et al*. (2020), there is no doubt that *V. uncinata* (a) is an invalid name and (b) represents a taxon conspecific to *V. karen-christianae*. Data of the Table 1 do not show any significant difference between both taxa. Unfortunately Hoehne did not specify whether the stem of his species is strictly terete or more or less sulcate; the type does not contain stem and the illustration in Hoehne (1945) shows a terete stem (however the Hoehne's drawings are sometimes imprecise).

Vanilla karen-christianae. The sulcate stem, the relative width of the leaves, the entire, subentire or hardly trilobed lip with rounded apex, more or less emarginate, and anterior margins more or less crenate-denticulate but not fimbriate, more or less ondulate-crispate, are reminiscent of *V. ensifolia* as discussed above. Moreover the shape and apex of the lateral sepals are very similar in both taxa. On the other hand, as far as we can appreciate this character, the petals seem to be more acute in the latter and the lip more deeply emarginate in the former.
These differences are too small to separate the taxa: they can be due to the natural intraspecific variability and the corresponding characters are difficult to precisely evaluate in *V. ensifolia*). Therefore we consider *V. karen-christianae* (and consequently *V. uncinata*) as a synonym of *V. ensifolia*.

Epidendrum vermifugum. The ensiform leaves, presenting a ratio L/w about 6-8, the lip probably subentire with hardly crenate ondulate margins are reminiscent of *V. uncinata*. The likely sulcate stems are reminiscent of *V. ensifolia*. We propose to place – with doubt and although one of us (AS) does not agree – this poorly known taxon within the synonymy of *V. ensifolia*.

Vanilla fimbriata. Karremans *et al*. (2020) note: "*Vanilla fimbriata* Rolfe resembles *V. odorata*, *V. insignis* Ames and *V. labellopapillata* A.K.Koch, Fraga J.U.Santos & Ilk.-Borg. It is excluded from the synonymy of *V. odorata* pending a thorough inspection of the original materials." The thorough examination of this original material led us to consider *V. fimbriata* and *V. odorata* as clearly distinct. Both species certainly have a few similar characters, such as lip trilobed with fimbriate margins. However they differ by the leaves, ensiform and very narrow in the latter, straight, broader and shorter in the former, by the sepals, narrower in the former, and by the lip, apically more or less truncate in the former, acute-obtuse in the latter, with an apical callus an uniform mass in the former, made of 3 separate papillate keels in the latter. Even if the difference is weak, we can also add that the apical surface of the former is "very slightly papillose" whereas, in the latter, it is furnished with "several papilliform emergences". With the necessary caution due to these features, we can also mention a different flower colour and internodes distinctly longer in the former.
In conclusion we consider *V. fimbriata* as a good species, different from *V. odorata*.

Vanilla denticulata. Still recently this taxon was treated as a good species (Fraga, 2002 ; Giuletti *et al*., 2009; Flora do Brasil, 2020). It is referred to as conspecific to *Vanilla odorata* by Soto Arenas & Cribb (2010) – but not by Soto Arenas & Dressler (2010) – and Karremans *et al*. (2020). However none of the characters of Table 1 goes towards a link between these taxa. It would be better to compare *V. denticulata* to *V. fimbriata* or *V. labellopapillata*: leaf width when compared to the length, margins and apex of the lip. The lip apex and the apical callus are rather similar to what is observed in *V. fimbriata* (but not at all in *V. labellopapillata*); the lip shape is reminiscent of the latter, however the apical portion of the lip is glabrous, not covered by a tuft of long trichomes. So that we do not retain the conspecificity of *V. denticulata* and *V. labellopapillata*.
Even though *V. fimbriata* and *V. denticulata* are known only by the type specimens, on the basis of the above similarities we consider that they are conspecific.

Vanilla ribeiroi. This taxon belongs to species with straight and moderately narrow leaves (L/w < 7), with lip apically truncate and column not very pubescent on its ventral face. Characters different from those of *V. fimbriata* are not many. Hoehne (1945) did not find many arguments to separate his species from *V. fimbriata*: "If not the flower colour and their size [however we have seen above that the dimensions given by Rolfe are clearly not confirmed by a number of flowers of the type specimen], I would be inclined to think that both species are identical" (translation GC). He added that, in *Vanilla ribeiroi*, the lip fimbriae are terete "detail that would not escape to Rolfe if it would be present in *V. fimbriata*". We may add that, in *V. ribeiroi*, the lip is entire with crispate margins and that the dorsal sepal is somewhat wider, whereas in *V. fimbriata* the lip is trilobed with margins not crispate and the dorsal sepal somewhat narrower (even though this late observation is based on dried material and therefore should be considered with some caution). These differences are sufficient to treat *V. ribeiroi* as a species different from *V. fimbriata*, with a different flower colour. Engels & Koch (2021) give a more complete description together with clearer illustrations. In their Para specimen the lip is minutely emarginate and therefore somewhat reminiscent of *V. karen-christianae*. However, as for other characters, the species are very different.

Vanilla labellopapillata. Krahl *et al*. (2020) and Engels *et al*. (2020) have reported the observation of *Vanilla labellopapillata* in the Brazilian forests, respectively in the state of Amazonas, then in the state of Mato Grosso. Table 2 gives, for the three specimens, the same characters as retained in Table 1.

Table 2. Discriminating characters observed in the three specimens of *Vanilla labellopapillata*

specimen from	Para	Amazonas	Mato Grosso
leaves (length/width)	~ 5,5-6	~ 9-10	~ ~ 5,5-6
leaves (oblicity)	straight?	somewhat ensiform	straight
lip shape	barely trilobed	distinctly trilobed	barely trilobed
lip apex	truncate	truncate	retuse
lip anterior margins	fimbriate not crispate	fimbriate not crispate	fimbriate not crispate
lip apical surface	long trichomes	short trichomes	long trichomes
lip apical callus	7 rows of tuberculate papillae	3-5 keels	7-9 rows of tuberculate papillae
column ventral surface	glabrous	pilose	glabrous
flowers (colour)	greenish white lip yellowish white	greenish pale yellow lip yellowish white	greenish yellow lip white with orange
relative length internodes/leaves	~ 1,5	~ 0,5-0,6	~ 1,1-1,3
dorsal sepal	47-49 mm	53-59 mm	37 mm

The first constatation is that the Amazonas plant is not a representative of *V. labellopapillata*: internodes 2-3 times shorter, leaves comparably narrower, sepals somewhat longer, lip more deeply trilobed, with an apical

surface furnished with short trichomes and with a different callus, ventral face of the column hairy. This set of characters is more reminiscent of *V. odorata* (see Tab. 1) than of *V. labellopapillata*. We treat this specimen as a representative of *V. odorata*.

The Mato Grosso specimen, as for it, is similar to the type specimen of *V. labellopapillata*. This taxon presents, when compared to *V. fimbriata* and *V. ribeiroi* (see Tab. 1 and above descriptions), internodes of similar length, leaves with shape and size comparable, bracts of similar size, same shape of the dorsal sepal, apically truncate lip. More precisely, the Mato Grosso specimen is more similar to *V. ribeiroi* whereas the Para specimen is more similar to *V. fimbriata*. We can indeed observe, for some characters, a gradual variation between these taxa. In *V. fimbriata*, flowers are withish green, in *V. labellopapillata* greenish white or yellow and in *V. ribeiroi* white, the lip being white to whitish in the three taxa, with yellow to orange through yellow/orange trichomes. In the same way, leaves are somewhat shorter in *V. fimbriata* (6-14 cm long) than in *V. ribeiroi* (10-15 cm) with an intermediate size in *V. labellopapillata* (8-9 cm in the Para specimen, 9-14 cm in the Mato Grosso specimen). The dorsal sepal goes from linear-lanceolate (ratio length/width ca. 6.5) in *V. fimbriata*, to elliptic-obovate (ratio ca. 3.5) in *V. ribeiroi* through oblanceolate-elliptic (ratio ca. 4.5-5) in *V. labellopapillata*. The lip is somewhat more deeply trilobed in *V. fimbriata* than in *V. labellopapillata* whereas it is entire to subentire in *V. ribeiroi*. The apical margins of the lip are fimbriate in the three taxa, with a gradual variation in the density, shape and length of the fimbriae. At last, the apical surface is variously ornamented: glabrous or subglabrous in *V. fimbriata*, to furnished with long trichomes in *V. ribeiroi*, through with just a tuft of long trichomes on the midlobe in *V. labellopapillata*. Of course we can also observe some differences such as the nature of the margin in the midlobe apex; in *V. labellopapillata* this margin is irregularly entire whereas it is more or less crenate-fimbriate in the other two taxa. All this evokes a possible hybrid origine for *V. labellopapillata*, as a result of the crossing between two distinct but close taxa (*V. fimbriata* and *V. ribeiroi*). However it can just remain an uncertain hypothesis until crossbreeding tests are carried out.

We must note here that one of the co-authors (AS) pointed the confusion between *V. ribeiroi* and *V. labellopapilata* out some time ago (pers. comm.). In 2014 he identified a plant native from French Guiana and placed in cultivation in the *Jardin Botanique de Guyane* as *V. ribeiroi*. And a photograph

of it has been published as *V. ribeiroi* in Sambin (2018) and Sambin & Ravet (2021). However at the end of 2020, during the course of the present work, he pointed out the misidentification, considering this plant as a representative of *V. labellopapillata*. Based on this observation we report here for the first time the presence of the species in French Guiana, which supports data from Engels & Koch (2021) who treat it as "most likely" present in this country.

Taxonomic conclusion

***Vanilla odorata* C. Presl**
Reliquiae Haenkeanae: 101 ([1827] 1830)
Ecuador, Guayaquil, 09-12/1790, *T. Haenke sn* (syntypes PR305753 and PRC450948 – other material PR305751 and PR305752)

Stem terete, 4-7 mm diam., rooting at nodes, internodes 7-13 cm long; leaves shortly petiolate, erect, linear-lanceolate, ensiform, very acute to acuminate, abruptly recurved at apex, nerved, fleshy or coriaceous, thick (ca. 2 mm thick), (12.5)14-20 × 1.2-2 cm; inflorescence short, 3-4 cm long, bearing up to 13 flowers; floral bracts oblong, acute, up to 8 mm long, the lower ones somewhat longer; pedicellate ovary 25-40 mm long; flower greenish (pale) yellow, lip white with yellow/orange papillae; sepals linear-lanceolate, 45-55 mm long, the lateral ca. 50 × 13 mm, slightly concave, fleshy, subacute, the dorsal ca. 52 × 11 mm, acute; petals ca. 50 × 10 mm, narrowly lanceolate sometimes suboblique, obtuse, slightly carinate along the outside midnerve; lip ca. 45 × 22 mm spread out, fused to the column on the basal half, free portion flabelliform, apically trilobed, slightly 3-5-carinate with keels rounded and giving rise to several retrorse papillae on the distal end, anterior margins fimbriate, midlobe acute or obtuse, strongly reflexed; disc with a penicellate callus just before its middle; column ca. 30 mm long, ventrally more or less densely granulose/hairy; fruit sessile, linear-lanceolate, 12.5-16 cm long, strongly perfumed. Fig. 13.

Ames's specimens:
Bolivia, Beni, swampy woods, 270-300 m alt., 03/12/1921, *O.E. White 1821* (AMES02158520 and NY4170434); Ixiamas, damp forest, 300-450 m alt., *O.E. White 1115* (AMES02158519)

Fig. 13. *Vanilla odorata*, flower
Specimen from Brazil (AM) - ph. Amauri Krahl

Other herbarium material examined
specimens with flower:
Suriname, Mts. Bakhuis, concession BMS : zone 21 Est, 57°03' W, 04°28'' N, 200 m alt., 15/04/2006, *Bordenave et al. 8517* (CAY132676!, MO04799286!)
Brazil, Amazonas, Manaus, Reserva Florestal Adolpho Ducke, 19/02/2019, *D.R.P. Krahl & A.H. Krahl 418* (INPA)
sterile specimens (therefore to be cautiously considered):
Bolivia, 16,7261S, 64,435W, 18/06/1993, *I.G. Vargas C. et al. 2617* (F2295772); Beni, Vaca Diez, ca. 200 m alt., 31/03/1984, *B.M. Boom 4893* (NY4170433)
Peru, Loreto, 04/09/1974, *R.B. Foster & W.A. Foster 4090* (F1893719); Ucayali, Coronel Portillo, 200 m alt., 11/05/1984, *R. Vasquez 4995* (NY4170436)
Ecuador, 1,4628S, 78,1869W, 30/04/1897, *von Eggers 15138* (F143393)
Colombia, 3,8811N, 72,8667W, 20/03/1858, *A.C.V. Schott 12* (F41068)
Venezuela, Amazonas, Atabapo, 08-09/03/1985, *R.L. Liesner 18444* (NY4170431)
French Guiana, Route Régina-Saint Georges, Approuagues, 100 m alt., 30/11/1995, *G. Cremers & J.J. de Granville 14281* (P-00367047! and CAY-19043 !); Roura, crête de Kaw, proche du camp Caïman, chemin à droite,forêt de transition sur cuirasse latéritique, alt. 300 m, 15/03/2017, *A. Sambin & G. Chiron 1155* (HJBG-H 0321!); Monts Atachi-Bakka, plateau sommital, zone broussailleuse, alt. 750 m, 14/10/2020, *A. Sambin & M. Aucourd 1154* (HJBG-H 0320!); Régina, montagne Tortue, plateau sommital, forêt basse lianescente sur cuirasse latéritique, alt. 480 m, 06/12/2020, *A. Sambin, M. Aucourd & E. Ravet 1156* (HJBG-P 0323! photos); Roura, montagne de Kaw, forêt haute sur pente, alt. 250 m env., 05/01/2021, *M. Aucourd & B. Villette sn.* (HJBG-P 0322! photos); Régina, Réserve des Nouragues, plateau à dendrobates proche du camp Pararé, alt. 150 m environ, 22/01/2021, *M. Aucourd sn.* (HJBG-P 0324! photos); Monts Bakra, Pic Coudreau, à une cinquantaine de kilomètres au sud-est de Saül, forêt basse de transition sub-montagnarde, alt. 600-680 m, 25/03/2021, *A. Sambin & M. Aucourd 1158* (HJBG-P 0326! photos)
Brazil, Para, 12 km North of Tucurui, 21/03/1980, *T. Plowman et al. 9868* (NY2695612); Para, Vitória do Xingu, 02/02/2012, *C.A.S. Silva 05383* (RB1031586); Mato Grosso, *S. Moore 657a* (NY910932)
Costa Rica, Limon, Hamburg Finca, Rio Reventazon, env. 55 m alt., *P.C. Standley & J. Valerio 48917* (AMES2158432)

Distribution: Bolivia, Peru(?), Ecuador, Colombia(?), Costa Rica(?), Venezuela(?), Suriname, French Guiana(?), Brazil (AM).

***Vanilla ensifolia* Rolfe**
Bulletin of Miscellaneous Information, Kew 1892(65-66): 141 (1892)
Colombia, Cauca, Penol, *J. Goudot* (syntype K00046374 – isotype P0036707); Cauca, Patia (syntype PHA)

?*Epidendrum vermifugum* Sessé & Mociño
Flora Mexicana, éd. 2: 201 (1894)
Type: Mexico, *Sessé et al. 4358* (holotype MA600496 – isotype F848611)

Vanilla uncinata Huber ex Hoehne, *nomen nudum*
Archivos do Instituto Biologico (São Paulo) viii : 269 (1937); *Flora Brasilica*, fasc. 8, XII, 2: 13
Type: Brazil, Para, Rio Purus, A. Goeldi, in cultivation, *J. Huber 7392* (MG007302)

Vanilla karen-christianae Karremans & P. Lehmann, ***syn. nov.***
Orchids. Magazine of the American Orchid Society 87(4): 305 (2018)
Type: Costa Rica, Puntarenas, Corredores, Canoas, 27/09/2017, *A.P. Karremans et al. 8087* (holotype USJ – isotypes JBL, CR)
Stems sulcate, smooth, 6-7 mm diam., internodes 6-12 cm long; leaves subsessile to shortly petiolate, petiole up to 10 mm long, blade coriaceous, linear, ensiforme, 9-23 × 1-2.5 cm, apex acute to shortly acuminate, reflexed; inflorescence short, up to 6 cm long, many-flowered (up to 25 flowers); floral bracts lanceolate-ovate, acute to obtuse, 4-8(15) mm long; pedicellate ovary ca. 30 mm long (25-43 mm); flowers with non spreading segments, sepals and petals light green, lip white with veins and appendages dull yellow, penicellate callus white; sepals linear-lanceolate to oblanceolate, acute, the dorsal 40-50 × 7-11 mm, the laterals slightly shorter and wider, oblique; petals subsimilar to the sepals, more or less carinate along the dorsal median nerve, 37-44 × 5.5-10 mm; lip fused to the column margins for ca. 25 mm, tubular, blade elliptic to obovate, apically emarginate recurved, 39-45 × 20-35 mm, 10 mm long clawed, blade subentire to obscurely trilobed, with some low papillose-verruculose keels, lateral lobes rounded obtuse, midlobe short, bilobed, margins subentire to slightly crenate, crispate; penicellate callus 25-30 mm from the base; column slender, 25-40 mm long, with a ventral surface densely covered by trichomes; fruit 6.7-12 cm long.
Pictures of flowers are given in Karremans & Lehmann (2018: 305) and Karremans *et al*. (2020: 421), as *V. karen-christianae*.

Other herbarium material examined (sterile specimens to be cautiously considered):
Colombia, Antioqua, Turbo, s.d., *Schott sn* (NY4170432); Meta, Villavicencio, plains of San Martin, 400 m alt., 01/1856, *J. Triana sn* (P00367024)

Distribution: Peru, Costa Rica, Nicaragua (according to Karremans *et al*., 2020), Colombia, Brazil (PA – type of *V. uncinata*), Mexico (? - type of *Epidendrum vermifugum*).

Vanilla fimbriata **Rolfe**
Bulletin of Miscellaneous Information, Royal Gardens, Kew, 189 (151-152): 133 (1901)
Guyana, Barima River, *Jenman 6771* (K00463746 and K00463747)

Vanilla denticulata Pabst, ***syn. nov.***
Anais da Sociedade Botânica do Brasil, XXIII Congresso Nacional de Botânica: 109 (1973)
Brazil, Pernambuco, Escada, fl. in cultivation 28/09/1967, *P. Ferreira 3767* (HB57667)

Stem not very thick, ca. 5-6 mm diam., internodes 7.5-14 cm long; leaves shortly petiolate, petiole 4-6(10) mm long, narrowly lanceolate to linear-oblong, acute to shortly acuminate, 6.5-14 × 1.4-2.2(2.5) cm, somewhat thick, coriaceous; inflorescence short, 25-30 mm long, somewhat thick, a few to many-flowered raceme; floral bracts oblong, obtuse, 6-8 mm long; pedicellate ovary ca. 20-35 mm long; flowers green on the outside, sepals and petals whitish to pale-yellowish green inside, lip whitish to pale yellow, with yellow in the throat; dorsal sepal narrowly lanceolate-obovate to linear-lanceolate, subobtuse to somewhat acute, 26-48 × 8 mm; lateral sepals linear-lanceolate, obtuse to subobtuse, 26-43 × 7 mm, slightly oblique; petals linear-lanceolate to narrowly tongue-shaped, 26-40 × 6 mm, subobtuse; lip fused to the column margins in the basal portion, a narrow tube, 24-40 mm long, lamina narrowly obovate, apically trilobed, lateral lobes with margins rather deeply fimbriate, margin of the midlobe less deeply fimbriate, apex truncate to rounded truncate, disc with a penicellate callus in the middle, disc veins slightly thickened converging towards the apical part to give a semi-lanceolate uniform sparsely papillate callus, apical surface glabrous to slightly papillose; column slender, 20-30 mm long, subglabrous to pubescent on the ventral face. Fig. 14.

Fig. 14. *Vanilla fimbriata*, flower

A. Sambin 1018 - ph. A. Sambin

Other herbarium material examined
specimens with flower:
French Guiana, Sinnamary, Petit-Saut, alt. 60 m env., 19/07/2014, *A. Sambin 1018* (HJBG-L 0048! fl. in liquid and CAY-318551!); Bassin du Maroni, rivière Alitany, alt. 160 m, 28/07/1993, *P. Acevedo-Rodriguez, J.-J. de Granville, L. Hollenberg, A. Joly & C. Avril 5747* (CAY- 77305!)
Thus the species is here reported for the first time for this country.
sterile specimens (therefore to be cautiously considered):
Venezuela, Bolivar, La Paragua, 70 m alt., 08/03/1940, *L. Williams 12414* (F1085857) and *L. Williams 12514* (F1079459)
Brazil, Para, Tucurui, 50 m alt., 21/03/1980, *T. Plowman et al. 9868* (F1900798); Bahia, Entre Rios, 26/08/15, *A.V. Popovkin 1968* (HUEFS218050)
The figure 35B in Karremans *et al.* (2020) shows a photograph by G.["L."?] Leotard of a plant from French Guiana. It represents in fact *V. fimbriata* (and not *V. odorata*, as noted in the caption) which confirms the presence of the species in this country.
Distribution: Venezuela(?), Guyana, French Guiana, Brazil (PE [type of *V. denticulata*], PA[?], BA[?])

***Vanilla ribeiroi* Hoehne**
Relatório, Commissão das Linhas Telegráficas Estratégicas de Matto Grosso ao Amazonas. Anexo 5, Botânica 1: 28 (1910)
Brazil, Mato Grosso, Matas do Rio Jaurù, perto do Barrancão, 09/1908, col. A. de M. Ribeiro, *Hoehne 997* (R2512)
Stem slender, 5-7 mm diam.; leaves about the same length as the internodes, a bit longer or (rarely) a bit shorter, 8-15 × 1.5-3 cm, lanceolate-ligulate, acute, incurved, shortly petiolate, petiole 6-8 mm long; inflorescence 2.5-5 cm long, 5-12-flowered; floral bracts ovate, obtuse, 6-7 mm long; flowers white with the lip disc yellow; ovary calyculate, 20-30 mm long; sepals and petals narrowly oblong, rather obtuse, sepals 40-45 × 13-14 mm; petals similar but somewhat shorter and narrower, dorsally carinate; lip ovate-oblong in the apical part, ca. 37.5 mm long, subentire to minutely trilobed, deeply fimbriate (fimbriae 2-4 mm long), crispate ondulate, apex obtuse rounded to somewhat truncate, not or slightly emarginate, reflexed, disc with a rather pilose penicellate callus in the middle, apical surface with long trichomes except on a narrow strip along the margins; column 27-30 mm long, minutely pilose on its ventral face. Fig. 15.

Distribution. Brazil (MT, PA [after Engels & Koch, 2021]).

Fig. 15. *Vanilla ribeiroi*, flower
M.E. Engels 7771 - ph. Mathias Engels

***Vanilla labellopapillata* A.K. Koch, Fraga, J.U. Santos & Ilkiu-Borges**
Systematic Botany 38(4): 975 (2013)
Brazil, Para, Melgaço, Caxiuanã National Forest, 12/04/2010, *A.K. Koch & C. de Souza 226* (holotype MG)

Stem ca. 10 mm diam., internodes 12.5-16 cm long; leaves linear-lanceolate, ca. 8.5 × 1.5 cm, acute, reflexed, subpetiolate, petiole 8-10 mm long; inflorescence short, 4-4.5 cm long, many-flowered (up to 16 flowers); floral bracts spreading, ovate, 4-5 mm long, shorter towards the apex; flowers greenish white inside, whitish green outside, lip yellowish white with a yellow throat; pedicellate ovary 18-45 mm long; sepals oblanceolate, obtuse, slightly concave, the dorsal 47-49 × 8-11 mm, the laterals similar; petals linear-lanceolate, obtuse, slightly concave, 47-49 × 9 mm, dorsaly

Fig. 16. *Vanilla labellopapillata*, flower
A. Sambin 1103 - ph. Aurélien Sambin

distinctly carinate; lip long-clawed, basally tubular, 38 × 17 mm, fused to the column along the margins of the basal half, apically recurved, very slightly trilobed, lateral lobes rounded with fimbriate apical margins,

midlobe transversaly oblong, very short, fimbriate on both sides but not on the apical margin, truncate; disc in the middle with a penicellate callus which continues towards the apex with 7 rows of tuberculate papillae becoming a suborbicular tuft of long trichomes on the almost entire midlobe; column ca. 30 mm long, ventrally glabrous; fruit linear-tongue-shaped. Fig. 16.

Other material examined (all with flowers)
French Guiana, Kourou, CSG, rive est de la crique Karouabo, 03/11/2012, *O. Tostain 6376* (HJBG-H 0070 & 0071!); Kourou, Savane de Wayabo, Ternstroemia, bordure de forêt, 19/07/2014, *Sambin 1103* (HJBG-L 0230, fleur en alcool!)

Distribution. Brazil (MT, PA), French Guiana.

Key to the species discussed in the present article

1. Lip distinctly trilobed, with fimbriate and not crispate margins----------2
1a. Lip entire to minutely trilobed, with crispate, fimbriate or not, margins 4

2. Leaves very narrow (L/w ≥ 10), ensiform, much longer than internodes, apical callus made of 3-5 keels, midlobe apex acute to obtuse, flower greenish yellow----------*V. odorata*
2a. Leaves broader (L/w < 7), straight, as long as to distinctly shorter than internodes, apical callus either an uniforme mass or made of several rows of papillae, midlobe apex more or less truncate, sepals and petals whitish green----------3

3. Leaves about as long as internodes, dorsal sepal linear-lanceolate, apical part of the lip glabrous to slightly papillose, apical callus an uniform mass ----------*V. fimbriata*
3a. Leaves much shorter than internodes, dorsal sepal elliptic-oblanceolate, apical part of the lip with a tuft of long trichomes, apical callus made of rows of papillae----------*V. labellopapillata*

4. Leaves narrow (L/w ≥ 7), anterior margins of the lip more or less denticulate but not fimbriate, column ventrally densely pubescent, flower greenish----------*V. ensifolia*
4a. Leaves wider (L/w < 7), anterior margins of the lip fimbriate, column ventrally minutely pilose, flower white----------*V. ribeiroi*

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