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President's Message

Robert Hamilton

This issue of the International Odontoglossum Alliance Journal, (IOAJ) presents four articles dealing with taxonomy of the Oncidiinae and specifically the genus *Odontoglossum*. While originally intended for inclusion in the Spring 2021 IOAJ, our editors opted to publish this collection of papers as a separate issue and provide the information for reference. The depth and rigor of these exchanges is useful in understanding that taxonomy is fluid and taxonomists differ in opinion on how to organize data.

Taxonomic Transfers in Oncidiinae to Accord with Genera *Orchidacerum*, Vol. 5

(reprinted with permission from the American Orchid Society and from the author Mark Chase)

Authors: Chase, Williams, Neubig and Whitten (2008),

The Restoration of a Monophyletic *Odontoglossum*

(reprinted with permission from the author, Stig Dalström.

Authors: Stig Dalström and Wesley E. Higgins.

Problems with the generic delimitation in the *Odontoglossum* complex (Orchidaceae. Oncidiinae) and an attempt for a solution

(Reprinted with permission from the author, Marta Kolanowski)

Authors: Marta Kolanowska and Dariusz L. Szlachetko.

Comments on the Kolanowska and Szlachetko Paper

Authors: Stig Dalström, Wesley E. Higgins

A Comparative Analysis of Four Populations of *Odontoglossum crispum* Lindl. In Colombia

Authors: Julian Cabal Torrente, Ruben P. Sauleda and Juan G. Saldarriaga.

TAXONOMIC TRANSFERS IN ONCIDIINAE TO ACCORD WITH *GENERA ORCHIDACEARUM, VOL. 5*¹

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ABSTRACT: To bring species nomenclature for Oncidiinae in line with changes in generic circumscription in volume five of *Genera Orchidacearum*, we present a series of name transfers. These changes in circumscription are discussed in more detail in *Genera Orchidacearum*, but a general reason for the changes is provided here. In general, we favor fewer, larger genera (“lumping”), which we believe is easier for users of a system of classification to manage and use. Narrowly circumscribed genera, regardless of how homogenous, result in a system that only specialists can readily and effectively use.

THE NEXT VOLUME, the fifth and penultimate, of *Genera Orchidacearum* will be published in early 2009, and this volume will contain the treatment for the oncioid orchids, Oncidiinae, which next to Pleurothallidinae are the largest of the Neotropical orchid subtribes. The arrangement and distinctions among the genera of this subtribe have long been the subject of much controversy. Several genera, e.g., *Miltonia* Lindl., *Odontoglossum* Kunth and *Oncidium* Sw., have historically been viewed as taxa of convenience and thus became dumping grounds for species of unclear relationships. The process of sorting out the unrelated species from these groups has been ongoing for many years, and much of the re-circumscription has been reinforced by analyses of DNA (molecular) data. The continuing application of molecular phylogenetics and the concept of monophyly have led us to consider yet further changes. We now have an early comprehensive generic DNA matrix for Oncidiinae, and it is upon this analysis that we have based the treatment of the subtribe in *Genera Orchidacearum, Vol. 5*.

¹We are grateful to Rafael Govaerts, editor of the *World Checklist of the Monocotyledons*, which greatly facilitated the production of this effort and *Genera Orchidacearum*. Portions of this work is based on molecular systematic studies that were supported by National Science Foundation grant DEB 9815821 to NHW and by grants from the American Orchid Society Fund for Education and Research and the Florida Museum of Natural History.

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There are two major approaches to taxon delimitation, popularly known as “lumping” and “splitting.” Those favoring the former produce fewer, larger and usually more heterogeneous genera, whereas the latter produce many, more finely split, smaller and usually more homogeneous genera. Usually, the latter approach also produces many more monotypic genera, which are a redundancy in classification (we already know that it is distinct if it has been named as a species — assignment to genus is supposed to tell us something about what it is related to; a monotypic genus tells us nothing about the relatives of that species). There are situations in which monotypic genera must be created, even if taking a lumping approach — when a single species is the sister taxon of a large group of genera. This was the reason behind creation of *Zelenkoa* for the species long known as *Oncidium onustum* Lindl.; its closest relatives were not members of *Oncidium*, but rather included a large set of other genera. The choice here was one of lumping all those genera, including *Z. onusta*, into one or erecting a monotypic genus. This latter choice was in the interests of nomenclatural stability. Lumpers justify their actions on the basis that a system of classification with fewer genera is much easier to use for more people; splitters tend to produce so many genera that only an expert on the group can operate the system. Furthermore, the process of splitting often results in progressively narrower application of generic limits; for example, the Brazilian species of *Oncidium* have been the subject of efforts by three sets of authors working in Brazil, France and Poland. What initially started with a single genus being recognized,

Baptistonia Barb. Rodr., has ended up with 19 generic names being proposed over five years, some of which are competing (e.g., having the same type species but not the same circumscription). The fine details of this taxonomic chaos are detailed in Chase *et al.* (2009, in press), who lumped the whole group into *Gomesa*. The larger generic concept is indeed heterogeneous, but it is generally easily distinguished by the presence of fused lateral sepals, which are uncommon in Oncidiinae in general. If an oncidoid species is Brazilian and has a synsepal, then it is a member of this expanded concept of *Gomesa*.

We present here transfers of several more groups, generally following a lumping strategy. Fuller justifications are provided in *Genera Orchidacearum*, Vol. 5, and in an upcoming article in *Orchids*.

LEOCHILUS — The genus *Leochilus* is a member of the twig epiphyte clade and has a nectar cavity at the base of the lip. Chase (1986) provided a revision of the genus, but he also recognized that on morphological groups its closest relatives were *Goniochilus* Chase (one species from Panama and Costa Rica), *Hybochilus* Schltr. (one species from Costa Rica and Panama) and *Pappertizia* (one species native to Mexico, previously transferred to *Leochilus* by Reichenbach f.). At the time he described *Goniochilus*, Chase (1987) was unsure if it should be included in *Leochilus*, but because the single species differed from the general pattern of variation in *Leochilus*, he kept it separate, nonetheless recognizing that these genera were all closely related. They are indeed closely related in the results of phylogenetic analyses of multiple DNA datasets (Chase, 2009, in press), so here we transfer these two species to *Leochilus*, which thus brings *Leochilus* up to 12 species in total. We begin with a list of generic synonyms for *Leochilus*.

Leochilus Generic Synonymy

Leochilus Knowles and Westc., Flor. Cab. 2:143. 1838. Type species: *Leochilus oncidoides* Knowles and Westc.

Cryptosanus Scheidw., Allg. Gartenz. 9:101. 1843. Type species: *Cryptosanus scriptus* Scheidw.

Papperitzia Rchb.f., Bot. Zeit. 10:670. 1852. Type species: *Papperitzia leiboldii* Rchb.f.

Cryptosaccus Rchb.f., Xenia Orchid. 1:15. 1858. Misspelling of *Cryptosanus*.

Hybochilus Schltr., Repert. Spec. Nov. Regni Veg. 16:429. 1920. Type species: *Hybochilus inconspicuus* Schltr.

Goniochilus M.W. Chase, Contr. Univ. Michigan Herb. 16:125. 1987. Type species: *Goniochilus leochilinus* (Rchb.f.) M.W. Chase (basonym: *Rodriguezia leochilina* Rchb.f.)

Name Transfers in *Leochilus*

Leochilus inconspicuus (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basonym: *Rodriguezia inconspicua* Kränzl., Bull. Herb. Bossier 3:630. 1895.

Leochilus leochilinus (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basonym: *Rodriguezia leochilina* Rchb.f., Gard. Chron. 1871:970. 1871.

ODONTOGLOSSUM AND ONCIDIUM — The distinction between *Odontoglossum* Kunth and *Oncidium* Sw. has long been a contentious issue (Fig. 1A–F, page 23). Over the years, the anomalous species included in *Odontoglossum* (type species *O. epidendroides* Kunth) have been transferred to other genera (e.g., *Rhynchostele* Rchb.f., *Rossioglossum* [Schltr.] Garay and G.C. Kenn, and *Otoglossum* [Schltr.] Garay and Dunst.), and these transfers (generally done before the DNA information became available) have been subsequently supported by molecular phylogenetic studies. A monograph of *Odontoglossum* was published by Bockemühl (1989), which seemed to settle the issue of generic circumscription, but two of her subgenera were subsequently shown to be members of *Cyrtorchilum* by Williams *et al.* (2001a,b) using DNA analyses and transferred there. After these changes, there still remains a core group of *Odontoglossum* species that DNA studies have indicated are monophyletic, but these are deeply embedded in *Oncidium*. If *Odontoglossum* is to be maintained as a distinct genus, then many more genera will need to be created or some long-known species with typical *Oncidium* floral morphology (e.g., *O. chrysomorphum* Lindl., *O. obryzatum* Rchb.f.) will have to be transferred into *Odontoglossum*, which removes any hope of morphological distinctiveness for *Odontoglossum*. *Oncidium* and *Odontoglossum* represent shifts in pollinators, and this is not a suitable basis for generic delimitation. The species of *Odontoglossum* and *Oncidium* are also closely related and make fertile hybrids. We realize the upheaval this will cause with hybrid nomenclature of this group, but many of the intergenerics will now become simple *Oncidium* hybrids. Although it will cause problems for hybrid nomenclature, this is preferable from many other standpoints. In addition, *Cochlioda* Lindl. and *Symphyloglossum* Schltr. are hummingbird-pollinated species of *Oncidium* and also deeply imbedded in *Oncidium/Odontoglossum*, so these too are transferred.

Reduction in size has long resulted in small plants being segregated into their own genera apart from their often unrecognized closest relatives. Examples of this include *Rhynchostele pygmaea* (Lindl.) Rchb.f., which is

related to *Odontoglossum bictoniensis* (Bateman) Lindl. and relatives, and *Neodryas* Rchb.f., which is related to *Cyrtochilum*. *Sigmatostalix* is another such case. These often-tiny plants produce oil on their lip calli and are recorded to be pollinated by oil-collecting bees, as are the great majority of species in *Oncidium*. Size alone is not suitable for generic delimitation, and in all other ways the species of *Sigmatostalix* are similar to those in *Oncidium*. These too we transfer to *Oncidium*. To help readers maintain some sense of the current circumscription of *Oncidium*, we provide first the current generic synonymy from *Genera Orchidacearum*, Vol. 5.

Oncidium Generic Synonymy

Oncidium Sw., Kongl. Vetensk. Acad. Nya Handl., 21:239. 1800. Type species: *Oncidium altissimum* (Jacq.) Sw. basionym: *Ephidendrum altissimum* Jacq.)

Odontoglossum Kunth, Nov. Gen. Sp. 1, 351. 1816. Type species: *Odontoglossum epidendroides* Kunth.

Sigmatostalix Rchb.f., Bot. Zeit. (Berlin) 10:769. 1852. Type species: *Sigmatostalix graminea* (Poepp. and Endl.) Rchb.f. (basionym: *Specklinia graminea* Poepp. and Endl.) *Cochlioda* Lindl., Fol. Orchid. 4:1. 1853. Type species:

Cochlioda densiflora Lindl.

Petalocentrum Schltr., Repert. Spec. Nov. Regni Veg. 15:144. 1918. Type species: *Petalocentrum pusillum* (Schltr.) Schltr. (basionym: *Sigmatostalix pusilla* Schltr.)

Rozeiella Schltr., Repert. Spec. Nov. Regni Veg. 15:146. 1918. Type species: *Rozeiella dilata* (Rchb.f.) Schltr. (basionym: *Sigmatostalix dilata* Rchb.f.)

Symphyglossum Schltr., Orchis 13:8. 1919. Type species: *Symphyglossum sanguineum* (Rchb.f.) Schltr. (basionym: *Odontoglossum sanguineum* Rchb.f.)

Mexicoa Garay, Bradea 1:423. 1974. Type species: *Mexicoa ghiesbreghtiana* (A.Rich. and Galeotti) Garay (basionym: *Oncidium ghiesbreghtianum* A.Rich. and Galeotti)

Miltonioides Brieger and Lückel, Orchidee (Hamburg) 34:130. 1983. Type species: *Miltonioides karwinskii* (Lindl.) Brieger and Lückel (basionym: *Cyrtochilum karwinskii* Lindl.)

Solenidiopsis Senghas, Orchidee (Hamburg) 37:274. 1986. Type species: *Solenidiopsis tigroides* (C. Schweinf.) Senghas (basionym: *Odontoglossum tigroides* C. Schweinf.)

Chamaeleorchis Senghas and Lückel, Schlechter Orchideen, ed. 3, I/C (33–36):2305. 1997. Type species: *Chamaeleorchis warcewiczii* (Rchb.f.) Senghas and Lückel (basionym: *Miltonia warcewiczii* Rchb.f. = *Oncidium fuscatum* Rchb.f.)

Collare-stuartense Senghas and L. Bockemühl, J. Orchideenfr. 4:73. 1997. Type species: *Collare-stuartense multistellare* (Rchb.f.) Senghas and L. Bockemühl (basionym: *Odontoglossum multistellare* Rchb.f.)

Heteroncidium Szlach., Mytnik and Romowicz, Pol. Bot. J. 51:54. 2006. Type species: *Heteroncidium heteranthum*

(Poepp. and Endl.) Szlach., Mytnik and Romowicz (basionym: *Oncidium heteranthum* Poepp. and Endl.)

Name Transfers to *Oncidium*

Oncidium abortivoide M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix abortiva* L.O. Williams, Ann. Missouri Bot. Gard. 27:284. 1940. In *Oncidium*, this epithet is already occupied by *Oncidium abortivum* Rchb.f.

Oncidium* × *acuminatissimum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum* × *acuminatissimum* Rchb.f., Gard. Chron., n.s. 17:256. 1882.

Oncidium adamsii (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix adamsii* Dodson, Selbyana 2:54. 1977.

Oncidium adelaidae (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix adelaidae* Königer, Arcula 3:82. 1995.

Oncidium* × *adrianae (L. Linden) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum* × *adrianae* L.Linden, Semaine Hort. 1:150. 1879.

Oncidium alberti (P. Ortiz) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum alberti* P. Ortiz, Orquideologia 24:5. 2005.

Oncidium alexandrae (Bateman) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum alexandrae* Bateman, Gard. Chron. 1864:1083. 1864; synonym: *Odontoglossum crispum* Lindl., Ann. Mag. Nat. Hist. 15:256. 1845. Unfortunately, in *Oncidium*, this epithet is occupied by *Oncidium crispum* Lodd., so the name of this species widely used in hybridization must be changed to a later synonym.

Oncidium alvarezii (P. Ortiz) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum alvarezii* P. Ortiz, Orquideologia 22:7. 2001.

Oncidium amazonicum (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix amazonica* Schltr., Beih. Bot. Centralbl. 42:148. 1925.

Oncidium* × *andersonianum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum* × *andersonianum* Rchb.f., Gard. Chron. 1868:599. 1868.

Oncidium arangoi (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix arangoi* Königer, Arcula 11:290. 2001.

Oncidium ariasii (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix ariasii* Königer, Arcula 3:82. 1995.

Oncidium aristulliferum (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix aristullifera* Kränzl., in H.G.A. Engler (ed.), Pflanzenr., IV, 50(80):305. 1922. ***Oncidium armatum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum armatum* Rchb.f., Linnaea 41:32. 1876.

Oncidium aspidorhinum (F. Lehm.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum aspidorhinum* F. Lehm., Gard. Chron., III, 18:356. 1895.

Oncidium astranthum (Linden and Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum*



Fig. 1A–F. There has been long-standing debate about the generic limits of *Oncidium*, but DNA studies have now provided clear evidence that the standard floral traits of *Oncidium* are a pollination syndrome (oil-collecting bees visit the flowers and attempt to collect oil from the lip callus). This syndrome occurs in unrelated sets of species, and so some groups have been removed from *Oncidium* (*Gomesa*, *Tolumnia* and *Zelenkoa*), whereas others with other forms of pollination have traditionally been kept as distinct genera. Thus, bird-pollinated members of *Oncidium* have been placed in *Cochlioda* and *Symphyglossum*, whereas those pollinated by other types of bees were treated as members of *Odontoglossum*. These are now all here transferred into *Oncidium*. The core group of *Odontoglossum* could have

been maintained, but species such as *Oncidium obryzatum* would have to be included in *Odontoglossum* because these species are more closely related to the core group of *Odontoglossum* than they are to the rest of the species of *Oncidium*. In the case of *Sigmatostalix*, a relationship to *Oncidium* was unrecognized due to the small size of these plants and their flowers; these species are also pollinated by oil-collecting bees. A. *Oncidium* (*Sigmatostalix*) *huebneri*. Photograph by Mark Chase. B. *Oncidium* (*Miltonioides*) *karwinskii*. Photograph by Mark Chase. C. *Oncidium* (*Odontoglossum*) *luteopurpureum*. Photograph by Mark Chase. D. *Oncidium obryzatum*. Photograph by Mark Whitten. E. *Oncidium* (*Odontoglossum*) *odoratum*. Mark Chase. F. *Oncidium* (*Cochlioda*) *vulcanicum*. photograph by Mark Chase.

astranthum Linden and Rchb.f., Gard. Chron. 1867:404. 1867.

Oncidium auriculatum (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum auriculatum* Rolfe, Kew Bull. Misc. Inform. 1892:140. 1892.

Oncidium auriculatoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix auriculata* Garay, *Caldasia* 10:236. 1968. In *Oncidium*, this epithet is occupied by *Oncidium auriculatum* (Rolfe) M.W. Chase and N.H. Williams.

Oncidium beyrodtioides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Cochlioda berodtiana* Schltr., *Orchis* 13:5. 1919. In *Oncidium*, this epithet is occupied by the earlier *Oncidium beyrodtianum* Schltr. (*Repert. Spec. Nov. Regni Veg.* 8:572. 1910).

Oncidium bicallosoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix bicallosa* Garay, *Arch. Jard. Bot. Rio de Janeiro* 11:57. 1951. In *Oncidium*, this epithet is occupied by *Oncidium bicallosum* Lindl.

Oncidium blandum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum blandum* Rchb.f., *Gard. Chron.* 1870:1342. 1870.

Oncidium contaypacchaense (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum contaypacchaense* D.E. Benn. and Christenson, *Icon. Orchid. Peruv.*t. 726. 2001.

Oncidium ×cookianum (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum cookianum* Rolfe, *Gard. Chron.* 1891:695. 1891

Oncidium coradinei (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum coradinei* Rchb.f., *Gard. Chron.* 1872:1068. 1872.

Oncidium crescentilabium (C. Schweinf.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym:

Sigmatostalix crescentilabia C. Schweinf., *Amer. Orchid Soc. Bull.* 15:162. 1947.

Oncidium crinitum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum crinitum* Rchb.f., *Xenia Orchid.* 2:207. 1874.

Oncidium crocidipterum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum crocidipterum* Rchb.f., *Gard. Chron.* 1871:1129. 1871.

Oncidium crocidipterum subsp. *dormanianum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum dormanianum* Rchb.f., *Gard. Chron.*, n.s., 21:11. 1884.

Oncidium cruentoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum cruentum* Rchb.f., *Xenia Orchid.* 2:174. 1873. In *Oncidium*, this epithet is occupied by *Oncidium cruentum* Hort. ex Veitch.

Oncidium cuculligerum (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Rozeiella cuculligera* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 7:193. 1920.

Oncidium curvipetalum (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix curvipetala* D.E. Benn. and Christenson, *Brittonia* 47:202. 1995.

Oncidium densiflorum (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Cochlioda densiflora* Lindl, *Fol. Orchid.* 4:1. 1853.

Oncidium ×dicranophorum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×dicranophorum* Rchb.f., *Gard. Chron.* 1888(1):330. 1888.

Oncidium digitoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum digitatum* C. Schweinf., *Amer. Orchid. Soc. Bull.* 14:208. 1945. In *Oncidium*, this epithet is occupied by *Oncidium digitatum* Lindl.

Oncidium dilatatum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix dilatata* Rchb.f., *Linnaea* 41:16. 1876.

Oncidium dracoceps (Dalström) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum dracoceps* Dalström, *Lindleyana* 14:87. 1999.

Oncidium dulcineae (Pupulin and G. Rojas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix dulcineae* Pupulin and G. Rojas, *Orchids* 75:681. 2006.

Oncidium ×elegans (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×elegans* Rchb.f., *Gard. Chron.*, n.s., 11:462. 1879.

Oncidium eliae (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix eliae* Rolfe, *Bull. Misc. Inform. Kew* 1908:416. 1908.

Oncidium excellens (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum excellens* Rchb.f., *Gard. Chron.*, n.s., 16:426. 1881.

Oncidium flavobrunneum (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Solenidiopsis flavobrunnea* Senghas, *Orchidee (Hamburg)* 40:206. 1989.

Oncidium floryi (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Cochlioda floryi* Rolfe, *Orchid Rev.* 19:144. 1911.

Oncidium galianoi (Dalström and Nuñez) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Solenidiopsis galianoi* Dalström and Nuñez, *Selbyana* 23:197. 2002.

Oncidium gentryi (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix gentryi* Dodson, *Orquideologia* 21:15. 1998.

Oncidium gloriosum (Linden and Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum gloriosum* Linden and Rchb.f., *Bonplandia (Hannover)* 2:278. 1854.

Oncidium ×godseffianum (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×godseffianum* Rolfe, *Gard. Chron.*, III, 16:728. 1894.

Oncidium gramazuense (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum gramazuense* D.E. Benn. and Christenson, *Icon. Orchid. Peruv.*t. 728. 2001.

Oncidium gramineum (Poepp. and Endl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Specklinia graminea* Poepp. and Endl., *Nov. Gen. Sp. Pl.* 1:51. 1836.

Oncidium guatemalenoides M.W. Chase and N.H.

- Williams, **nom. nov.**; synonym: *Sigmatostalix guatemalensis* Schltr., Repert. Spec. Nov. Regni Veg. 10: 253. 1911. In *Oncidium*, this epithet is occupied by *O. guatemalense* Schltr., a synonym of *O. oliganthum* (Rchb.f.) L.O. Williams.
- Oncidium harryanum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum harryanum* Rchb.f., Gard. Chron., n.s., 26:486. 1886.
- Oncidium hauensteinii* (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum hauensteinii* Königer, Arcula 2:45. 1994.
- Oncidium helgae* (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum helgae* Königer, Arcula 7:211. 1997.
- Oncidium hennisii* (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum hennisii* Rolfe, Gard. Chron., III, 16:158. 1894.
- Oncidium hermansianum* (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix hermansiana* Königer, Arcula 8:243. 1999.
- Oncidium heterosepalum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum angustatum* var. *heterosepalum* Rchb.f., Linnea 22:850. 1849.
- Oncidium ×hinnus* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×hinnus* Rchb.f., Xenia Orch. 2:153. 1870.
- Oncidium hirtzoides* (Königer) M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix hirtzii* Dodson, Orquideologia 21:17. 1998. In *Oncidium*, this epithet is occupied by *Oncidium hirtzii* Dodson.
- Oncidium hrubyatoides* M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum hrubyatum* Rchb.f., Gard. Chron. 1888:234. 1888. In *Oncidium*, this epithet is occupied by *Oncidium hrubyatum* Rchb.f.
- Oncidium huebneri* (Mansf.) M.W. Chase and N.H. Williams, **comb. Nov.** basionym: : *Sigmatostalix huebneri* Mansf., Repert. Spec. Nov. Regni Veg. 36:63. 1934.
- Oncidium hymenanthum* (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix hymenantha* Schltr., Beih. Bot. Centralbl. 36:419. 1918.
- Oncidium ibis* (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix ibis* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7:193. 1920.
- Oncidium integrilabris* (Pupulin) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix integrilabris* Pupulin, Harvard Pap. Bot. 8:45. 2003.
- Oncidium juninense* (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum juninense* Schltr., Repert. Spec. Nov. Regni. Veg. Beih. 9:109. 1921.
- Oncidium kegeljani* (E. Morren) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum kegeljani* E. Morren, Ann. Hort. Belge Étrangère 27:212. 1977.
- Oncidium ×kraenzlinii* (O'Brien) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×kraenzlinii* O'Brien, Gard. Chron., III, 13:442. 1893.
- Oncidium leeanum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum leeanum* Rchb.f., Gard. Chron., n.s., 17:525. 1882.
- Oncidium lehmannianum* (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix lehmanniana* Kränzl., Bot. Jahr. Syst. 26:480. 1899.
- Oncidium lehmannii* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum lehmanni* Rchb.f., Otia Bot. Hamburg.:4 (1878); synonym: *Odontoglossum cristatellum* Rchb.f., Gard. Chron., n.s., 10: 716. 1878. In *Oncidium*, this epithet is occupied by *Oncidium cristatellum* Garay, but in fact *O. lehmannii* Rchb.f. was published in April, 1878, whereas *O. cristatellum* Rchb.f. was not published until December, 1878; therefore, the correct epithet for this species in both *Odontoglossum* and *Oncidium* is *lehmannii* Rchb.f.
- Oncidium ligiae* (Königer and R. Escobar) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix ligiae* Königer and R. Escobar, Arcula 4:116. 1995.
- Oncidium limbatum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum limbatum* Rchb.f., Gard. Chron. 1870:417. 1870.
- Oncidium lindleyoides* M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum lindleyanum* Rchb.f. and Warsz., Bonplandia (Hannover) 2:99. 1854. In *Oncidium*, this epithet is occupied by *Oncidium lindleyanum* Hort. Linden.
- Oncidium llanachagaense* (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum llanachagaense* D.E. Benn. and Christenson, Icon. Orchid. Peruv.:t. 729. 2001.
- Oncidium lucianianum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum lucianianum* Rchb.f., Lindenia 2:37. 1886.
- Oncidium lueroroides* M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix luerora* Dodson., Orquideologia 21:18. 1998. This epithet is occupied in *Oncidium* by *O. luerorum* Dodson (Orquideologia 20:91. 1996).
- Oncidium lutzii* (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix lutzii* Königer, Arcula 3:84. 1995.
- Oncidium machupicchuense* (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum machupicchuense* D.E. Benn. and Christenson, Icon. Orchid. Peruv.:t. 730. 2001.
- Oncidium macrobulbon* (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix macrobulbon* Kränzl., in H.G.A. Engler (ed.), Pflanzenr., IV, 50(80):307. 1922.
- Oncidium malleiferum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix malleifera* Rchb.f., Gard. Chron., n.s., 20:360. 1883.
- Oncidium manuelariasii* M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum ariasii* Dalström, Selbyana 22:137. 2001. In *Oncidium*, this epithet is occupied by the earlier *Sigmatostalix ariasii* Königer; the new epithet combines his given name and surname.
- Oncidium marinii* (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix marinii*

Königer, *Arcula* 4:119. 1995.

Oncidium ×marriottianum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×marriottianum* Rchb.f., *Gard. Chron.*, n.s., 15:168. 1881.

Oncidium mexicanum (L.O. Williams) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix mexicana* L.O. Williams, *Amer. Orchid Soc. Bull.* 10:239. 1942.

Oncidium micklowii (Dalström) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum micklowii* Dalström, *Lindleyana* 8:15. 1993.

Oncidium minaxoides (Kränzl.) M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix minax* Kränzl., in H.G.A. Engler (ed.), *Pflanzenr.*, IV, 50(80):309. 1922. In *Oncidium*, this epithet is occupied by *O. minax* Rchb.f.

Oncidium miniatum (L. Linden) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Cochlioda miniata* L. Linden, *Lindenia* 12:t. 562. 1896.

Oncidium mirandoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix miranda* Kränzl., in H.G.A. Engler (ed.), *Pflanzenr.*, IV, 50(80):305. 1922. In *Oncidium*, this epithet is occupied by *O. mirandum* (Rchb.f.; 1882) M.W. Chase and N.H. Williams.

Oncidium mirandum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum mirandum* Rchb.f., *Gard. Chron.*, n.s., 17:143. 1882.

Oncidium mixturum (Dalström and Sönnemark) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Cochlioda mixtura* Dalström and Sönnemark, *Selbyana* 22:135. 2001.

Oncidium morgani (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix morgani* Dodson, *Icon. Pl. Trop.* 1:t. 301. 1980.

Oncidium multistellare (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum multistellare* Rchb.f., *Linnaea* 41:25. 1876.

Oncidium ×mulus (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×mulus* Rchb.f., *Xenia Orchid.* 2:151. 1870.

Oncidium ×murrellianum (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×murrellianum* Rchb.f., *Gard. Chron.*, n.s., 3: 653. 1875.

Oncidium nevadense (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum nevadense* Rchb.f., *Ill. Hort.* 17:243. 1870.

Oncidium nobile (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum nobile* Rchb.f., *Linnaea* 22:850. 1850.

Oncidium noezlianum (Mast.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum noezlianum* Ma 0.

Oncidium oxyceras (Königer and J.G. Weinm.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix oxyceras* Königer and J.G. Weinm., *Arcula* 5:146. 1996.

Oncidium panduratoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix pandurata*

Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 7:192. 1920. In *Oncidium*, this epithet is occupied by *O. panduratum* Rolfe.

Oncidium papilioides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix papilio* Königer and R. Escobar, *Arcula* 5:148. 1996. In *Oncidium*, this epithet is occupied by *O. papilio* Lindl.

Oncidium perpusillum (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix perpusilla* Kränzl., in H.G.A. Engler (ed.), *Pflanzenr.*, IV, 50(80):308. 1922.

Oncidium peruvianoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Solenidium peruvianum* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 9:113. 1921. In *Oncidium*, this epithet is occupied by *O. peruvianum* (Poepp. and Endl.) Rchb.f.

Oncidium pichinchensis (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix pichinchensis* Dodson, *Orquideologia* 21:21. 1998.

Oncidium pictoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix pictum* Rchb.f., *Ann. Bot. Syst.* 5:859. 1864. In *Oncidium*, this epithet is occupied by *O. pictum* Kunth.

Oncidium picturatissimum (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix picturatissima* Kränzl., in H.G.A. Engler (ed.), *Pflanzenr.*, IV, 50(80):312. 1922.

Oncidium playnaris (Dalström) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum platynaris* Dalström, *Selbyana* 22:5. 2001.

Oncidium poikilostalix (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix poikilostalix* Kränzl., in H.G.A. Engler (ed.), *Pflanzenr.*, IV, 50(80):310. 1922.

Oncidium portilloides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum portillae* Bockemühl, *Orchidee (Hamburg)* 36:153. 1985. In *Oncidium*, this epithet is occupied by *O. portillae* Königer.

Oncidium portillaellum M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix portillae* Königer, *Arcula* 3:87. 1995. In *Oncidium*, this epithet is occupied by *O. portillae* Königer (*Arcula* 10:274. 2000).

Oncidium portmannii (Bockemühl) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum portmannii* Bockemühl, *Orchidee (Hamburg)* 39:13. 1888.

Oncidium portmannii subsp. **cohriae** (Bockemühl) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum* subsp. *cohriae* Bockemühl, *Orchidee (Hamburg)* 39:15. 1888.

Oncidium posadaroides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix posadarum* Königer, *Arcula* 11:293. 2001. In *Oncidium*, this epithet is occupied by *O. posadarum* Königer (*Arcula* 4:110. 1995).

Oncidium povedanum (P. Ortiz) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum povedanum* P. Ortiz, *Orquideologia* 20:321. 1997.

Oncidium praenitens (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum praenitens* Rchb.f., *Gard. Chron.*, n.s., 3:524. 1875.

- Oncidium praestanoides*** M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum praestans* Rchb.f. and Warsz., Bonplandia (Hannover) 2:99. 1854. In *Oncidium*, this epithet is occupied by *Oncidium praestans* Rchb.f.
- Oncidium pseudomelanthes*** (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum pseudomelanthes* D.E. Benn. and Christenson, Icon. Orchid. Peruv.:t. 733. 2001.
- Oncidium pseudounguiculatum*** (Pupulin and Dressler) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix pseudounguiculata* Pupulin and Dressler, Lindleyana 15:27. 2000.
- Oncidium putumayensis*** (P. Ortiz) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix putumayensis* P. Ortiz, Orquideologia 18:178. 1991.
- Oncidium reichenbachianum*** (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix reichenbachiana* Kränzl., in H.G.A. Engler, Pflanzenr., IV, 50(80):307. 1922.
- Oncidium renatoi*** (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix renatoi* Königer, Arcula 12:308. 2003.
- Oncidium reversoides*** M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum reversum* Bockemühl, Orchidee (Hamburg) 37:207. 1986. In *Oncidium*, this epithet is occupied by *O. reversum* (Rchb.f.) M.W. Chase and N.H. Williams.
- Oncidium reversum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix reversa* Rchb.f., Linnaea 41:103. 1876.
- Oncidium rhombicallum*** (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Solenidiopsis rhombicalla* D.E. Benn. and Christenson, Brittonia 46:44. 1994.
- Oncidium rhynchanthum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum rhynchanthum* Rchb.f., Gard. Chron., III, 1:380. 1887.
- Oncidium roseoides*** M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum roseum* Lindl., in G. Benth., Pl. Hartw.:151. 1845 (synonym: *Cochlioda rosea* [Lindl.] Benth.). In *Oncidium*, this epithet is occupied by *O. roseum* Lodd.
- Oncidium rubrocallosum*** (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum rubrocallosum* D.E. Benn. and Christenson, Icon. Orchid. Peruv.:t. 734. 2001.
- Oncidium savegrensis*** (Pupulin) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix savegrensis* Pupulin, Harvard Pap. Bot. 8:55. 2003.
- Oncidium sceptrum*** (Rchb.f. and Warsz.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum sceptrum* Rchb.f. and Warsz., Bonplandia (Hannover) 2:99. 1854.
- Oncidium sceptrum* var. *facetum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum sceptrum* var. *facetum* (Rchb.f.) Bockemühl, *Odontoglossum*, Monogr.:116. 1989.
- Oncidium ×schroederianum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×schroederianum* Rchb.f., Gard. Chron., n.s., 17:700. 1882.
- Oncidium sergii*** (P. Ortiz) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix sergii* P. Ortiz, Orquideologia 18:174. 1991.
- Oncidium spectatissimum*** (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum spectatissimum* Lindl., Fol. Orchid. 1:19. 1852.
- Oncidium ×stellimicans*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum ×stellimicans* Rchb.f., Gard. Chron., n.s., 22:680. 1884.
- Oncidium strictum*** M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Cochlioda stricta* Cogn, Gard. Chron., III, 1897(1):410. 1897; synonyms: *Mesospinidium sanguineum* Rchb.f., Ann. Bot. Syst. (Walpers) 6:858. 1864; *Symphyglossum sanguineum* (Rchb.f.) Schltr., Orchis 13:9. 1919. In *Oncidium*, this epithet is occupied by *Oncidium sanguineum* Lindl.
- Oncidium subuligerum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum subuligerum* Rchb.f., Linnaea 41:27. 1876.
- Oncidium tenuifolium*** (Dalström) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum tenuifolium* Dalström, Lindleyana 11:114. 1996.
- Oncidium tenuirostris*** (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix tenuirostris* Kränzl., in H.G.A. Engler (ed.), Pflanzenr., IV, 50(80):307. 1922. ***Oncidium tenuoides*** (Cogn.) M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Odontoglossum tenue* Cogn., J. Orchidés 6:266. 1895. In *Oncidium*, this epithet is occupied by *Oncidium tenue* Lindl.
- Oncidium tigroides*** (C. Schweinf.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum tigroides* C. Schweinf., Amer. Orchid Soc. Bull. 14:22. 1945.
- Oncidium trimorion*** (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix trimorion* Königer, Arcula 6:172. 1996.
- Oncidium tripudians*** (Rchb.f. and Warsz.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum tripudians* Rchb.f. and Warsz., Bonplandia (Hannover) 2:100. 1854.
- Oncidium unguiculoides*** M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix unguiculata* C. Schweinf., Bot. Mus. Leaf. 8:55. 1940. In *Oncidium*, this epithet is already occupied by *O. unguiculatum* Lindl.
- Oncidium velleum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum velleum* Rchb.f., Gard. Chron., n.s., 1:406. 1874.
- Oncidium vierlingii*** (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum vierlingii* Senghas, J. Orchideenfr. 7:136. 2000.
- Oncidium vulcanicum*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Mesospinidium vulcanicum* Rchb.f., Gard. Chron. 1872:393. 1872.



Fig. 2A–D. *Comparettia* in the former sense includes species with long spurs, such as *Comparettia speciosa*, but the genera with shorter spurs, such as *Diadenium*, *Neokoehleria* and *Scelochilus*, are now transferred there. A. *Comparettia (Scelochilus) heterophylla*. Photographs by Mark Whitten.

B. *Comparettia (Diadenium) micrantha*. Photographs by Mark Whitten. C. *Comparettia speciosa*. Photograph by Mark Chase. D. *Comparettia (Scelochilus) tungurahuae*. Photograph by Mark Whitten.

Oncidium wallisii (Linden and Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum wallisii* Linden and Rchb.f., Gard. Chron. 1879:104. 1879.

Oncidium wallisoides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Sigmatostalix wallisii* Rchb.f., Linnaea 41:103. 1876. In *Oncidium*, this epithet is already occupied by *O. wallisii* (Linden and Rchb.f.) M.W. Chase and N.H. Williams.

Oncidium weinmannianum (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Sigmatostalix weinmanniana* Königer, Arcula 2:55. 1994.

Oncidium × *wilckeanum* (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum* × *wilckeanum* Rchb.f., Gard. Chron., n.s., 13:298. 1880.

Oncidium wyattianum (Gurney Wilson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Odontoglossum wyattianum* Gurney Wilson, Orch. Rev. 36:47. 1928.

COMPARETTIA — The genera centered around *Comparettia* only differ in the fine details of their nectar horn or simply the length of the nectar horn (Fig. 2A–D, page 28). In phylogenetic analyses of DNA sequences, they all come embedded within *Scelochilus* (the largest genus), so we here combine them into a single genus, *Comparettia*. *Ionopsis* could perhaps also be transferred here, but this result is not well supported, so we do not transfer it here. The generic synonymy for *Comparettia*, now a genus of 73 species, is presented first.

Comparettia Generic Synonymy

Comparettia Poepp. and Endl., Nov. Gen. Spec. 1:42, t. 73. 1835. Type species: *Comparettia falcata* Poepp. and Endl.

Diadenium Poepp. and Endl., Nov. Gen. Spec. 1:41, t. 71. 1835. Type species: *Diadenium micranthum* Poepp. and Endl.

Chaenanthus Lindl., Bot. Reg. 24:38. 1838. Type species: *Chaenanthus barkeri* Lindl.

Scelochilus Klotzsch, Allg. Gartenz. 9:261. 1841. Type species: *Scelochilus ottonis* Klotzsch

Neokoehleria Schltr., Repert. Spec. Nov. Regni Veg. 10:390. 1912. Type species: *Neokoehleria equitans* Schltr.

Scelochiloides Dodson and M.W. Chase, Icon. Pl. Trop., II, 3:t. 293. 1989. Type species: *Scelochiloides vasquezii* Dodson and M.W. Chase

Stigmatorthos M.W. Chase and D.E. Benn., Lindleyana 8:4. 1993. Type species: *Stigmatorthos peruviana* M.W. Chase and D.E. Benn.

Pfitzeria Senghas, J. Orchideenfr. 5:30. 1998. Type species: *Pfitzeria schaeferi* Senghas

Scelochilopsis Dodson and M.W. Chase, Orquideologia, 21:61. 1998. Type species: *Scelochilopsis ecalcarata* (Determann) Dodson and M.W. Chase

New Combinations in *Comparettia*

Comparettia acebeyae (R. Vásquez and Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym:

Scelochiloides acebeyae R. Vásquez and Dodson, Revista Soc. Boliv. Bot. 3:29. 2001.

Comparettia amboronensis (R. Vásquez and Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus amboronensis* R. Vásquez and Dodson, Revista Soc. Boliv. Bot. 2:15. 1998.

Comparettia aurea (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus aureus* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:144. 1923.

Comparettia auriculata (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus auriculatus* Rchb.f., Flora 69:551. 1886.

Comparettia barkeri (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Chaenanthus barkeri* Lindl., Edwards's Bot. Reg. 24 (Misc.):38. 1838.

Comparettia bennettii M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Stigmatorthos peruviana* M.W. Chase and D.E. Benn., Lindleyana 8:7. 1993. In *Comparettia*, this epithet is occupied by *C. peruviana* Schltr., so we have named it after David E. Bennett, one of the original co-authors.

Comparettia blankei (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus blankei* Senghas, Caesiana 8:23. 1997

Comparettia brevis (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus brevis* Schltr., Repert. Spec. Nov. Regni Veg. 10:391. 1912.

Comparettia campoverdei (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus campoverdei* D.E. Benn. and Christenson, Brittonia 46:256. 1994.

Comparettia carinata (Rolfe) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus carinatus* Rolfe, Bull. Misc. Inform. Kew 1895:284. 1895.

Comparettia chiribogae (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus chiribogae* Dodson, Icon. Pl. Trop. 1:t. 288. 1980.

Comparettia corydaloides (Kränzl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Rodriguezia corydaloides* Kränzl., Repert. Spec. Nov. Regni Veg. 25:24. 1928.

Comparettia coimbrae (Dodson and R. Vásquez) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochiloides coimbrae* Dodson and R. Vásquez, Revista Soc. Boliv. Bot. 2:13. 1998.

Comparettia crucicorniba (Senghas, D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus crucicornibus* Senghas, D.E. Benn. and Christenson, Brittonia 50:183. 1998.

Comparettia delcastilloi (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus delcastilloi* D.E. Benn. and Christenson, Icon. Orchid. Peruv.:t. 567. 1998.

Comparettia ecalcarata (Determann) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus ecalcratus* Determan, Selbyana 7:88. 1982.

Comparettia embreei (Dodson) M.W. Chase and N.H.



Fig. 3. *Cuitlauzina* was at one time included in *Odontoglossum*, but it was recognized that its chromosome number and floral morphology were different. Even before the advent of DNA analyses, it was clear that other genera such as *Osmoglossum* and *Palumbina* should be included in *Cuitlauzina*, along with the type species, *C. pendula*; DNA studies confirm these transfers. *Cuitlauzina pendula*. Photograph by Mark Chase.

Williams, **comb. nov.**; basionym: *Scelochilus embreei* Dodson, *Icon. Pl. Trop.* 1:t. 289. 1980.

Comparettia equitans (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria equitans* Schltr., *Repert. Spec. Nov. Regni Veg.* 10:391. 1912.

Comparettia escobariana (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus escobarianus* Senghas, *Orquideologia* 19:6. 1994.

Comparettia frymirei (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus frymirei* Dodson, *Icon. Pl. Trop.* 1:t. 290. 1980.

Comparettia gentryi (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus gentryi* Dodson, *Icon. Pl. Trop.* 1:t. 291. 1980.

Comparettia granizoi (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus granizoi* Königer, *Arcula* 5:140. 1996.

Comparettia hauensteinii (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus hauensteinii* Königer, *Arcula* 5:143. 1996.

Comparettia heterophylla (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus heterophyllus* Rchb.f., *Linnaea* 41:105. 1876.

Comparettia hirtzii (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus hirtzii* Dodson, *Icon. Pl. Trop.*, II, 6:t. 580. 1989.

Comparettia jamiesonii (Lindl. and Paxton) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus jamiesonii* Lindl. and Paxton, *Paxton's Fl. Gard.* 3:88. 1852.

Comparettia janeae (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus janeae* Dodson, *Icon. Pl. Trop.*, II, 3:t. 294. 1989.

Comparettia kerspei (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria kerspei* Senghas, *Orchidee (Hamburg)* 41:17. 1990.

Comparettia kroemeri (R. Vásquez and Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus kroemeri* R. Vásquez and Dodson, *Revista Soc. Boliv. Bot.* 3:31. 2001.

Comparettia langkastii (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria langkastii* Senghas, *Caesiana* 10:28. 1998.

Comparettia langlassei (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus langlassei* Schltr., *Repert. Spec. Nov. Regni Veg.* 8:572. 1910.

Comparettia laeae (Dodson and R. Vásquez) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus laeae* Dodson and R. Vásquez, *Icon. Pl. Trop.*, II, 3:t. 295. 1989.

Comparettia latipetala (C. Schweinf.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus latipetalus* C. Schweinf., *Amer. Orchid Soc. Bull.* 13:306. 1945.

Comparettia limatamboensis (Dodson and R. Vásquez) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus limatamboensis* Dodson and R. Vásquez, *Icon. Pl. Trop.* II, 3:t. 296. 1989.

Comparettia luerae (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus luerae* Dodson, *Icon. Pl. Trop.* 1:t. 294. 1980.

Comparettia markgrafii (Friedrich) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria markgrafii* Friedrich, *Mitt. Bot. Staatssammi. München* 2:259. 1957.

Comparettia micrantha (Poepp. and Endl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Diadenium micranthum* Poepp. and Endl., *Nov. Gen. Sp. Pl.* 1:41. 1836.

Comparettia minuta (Garay and Dunst.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria minuta* Garay and Dunst., *Venez. Orchids Ill.* 3:196. 1965.

Comparettia mirthae (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus mirthae* Königer, *Arcula* 11:287. 2001.

Comparettia neudeckeri (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria neudeckeri* Königer, *Arcula* 7:208. 1997.

Comparettia newyorkora (R. Vásquez, Ibisch and I.G. Vargas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus newyorkorum* R. Vásquez, Ibisch and I.G. Vargas, *Revista Soc. Boliv. Bot.* 4:35. 2003.

Comparettia ottonis (Klotzsch) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus ottonis* Klotzsch, *Allg. Gartenzeitung* 9:261. 1841.

Comparettia pacensia (Senghas and Lef.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus pacensium* Senghas and Lef., *Orquideologia* 19:8. 1994.

Comparettia palatina (Senghas, Lang and Kast) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus palatinus* Senghas, Lang and Kast, *J. Orchideenfr.* 9:28. 2002.

Comparettia paniculata (C. Schweinf.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria paniculata* C. Schweinf., *Bot. Mus. Leafl.* 12:190. 1946.

Comparettia papillosa (D.E. Benn. and Christenson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *papillosa* D.E. Benn. and Christenson, *Icon. Orchid. Peruv.*: t. 520. 1998.

Comparettia paraguaensis (Garay and Dunst.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus paraguaensis* Garay and Dunst., *Venez. Orchids Ill.* 5:267. 1972.

Comparettia penduliflora (Senghas and Thiv) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria penduliflora* Senghas and Thiv, *Caesiana* 10:25. 1998.

Comparettia peruvioides M.W. Chase and N.H. Williams, **nom. nov.**; synonym: *Neokoehleria peruviana* Schltr., *Repert. Spec. Nov. Regni Veg.* 10:391. 1912. In *Comparettia*, this epithet is occupied by *C. peruviana* Schltr.

Comparettia portillae (Königer) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus portillae* Königer, *Arcula* 7:214. 1997.

Comparettia rauhii (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria rauhii* Senghas, *Orchidee* (Hamburg) 19:125. 1968.

Comparettia romansii (Dodson and Garay) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus romansii* Dodson and Garay, *Icon. Pl. Trop.* 5:t. 486. 1982.

Comparettia rubriflora (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus rubriflorus* Senghas, *Orchidee* (Hamburg) 38:120. 1987.

Comparettia schaeferi (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Pfitzeria schaeferi* Senghas, *J. Orchideenfr.* 5:30. 1998.

Comparettia seegeri (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus seegeri* Senghas, *Orchideen* (Senghas):172. 1993.

Comparettia serrilabia (C. Schweinf.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus serrilabius* C. Schweinf., *Fieldiana, Bot.* 33:70. 1970.

Comparettia sillarensis (Dodson and R. Vásquez) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus sillarensis* Dodson and R. Vásquez, *Icon. Pl. Trop.*, II, 4:t. 372. 1989.

Comparettia stenochila (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Rodriguezia stenochila* Lindl., *Orchid. Linden.*:23. 1846.

Comparettia thivii (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria thivii* Senghas, *Caesiana* 10:25. 1998.

Comparettia topoana (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus topoanus* Dodson, *Orquideologia* 21:12. 1998.

Comparettia tuerckheimii (Schltr.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus tuerckheimii* Schltr., *Repert. Spec. Nov. Regni Veg.* 10:252. 1911.

Comparettia tungurahuae (Dodson) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus tungurahuae* Dodson, *Selbyana* 7:356. 1984.

Comparettia variegata (Cogn.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochilus variegatus* Cogn., *J. Orchidees* 6:268. 1895.

Comparettia vasquezii (Dodson and M.W. Chase) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Scelochiloides vasquezii* Dodson and M.W. Chase, *Icon. Pl. Trop.*, II, 3:t. 293. 1989.

Comparettia williamsii (Dodson) M.W. Chase and N.H.

Williams, **comb. nov.**; basionym: *Scelochilus williamsii* Dodson, *Icon. Pl. Trop.*, II, 6:t. 581. 1989.

Comparettia wuerstlei (Senghas) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Neokoehleria wuerstlei* Senghas, *Orchidee* (Hamburg) 41:19. 1990.

CUITLAUZINA — The concept of *Cuitlauzina* has changed dramatically in the past 50 years (Fig. 3). It was considered a synonym of *Odontoglossum* for a long time, but then the process of paring down the limits of that genus began, and it was resurrected. A close relationship to *Palumbina* and *Osmoglossum* had been noted, and those species were moved to *Cuitlauzina* by Dressler and Williams (2003). These transfers have been corroborated by analyses of DNA sequences. One name was untransferred, which has been done here. *Dignathe* has been shown by Sosa *et al.* (2001) to be embedded in *Cuitlauzina*, so we transfer it here also. It is merely a small version of this group, which prevented its relationship from being recognized.

Cuitlauzina Generic Synonymy

Cuitlauzina Lex., in P. de La Llave and J.M. de Lexarza, *Nov. Veg. Desc.*, 2 (Orchid. Opusc.):32. 1825. Type species: *Cuitlauzina pendula* Lex.

Dignathe Lindl., *J. Hort. Soc.* 5:268. 1849. Type species: *Dignathe pygmaea* Lindl.

Lichterveldia Lem., *Illustr. Hortic.* 2:t. 59. 1855. Type species: *Lichterveldia lindleyi* Lem. (= *C. pendula*)

Palumbina Rchb.f., *Ann. Bot. Syst.* 6:699. 1861. Type species: *Palumbina candida* Rchb.f.

Osmoglossum Schltr., *Orchis*, 10:162. 1916. Type species: *Osmoglossum pulchellum* (Bateman) Schltr. (basionym: *Odontoglossum pulchellum* Bateman ex Lindl.)

Name Transfers to *Cuitlauzina*

Cuitlauzina panduratum (Garay) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Osmoglossum panduratum* Garay, *Bot. Mus. Leaf.* 26:29. 1978.

Cuitlauzina pygmaea (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basionym: *Dignathe pygmaea* Lindl., *J. Hort. Soc. London* 4:268. 1849.

ROSSIOGLOSSUM — The genus *Rossioglossum* is another fairly recent segregate of *Odontoglossum*, but DNA analyses have established that *Ticoglossum* and *Oncidium ampliatum* Lindl. are closely related to it (Fig. 4A–B). *Chelyorchis* was erected recently for the latter species (Dressler and Williams, 2003), but it shares with *Rossioglossum* a similar number of chromosomes ($2n = 44$) and general habit (although it becomes much larger than the other species in *Rossioglossum*). Florally, these species do not accord well with *Rossioglossum*, but all of these species are generally similar, and their differences are probably due



Fig. 4A–B. Like *Cuitlauzina*, the species of *Rossioglossum* were once included in *Odontoglossum*, but they too differ in floral characteristics and chromosome numbers. DNA studies have demonstrated that other genera such as *Ticoglossum* and *Chelyorchis* (*Oncidium ampliatum*) also should be transferred to *Rossioglossum*. A. *Rossioglossum schlieperianum*. Photograph by Mark Chase. B. *Rossioglossum* (*Ticoglossum*) *krameri*.

Photograph by Mark Chase

to shifts in pollinators. *Oncidium ampliatum* is clearly a case of oil-bee pollination, which is what defines most species of *Oncidium*, but most species in *Rossioglossum* have a tabula infrastigmatica on the base of the column; this structure is part of the oil-bee pollination syndrome, which is typical of *Oncidium*. *Chelyorchis* could be maintained, but monotypic genera should be avoided unless clearly no other choices, which is not the case here.

Rossioglossum Generic Synonymy

Rossioglossum (Schltr.) Garay and G.C. Kenn., *OrchidDig.* 40:139. 1976. Type species: *Rossioglossum grande* (Lindl.) Garay and G.C. Kenn. (basonym: *Odontoglossum grande* Lindl.)

Ticoglossum Lucas Rodr. ex Halb., *Orquídea* (MexicoCity) 9:4. 1983. Type species: *Ticoglossum krameri* (Rchb.f.)Halb. (basonym: *Odontoglossum krameri* Rchb.f.)

Chelyorchis Dressler and N.H. Williams in Romero and Carnevali, *Orchids Venezuela*, ed. 2:1130. 2000. Type species: *Chelyorchis ampliata* (Lindl.) Dressler and N.H. Williams (basonym: *Oncidium ampliatum* Lindl.)

Name Transfers to *Rossioglossum*

Rossioglossum ampliatum (Lindl.) M.W. Chase and N.H. Williams, **comb. nov.**; basonym: *Oncidium ampliatum* Lindl., *Gen. Sp. Orchid. Pl.*:202. 1833. ***Rossioglossum krameri*** (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basonym: *Odontoglossum krameri* Rchb.f., *Gard. Chron.* 1868:98. 1868.

Rossioglossum oerstedii (Rchb.f.) M.W. Chase and N.H. Williams, **comb. nov.**; basonym: *Odontoglossum oerstedii* Rchb.f., *Bonplandia* (Hannover) 3:214. 1855.

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Williams, N.H., M.W. Chase and W.M. Whitten. 2001b. Phylogenetic positions of *Milioniopsis*, *Caucaea*, a new genus, *Cyrtochiloides*, and *Oncidium phymatochilum* (Orchidaceae: Oncidiinae) based on nuclear and plastid DNA data. *Lindleyana* 16:272–285.

THE RESTORATION OF A MONOPHYLETIC *ODONTOGLOSSUM*

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Introduction

Many attempts have been made by various authors to solve the complicated taxonomy in Oncidiinae in general and to delineate the genus *Odontoglossum* Kunth in particular, but without lasting or entirely convincing results; Kunth (1815), Lindley (1852), Beer (1854), Pfitzer (1888), Bockemühl (1984, 1989), Chase *et al.* (2008), Pridgeon *et al.* (2009), Neubig (2012), and Kolanowska & Szlachetko (2016). Traditionally, taxonomists have focused on a few morphologic features, generally associated with some flower details, particularly the angle between the column and the lip. Species with similar looking flowers, with regards to the chosen important taxonomic features favored at the time, have ended up in the same genus despite displaying many different-looking features otherwise, such as vegetative and micro-morphologic structures. Since molecular research focusing on DNA sequencing arrived on the scene as an additional tool to work with, we realized that vegetative features are important in revealing close or distant relationships. Also, micromorphology has an important role to play here, while flower color, fragrance and general shape can be misleading and appear to be deceptive adaptations to attract available pollinators.

Phylogenetic systematics produces a set of evolutionary relationships that is presented as a branching tree (Fig.1). A phylogenetic tree is a hypothesis regarding the evolutionary relationships of a group of organisms. The limitation of phylogenetics is that it only produces relationships. Taxonomy, on the other hand, deals with the classification, identification, and naming of organisms based on available knowledge about relationships. Although classification is subjective (subject to biases and prejudices), it is important since it allows scientists to identify, group, and properly name organisms based on consistent similarities found in the organisms. Current taxonomic

thinking is that all taxa should be monophyletic, i.e., natural groups. That means that all descendents of a common ancestor must be included into the group (regardless of taxonomic level). The authors of this paper are in favor of maintaining a user-friendly and visually workable taxonomic classification.

When Chase and others (2008) transferred orchid genera *Cochlioda* Lindl., *Odontoglossum* Kunth, *Sigmatostalix* Rchb.f., and *Solenidiopsis* Senghas into *Oncidium* Sw., based on their molecular research a rather strange situation developed, seen from a taxonomic point of view. Many plants with very different vegetative features as well as floral features ended up in the same genus, together with some members of what clearly belong to the genus *Cyrtochilum* Kunth, such as “*Odm.*” *contaypacchaense* D.E.Benn. & Christenson, “*Odm.*” *machupicchuense* D.E.Benn. & Christenson, “*Odm.*” *pseudomelanthes* D.E.Benn. & Christenson and “*Odm.*” *rubrocallosum* D.E.Benn. & Christenson. In fact, even without these mistakenly transferred *Cyrtochilum* species, the members of the generously extended *Oncidium* (sensu Chase *et al.*) are so different from each other that it becomes virtually impossible to visually define the genus *Oncidium* and to separate it from many other genera in the Oncidiinae. Therefore, some of the arguments used by Chase *et al.* (2008, 2009) and later Neubig *et al.* (2012) to justify this transfer need to be re-addressed.

“If *Odontoglossum* is to be maintained as a distinct genus, then many more genera will need to be created or some long-known species with typical *Oncidium* floral morphology (e.g., *O. chrysomorphum* Lindl., *O. obryzatum* Rchb.f.) will have to be transferred into *Odontoglossum*, which removes any hope of morphological distinctiveness for *Odontoglossum*.” (Chase *et al.*, 2008).

No additional new names are needed to maintain *Odontoglossum* as a distinct genus once the florally

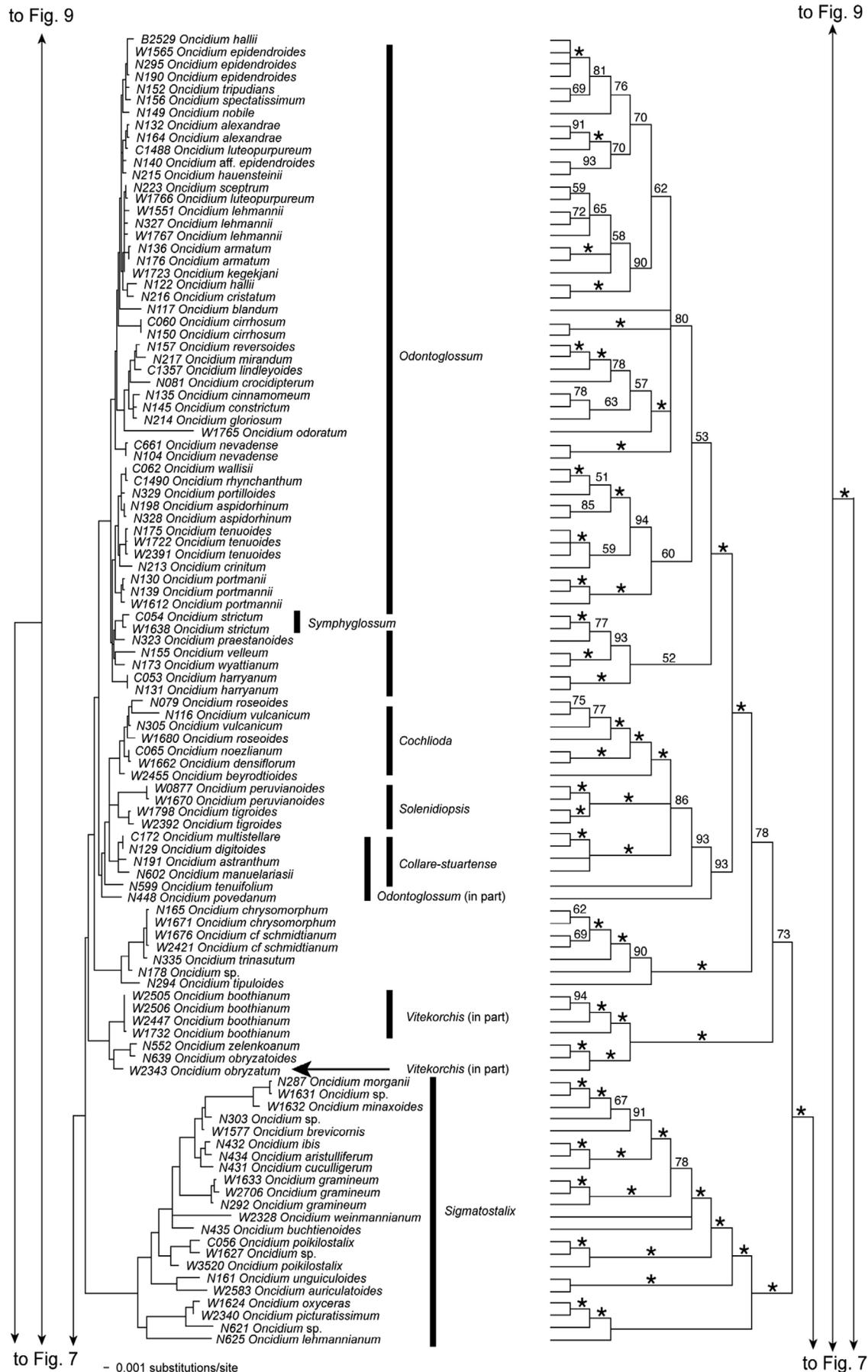


Figure 1: *Odontoglossum* portion (Fig.8) of Oncidiinae phylogeny from Neubig Figures 1–12 (Neubig et al. 2012).

Oncidium-looking but vegetatively *Odontoglossum*-looking “*chrysomorphum*” and “*obryzatum*” [= *Odm. pictum* (Kunth) Dalström & W.E.Higgins], complexes were transferred into *Odontoglossum* (Dalström & Higgins, 2016). This is clearly a more conservative and stabilizing alternative than lumping everything into *Oncidium*, which will effectively eliminate any possibility to distinguish it as a genus.

“After these changes [the removal of many *Cyrtorchilum* species from *Odontoglossum* by Dalström (2001a)], there still remains a core group of *Odontoglossum* species that DNA studies have indicated are monophyletic, but these are deeply embedded in *Oncidium*.” (Chase et al., 2008).

By studying the “...single maximum likelihood tree resulting from analysis of the combined five-region data set for 736 individuals” (Fig.1 in this article, and Fig. 8 in Neubig et al. 2012). We can see that an extended *Odontoglossum* is not actually “deeply embedded” in *Oncidium* at all, but a monophyletic sister-group to *Sigmatostalix*, and these two genera together form a monophyletic sister-group to *Oncidium (sensu stricto)*, even when the latter includes other distinguishable and monophyletic groups that have been described as separate genera, such as *Heteranthocidium* Szlach., Mytnik & Romowicz, and *Chamaeleorchis* Senghas & Lückel.

“In addition, *Cochlioda* Lindl. and *Symphyglossum* [as “*Symphyloglossum*”] Schltr., are hummingbird-pollinated species of *Oncidium* and also deeply imbedded in *Oncidium/Odontoglossum*, so these too are transferred.” (Chase et al., 2008).

Symphyglossum sanguineum (Rchb.f.) Schltr., as the sole species from that genus was transferred to *Odontoglossum* in 2001 based on molecular evidence and morphologic features and is not deeply

embedded in *Oncidium (sensu stricto)*. It is, however, deeply embedded in the monophyletic and extended *Odontoglossum* (Dalström 2001b, 2012; Dalström & Higgins, 2016). The other former *Symphyglossum* species; *S. distans* (Rchb.f.) Garay & Dunsterv., and *S. umbrosum* (Rchb.f.) Garay & Dunsterv., belong in *Cyrtorchilum* (Dalström, 2001a). Whether *Odm. sanguineum* is hummingbird pollinated or not is probably pure speculation. We are not aware of any scientific documentation for this phenomenon.

“We feel that it is better to use vegetative features in combination with few floral traits to define broader genera... *Oncidium* is perhaps the best example of our contention that floral morphology must be foregone in Oncidiinae as a basis for generic Characters... Floral traits in Oncidiinae are highly plastic and reflect evolutionary shifts in pollinators.” (Neubig et al., 2012).

Odontoglossum is a distinct and monophyletic genus even when it includes the florally *Oncidium*-looking but vegetatively *Odontoglossum*-looking “*chrysomorphum*” and “*pictum*” complexes. What DNA research has taught us is that flower morphology is not entirely reliable as the sole basis for taxonomic decisions, but vegetative features are, particularly

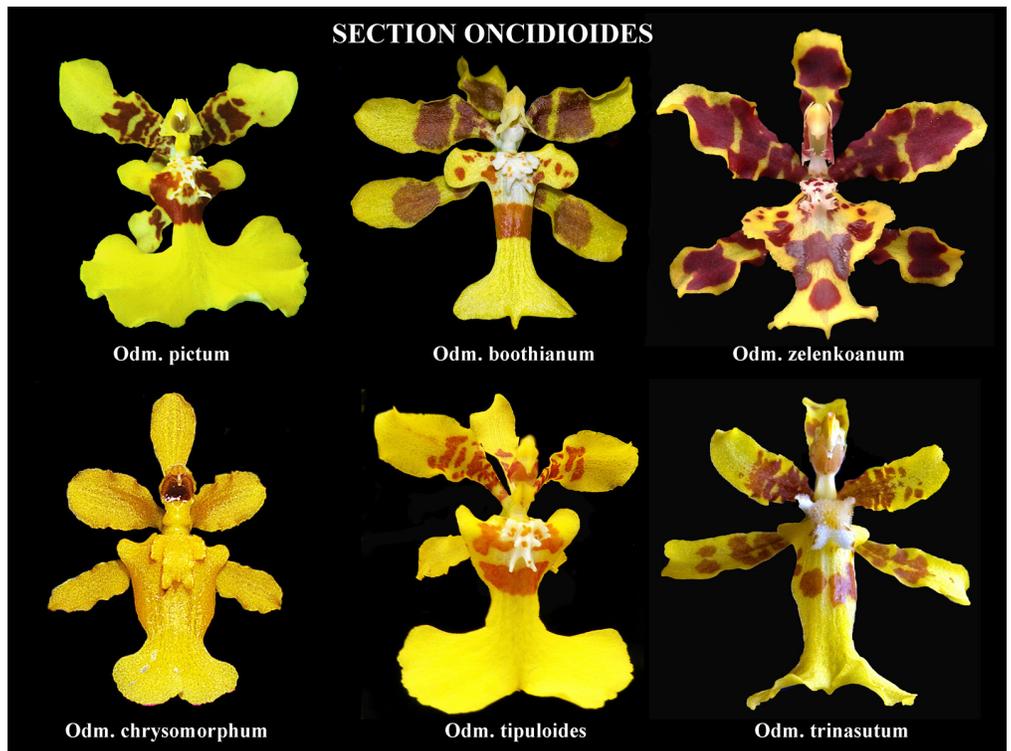


Figure 2: Members of Section *Oncidioides* in genus *Odontoglossum*. Photos by Guido Deburghgraeve, compiled by Stig Dalström

when combined with molecular evidence, flower morphology and any other available traits.

The species in the “*chrysomorphum*” and “*pictum*” complexes (Fig.2) were recently transferred to *Odontoglossum* (Dalström & Higgins, 2016) because they share more vegetative and molecular features with other species in that genus than with members of *Oncidium* (*sensu stricto*). They have simply switched to different pollination syndromes and therefore form a separate group within the genus, just like the “*Cochlioda* group” and the “*Solenidiopsis* group”. The “when” and “why” this switch took place are unknown of course, but some indications suggest that ancient hybridization between members of genus *Heteranthocidium* (the “*Oncidium heteranthum* Poepp. & Endl., complex”) and some *Odontoglossum* species may have taken place. Members of both genera are frequently sympatric in the upper Andean region and flower simultaneously, where few *Oncidium* (*sensu stricto*) species occur. The species in the “*chrysomorphum*” and “*pictum*” complexes display features from both *Heteranthocidium* and *Odontoglossum*. They sometimes, but apparently not always, produce abortive flowers. The flowers in general and the pollination apparatus in particular, are very similar to *Heteranthocidium* flowers, with an elongate, elephant trunk-like rostellum and very narrow stipe on a minute ovoid viscidium. The inflorescence shapes are similar to some *Heteranthocidium* species, but the glossy, strongly flattened and generally purple-mottled pseudobulbs are common *Odontoglossum* characteristics. Members of the “*chrysomorphum*” and “*pictum*” complexes are also characterized by having strictly unifoliate pseudobulbs (with very few exceptions), which makes them easily identified as a group even without flowers or on a herbarium sheet (Fig.3). These hybridization speculations may seem far-fetched at first, but we need to keep in mind that natural hybridization in *Odontoglossum* (Rolfe, 1893) is quite common and may be a much more active factor in the speciation process than we previously have acknowledged.

When the “DNA tree” of Neubig *et al.* is redrawn in a more artistic way (Fig. 4), it makes it easier to ex-



Figure 3: *Odontoglossum boothianum* displaying typical generic features such as glossy, unifoliate and purple-mottled pseudobulbs. Photo by Stig Dalström.

amine the *Odontoglossum s.l.* clade. So, while examining the phylogenetic relationships in this tree, the task is to set the limits of the genus. Draw the line too low and the genus becomes unrecognizable; draw the line too high creates multiple very similar genera, which are also difficult to work with. The art of classification is finding that sweet spot; not too large or small. This results in an intuitive classification based on observable morphological features supported by molecular evidence.

In conclusion, it is evident that the arguments presented by Chase *et al.*, for transferring *Cochlioda*, *Collare-stuartense*, *Solenidiopsis*, *Symphyglossum* and *Sigmatostalix* into *Oncidium* are not only weak but also misleading and unconvincing. We therefore argue that a taxonomic restoration of the genus *Odontoglossum* in a slightly extended form is necessary and presents a more accurate and user-friendly classification.

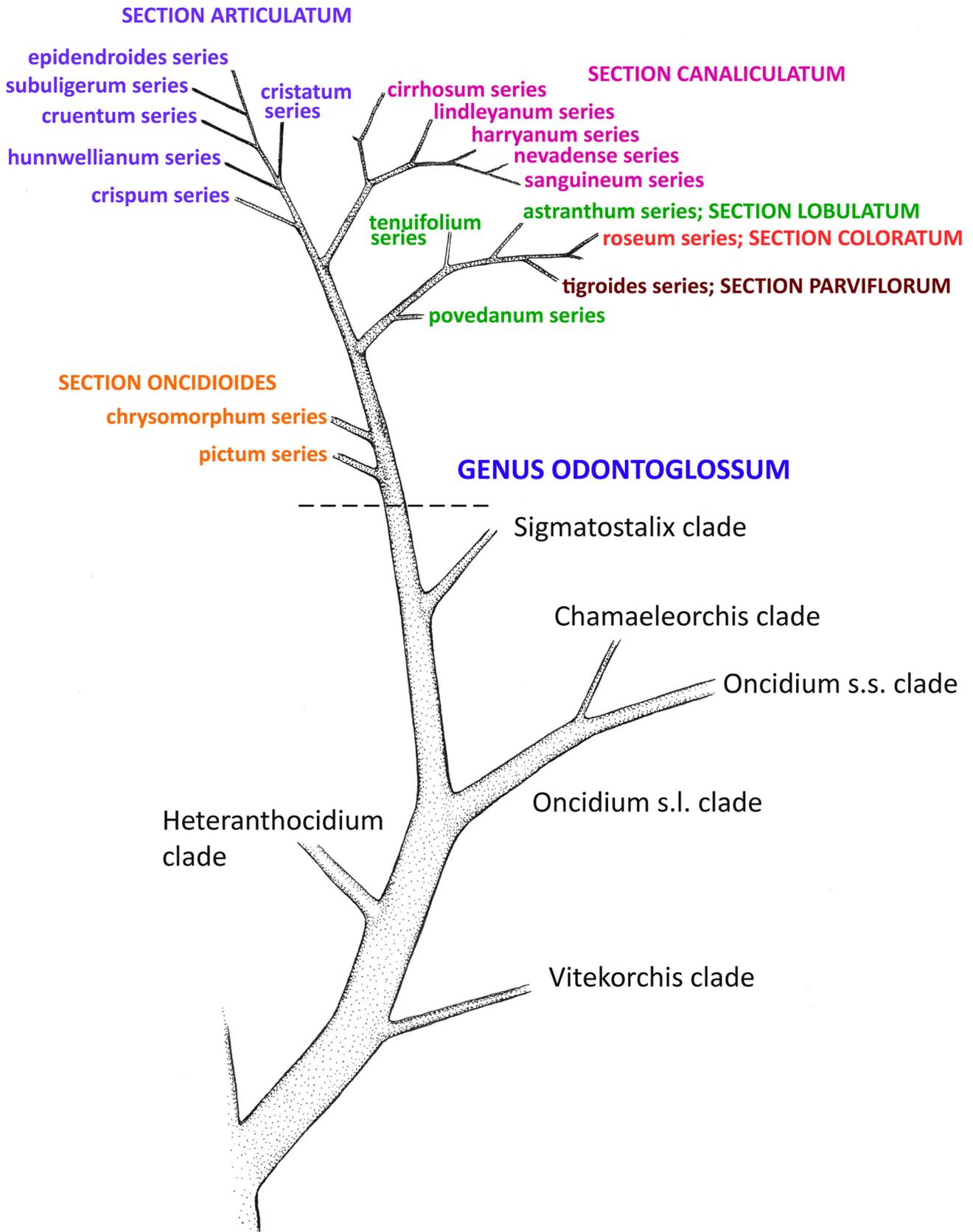


Figure 4: Artistic rendition of the Neubig et al., phylogenetic tree seen in Figure 1.

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Problems with generic delimitation in the *Odontoglossum* complex (Orchidaceae, Oncidiinae) and an attempt for a solution

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Abstract Concepts of the generic delimitation in the *Odontoglossum* complex are revised. Comparative morphology of previously recognized genera: *Cochlioda*, *Collare-stuartense*, *Odontoglossum*, *Solenidiopsis*, and *Symphyglossum* is presented. Differences between those taxa are compared with the results of molecular studies. A new combination within *Collare-stuartense* is proposed.

Keywords *Collare-stuartense* · Neotropics · *Odontoglossum* · *Symphyglossum* · Taxonomy

Introduction

The Neotropical genus *Odontoglossum* (Orchidaceae, Oncidiinae) was described by Carl Kunth in 1815 based on the plant collected by Humboldt and Bonpland in southern Ecuador. The author found this orchid similar to *Epidendrum* L., but with the gynostemium apically free from the lip, and named it *O. epidendroides* (Kunth 1815). Thirty-five years after formal description of the genus, about 70 names have already been linked with *Odontoglossum*. In the mid-XIX century, Lindley (1852) divided the genus into six sections based on the form of column appendages and clinandrium, the type of connation between lip and gynostemium, and the presence or lack of sepals fusion. Many of the species considered by Lindley as

representatives of *Odontoglossum* were later transferred to different genera, e.g., *Oncidium* Sw., *Cyrtochilum* Kunth., *Cochlioda* Lindl., *Osmoglossum* (Schltr.) Schltr., and *Otoglossum* (Schltr.) Garay & Dunst. The second major revision of the genus *Odontoglossum* was presented by Pfitzer (1888) who recognized eight sections including two adopted from Lindley. Also, orchids included by Pfitzer in the genus are currently comprised in other taxa, e.g., *Rossioglossum* (Schltr.) Garay & G.C.Kenn., *Miltonioides* Brieger & Lückel, and *Rhynchostele* Rchb.f. The most recent infrageneric classification of *Odontoglossum* was proposed by Bockemühl (1984, 1989) who accepted 58 species, which were embraced in six subgenera: nominal one, *Serratolaminata*, *Lindleyana*, *Erectolobata*, *Nevadensia*, and *Unguisepala*. Those taxa are distinguishable based on the form of lip-column adnation, shape of the lip base as well as anther and rostellum structure.

Pfitzer (1887) included *Odontoglossum* together with inter alia (“among others”) (i.a.) *Oncidium*, *Miltonia* Lindl., *Brassia* R.Br., *Solenidium* Lindl., *Sigmatostalix* Rchb.f., and *Gomesa* R.Br. in the subtribe Odontoglosseae (orig. orth.), and in all subsequent classification systems the genus was placed within Oncidiinae (Dressler 1993; Szlachetko 1995; Chase et al. 2003). Chase et al. (2008) decided to merge *Odontoglossum* together with i.a. *Symphyglossum* Schltr., *Cochlioda*, *Solenidiopsis* Senghas, *Collare-stuartense* Senghas & Bockemühl, *Chamaeleorchis* Senghas & Lückel, *Miltonioides*, *Mexicoa* Garay, and *Sigmatostalix* under *Oncidium*. In the phylogenetic tree presented by Neubig et al. (2012), species of *Oncidium* sensu Chase et al. (2008) form several clades. The first one that includes *Oncidium* s.s. is grouped along with *Miltonioides*, *Mexicoa*, *Vitekorchis* Romowicz & Szlach. p.p., *Chamaeleorchis*, and *Heteranthocidium* Szlach., Mytnik & Romowicz. The second embraces representatives of

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Odontoglossum and *Symphyglossum*, and it is sister to the clade composed of *Cochlioda*, *Solenidiopsis*, and *Collare-stuartense*. This large group is related to several species of *Oncidium* s.s. and *Vitekorchis* p.p. Lastly, sister to the above *Oncidium* s.l. there is a clade formed by representatives of *Sigmatostalix*. Neubig et al. (2012) stated that the recognition of these segregated genera “would require creation of many new genera to maintain monophyly, and these new genera would be difficult to diagnose using floral or vegetative traits,” and they suggested to keep monophyletic *Oncidium* clade as a single genus. Neubig et al. (2012) stated “that it is better to use vegetative features in combination with a few floral traits to define broader genera. The molecular analyses demonstrate the high levels of homoplasy in pollinator-related traits.” Unfortunately, the authors did not provide any vegetative character distinguishing *Oncidium* sensu latissimo from other clades of Oncidiinae. Our extensive examination of large number of representatives of this clade, both conserved and living specimens, has not identified such characters.

In the Neubig et al.’s (2012) approach, *Oncidium* includes over 500 species and it is not possible to define in terms of morphology only. The case of *Paphiopedilum* Pfitzer and *Phragmipedium* Rolfe is a good illustration of an analogous situation. Albert and Pettersson (1994) based on the results of a molecular study proposed lumping both genera under the priority name *Paphiopedilum*. The subsequent, well-sampled genetic research did not support this proposal (e.g., Cox et al. 1997), and the morphological-based generic delimitation within cypripedioid orchids is

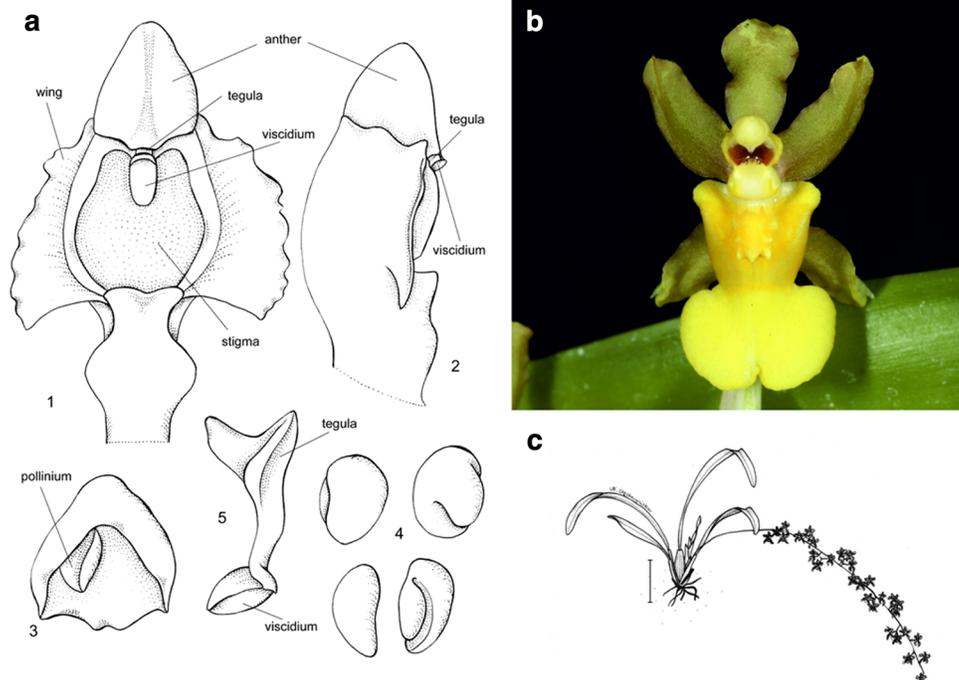
widely accepted. The other case is the subtribe Pleurothallidinae which is also monophyletic and was broken up into some major clades (Pridgeon et al. 2001). Few, however, propose resurrection of *Pleurothallis* s.l. or *Masdevallia* s.l. and smaller, but morphologically well-defined, genera, e.g., *Dracula* Luer, which gained general acceptance.

The arguments quoted by Neubig et al. (2012) can be equally well exploited to support fragmentation of *Oncidium* sensu latissimo and segregation of smaller genera. *Oncidium* according to the concept proposed by the aforementioned authors is exactly “difficult to diagnose using floral or vegetative traits”. Both groups (*Oncidium* and *Odontoglossum*) are distinguishable by i.a. the lip position (basal part perpendicular to the column in *Oncidium*), viscidium size, and viscidium/tegula ratio. Separation of *Oncidium* (Fig. 1) and *Odontoglossum* was also suggested by Dalström (2012); however, so far none of the modern taxonomists presented results of comprehensive morphological study supporting this segregation. The aim of our study is to evaluate morphological differences within taxa of *Odontoglossum* complex taking into account the outcomes of molecular phylogenetic studies.

Materials and methods

A total of over 5000 herbarium and liquid-preserved specimens of orchids representing *Oncidium* s.l., *Odontoglossum* s.l., and related oncidoid genera deposited in AMES, AMO, B, BM, C, COL, CUVC, F, FLAS, HUA, JAUM,

Fig. 1 a Gynostemium of *Oncidium altissimum* (Jacq.) Sw. 1 Gynostemium, bottom view; 2 gynostemium, side view; 3 anther; 4 pollinia, various views; 5 tegula and viscidium (Szlachetko and Mytnik-Ejsmont 2009). b Flower of *Oncidium chrysomorphum* Lindl. Photo by T. Kusibab. c *Oncidium niesseniae*—habit. Scale bar 5 cm. Redrawn by N. Olędzzyńska from Königer (1996)



K, MO, NY, P, PMA, RPSC, UGDA, VALLE, and W (Thiers 2015) were examined according to the standard procedures. Every studied specimen was photographed and the data from the labels were taken. Both vegetative and generative characters of each plant were examined. The shape and size of the pseudobulbs and leaves were examined first. Then inflorescence architecture and the shape and size of the floral bracts were studied. Finally, flower morphology was examined after its softening in boiling water.

Results

Morphological data

The studies revealed differences between examined taxa in both their vegetative and floral characters. Only *Symphyglossum* and *Odontoglossum tenuifolium* produce aggregated pseudobulbs. The inflorescence is produced from the bases of the pseudobulbs (*Odontoglossum* s.s., *O. tenuifolium*) or from the axil of the upper leaf-sheath. With the exception of *Solenidiopsis*, flowers of the studied orchids are resupinate. Connate lateral sepals are always observed in *Symphyglossum* and *O. tenuifolium*, while in *Odontoglossum* s.s. they are sometimes, at the most, shortly connate. Sepals and petals of other genera are free. The differences are also observed in the adnation of the basal lip portion with gynostemium, lip callus structure, and shape and size of the gynostemium appendages as well as clinandrium and tegula form. The comparative morphology of the analyzed taxa is presented in Table 1.

Molecular data

In the phylogenetic tree presented by Neubig et al. (2012), clade “*Odontoglossum*” is weakly supported and a polytomy is observed in one of the subclades (Fig. 2—subclade A). The same situation is observed in the analysis that included exclusively plastid regions (Fig. 3 in Neubig et al. 2012). *Odontoglossum hallii* Lindl. appears in two different branches of the tree provided by Neubig et al. (2012)—most probably due to incorrect identification of the samples. The representatives of previously recognized subgenera of *Odontoglossum* seem not to be closely related.

The following subclades can be distinguished in the *Odontoglossum* clade (Fig. 2):

- *Odontoglossum* s.s. intermixed with a single species of *Symphyglossum*, *S. sanguineum* (Rchb.f.) Schltr. (= *Oncidium strictum* (Cogn.) M.W.Chase & N.H. Williams), included in the analysis. It appears to be closely related to representatives of *Odontoglossum* subgen. *Nevadensis* and *O. praestanoides* (Fig. 2—subclade A).

Table 1 Comparative morphology of *Odontoglossum* s.s., *Symphyglossum*, *Cochlioda*, *Solenidiopsis*, and *Collare-stuartense*

	<i>Odontoglossum</i> s.s.		<i>Symphyglossum</i>	<i>Cochlioda</i>	<i>Solenidiopsis</i>	<i>Collare-stuartense</i>
Pseudobulbs	Approximate		Aggregated	Approximate	Approximate	Approximate
Apical leaves	1–3		2	1–2	1–3	1–2
Flowers	Resupinate		Resupinate	Resupinate	Non-resupinate	Resupinate
Sepals and petals	Usually free		Lateral sepals connate to about the middle, petals adnate to the gynostemium	Free	Free	Free
Lip	Continuous with the base of the gynostemium		Basally adnate to the gynostemium	United with the gynostemium down the middle	Fused to the base of gynostemium through a short, central keel	Free from the gynostemium
Lip callus	Variably cristate, denticulate, lamellate		A pair of plates at the base of lip free part	Two pairs of diverging lamellae	Two pairs of diverging lamellae	Several short, diverging lamellae
Gynostemium	Obscurely winged near the stigma, or with various appendages near or just above the stigma		Winged near the stigma	Obscurely winged near the stigma	With prominent wings on both anther sides	Obscurely winged near the stigma, with two digitate projections just below the stigma
Column part	1.5–3.5 times longer than the anther		Twice as long as the anther	5 times longer than the anther	3 times longer than the anther	2.5 times longer than the anther
Clinandrium	Narrow		Narrow	Prominent	Obscure	Prominent
Tegula	Oblong		Oblong	Obtriangular-obovate	Oblong, pocket-like at apex	Linear, forming narrowly triangular projection

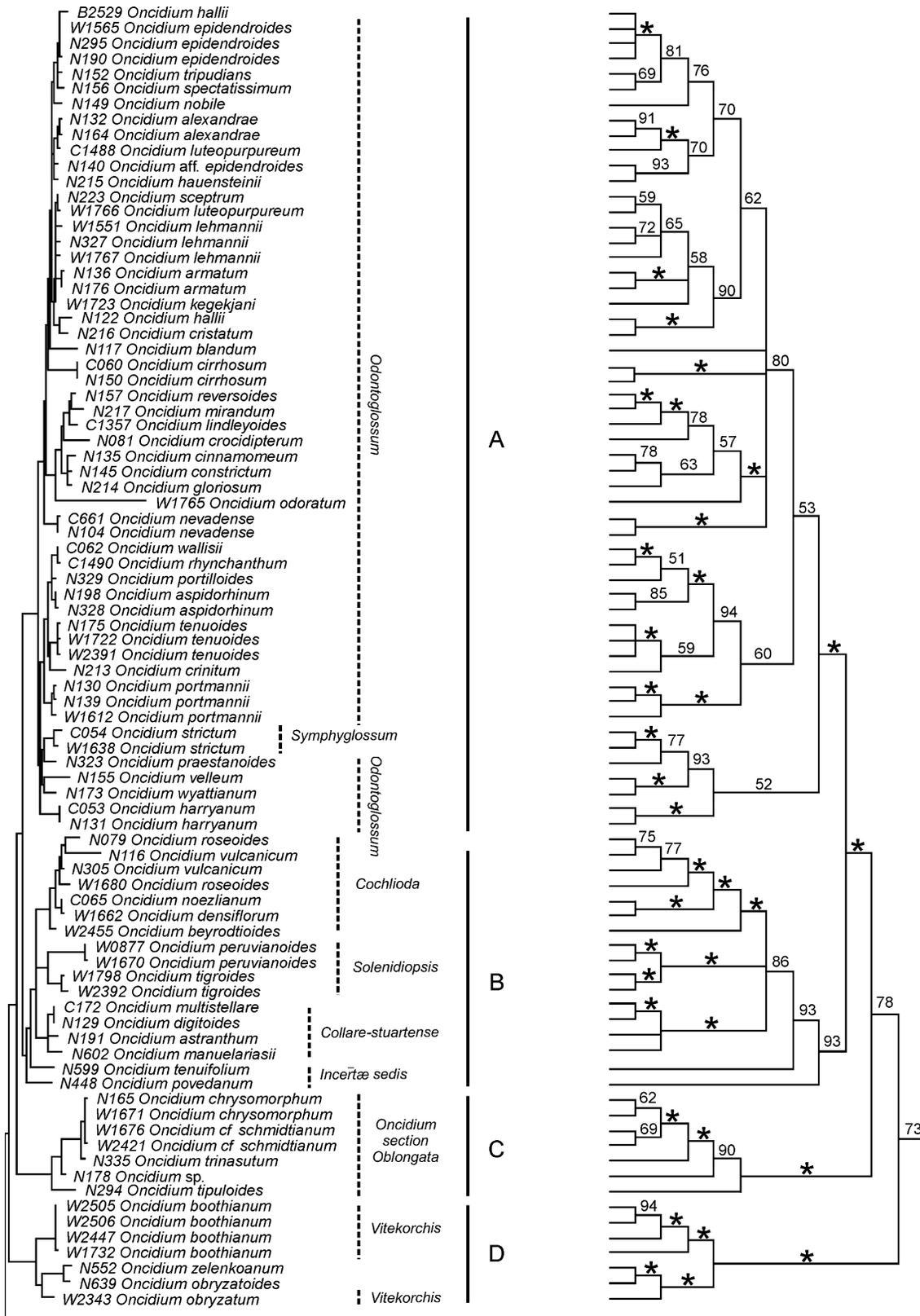


Fig. 2 Tree on the left side of the figure is a fragment of single maximum likelihood tree presented by Neubig et al. (2012, their Fig. 8, p 130). The tree on the right side of the figure displays bootstrap (BS) support >50 %; asterisks indicate 95–100 % BS support



Fig. 3 a Gynostemium of *Cochlioda vulcanica* (Rchb.f.) Benth. & Hook.f. ex B.D.Jacks. 1 Gynostemium apical part, side view; 2 gynostemium, apical part, bottom view; 3 anther, back view; 4 pollinia, various views; 5 tegula and viscidium, various views

(Szlachetko and Mytnik-Ejsmont 2009). b Flower of *Cochlioda noezliana* (Mast. ex L.Linden) Rolfe. Photo by Guido Deburghgraeve. c *Cochlioda densiflora*—habit. Scale bar 5 cm. Redrawn by N. Ołędryńska from Bennett and Christenson (1998)

- The second subclade (Fig. 2—subclade B) composed of representatives of *Cochlioda*, *Solenidiopsis*, and *Collare-stuartense* is well separated from *Odontoglossum*–*Symphyglossum* subclade. Most of the known species of *Cochlioda*, both known taxa of *Solenidiopsis*, and four of about seven *Collare-stuartense* species were included in the genetic studies (Neubig et al. 2012). The three genera form a distinct group in the phylogenetic tree. *Odontoglossum tenuifolium* and *O. povedanum* successively are sisters to other representatives of this subclade.
- The third subclade (Fig. 2—subclade C) includes *Oncidium chrysomorphum* Lindl., *O. schmidtianum* Rchb.f., *O. trinasutum* Kraenzl., and *O. tipuloides* Rchb.f.
- The fourth subclade (Fig. 2—subclade D) embraces *Oncidium boothianum* Rchb.f., *O. obryzatum* Rchb.f., *O. obryzatoides* Kraenzl., and *O. zelenkoanum* Dressler & Pupulin, i.e., species classified by taxonomists in the genus *Oncidium*.

Discussion

As highlighted by Hillis (1987) a primary objective of phylogenetic studies is to reconstruct the evolutionary history of organisms on the basis of the analysis of their

genomes. Since the organisms under study share a single history, “systematic studies of any set of genetically determined characters should be congruent with other such studies based on different sets of characters”. Phylogenetic relationships could be sometimes incongruent with taxonomic classifications based on morphological data. The disadvantage of the first type of analysis is the difficulty for taxonomists to verify species identification of the sampled taxa in the molecular study, while the problem associated with the second method is the occurrence of convergence and the possibility of misidentification of some diagnostic features. Hereby, the optimal approach would be to use both morphological and molecular data, which is what we are intending to do in this paper.

All species of the first subclade (A) of *Odontoglossum* s.l. mentioned in the previous section, i.e., *Odontoglossum* s.s., except *Symphyglossum* can be characterized by a series of common characters. The lip is divided into two parts. The basal one is channel formed and parallel with the gynostemium, and the apical part is bent in a knee-like manner, thereby perpendicular to the lower one. The apical part is geniculate, denticulate, and undulate along margins, and at the base of lamina adorned with various, usually horn-like to digitate projections showing a complex pattern. Other segments of the flower are usually subsimilar, narrower than lip, and undulate along margins. The gynostemium is erect or gently arched, stout, narrowly

alate along the column part and terminated with digitate or fringed projections on both sides of the rostellum. The basal part of the gynostemium is variously fused with the lip. *Symphyglossum* is a genus of two species, of which only *S. sanguineum* was represented in Neubig et al.'s (2012) analyses. The species is embedded in *Odontoglossum* subclade (A), but differs from all other species of the group in having simple lip callus consisting of two keels running from the lip center toward the gynostemium, hence forming a channel, basally connate lateral sepals, and gynostemium devoid of any projections. These modifications in the lip and gynostemium structure could eventually evolve under pollinator pressure, in this case hummingbirds (cf. Stpiczyńska and Davies 2006).

Shared characters for the second subclade (B) are rather difficult to identify. In all species of this subclade sampled in the phylogenetic tree (Fig. 2), the column part is prominently alate. Apical clinandrium is well developed and usually forms a prominent collar at the back and sides of the anther. The gynostemium is connate in the lower part with the lip along midvein in species of *Cochlioda* and *Collare-stuartense*. The stigmatic surface is divided into two parts by a strongly hook-bent rostellum in both *Cochlioda* and *Solenidiopsis* (cf. Szlachetko and Mytnik-Ejsmont 2009; Dalström 1999, 2001). This last character is missing in all the other species of this subclade (B). In general, however, there are more characters which differentiate alliances of the species within this subclade. *Cochlioda* species can be identified by purple, pink, or red flowers, which are adapted to hummingbird pollination. The lip callus consists of 2 or 4 papillate or ciliate keels running from the lamina center toward the gynostemium, together forming a tube accessible for pollinators. The elongate gynostemium is arched and parallel to the equally arched lip along its entire length. *Solenidiopsis* is the only genus included in this subclade (B) with non-resupinate flowers, probably being the result of adaptation to pollinator behavior. The lip and gynostemium of *Solenidiopsis* are relatively short, and the gynostemium is adorned with two large, elongate projections exceeding the anther. The shortly clawed lip possesses some thickened ridges on the upper surface and is papillate on its major part. In general, flower morphology of species of *Collare-stuartense* reminds somewhat *Odontoglossum* s.s. In both groups, the lip is ornamented with horn-like or digitate projections, and it is adnate with the lower part of the gynostemium along the midvein. Differences between *Collare-stuartense* and *Odontoglossum* s.s. concern gynostemium structure. In *Collare-stuartense*, there are no fringed or digitate projections. Instead, there are two wing-like structures being lateral lobes of prominent apical clinandrium and additional wings terminated with elliptic or ovate terminal lobes below stigmatic surface. As mentioned above, *O.*

tenuifolium is sister to other representatives of this subclade, and *O. povedanum* is sister to all above-mentioned species. In both these species, the gynostemium is relatively short and massive and parallel to the lip somewhat reminiscent of *Solenidiopsis*. Despite the latter, however, there are no elongate projections at the top of the gynostemium in neither of the considered species. In both *O. povedanum* and *O. tenuifolium*, the lip callus is rather similar to the one found in *Cochlioda* and like in this genus it forms along with the gynostemium a kind of tube.

The third subclade (C) includes species usually classified under *Oncidium* section *Oblongata* (Kraenzlin 1922). In general flower morphology, they share many features that are characteristic of *Oncidium* s.s., i.e., lip much larger than other perianth segments, prominently 3-lobed, with the middle lobe being the largest and apically split into two lobules, with complicated basal callus and gynostemium forming obtuse angle with the lip. The last subclade (D) comprises species which Romowicz and Szlachetko (2006) initially included in the genus *Vitekorchis*. Neubig et al. (2012) revealed, however, that the genus as circumscribed by those authors was polyphyletic and proposed a new and narrower concept of *Vitekorchis*. The species of this subclade have typical oncidoid flowers, i.e., with prominent tabula infrastigmatic and stigma sheltered by large, wing-like staminodes. Those wings are deeply dissected in *Oncidium zelenkoanum*, but otherwise this species is similar to the rest in subclade D. Morphological characters of *Oncidium chrysomorphum* and *O. boothianum* alliances (subclade C) as well as *Vitekorchis* (subclade D) will be dealt and discussed in detail in a future study dedicated to the classification of *Oncidium* s.s.

There is no consensus on the recognition of genera within the *Odontoglossum* complex, and generic concepts are changing as new data become available. For example, while initially Dalström recognized *Cochlioda* and *Solenidiopsis* as separated genera (Dalström 1999, 2001), he changed the concept in 2012 (Dalström 2012) and included both genera in *Odontoglossum*.

Detailed analyses of morphology of the species included in phylogenetic analyses conducted by Neubig et al. (2012) indicated that the *Odontoglossum* clade consists of some genera easily distinguishable morphologically. We propose to maintain *Cochlioda*, *Solenidiopsis*, *Collare-stuartense*, *Symphyglossum*, and *Odontoglossum* as separate genera, and therefore we postulate to reject Chase et al.'s (2008) proposal to include the *Odontoglossum* complex in *Oncidium*. In our view, nodes defining genera include morphological synapomorphies that permit recognition of their members.

In our approach, *Odontoglossum* is paraphyletic, with species falling into at least two poorly supported clades. The two species groups are separated by *Symphyglossum strictum*. A similar situation was recognized within

Coelogyne Lindl. (Gravendeel et al. 2001). In this case, the authors recognized that the morphology of the studied groups did not correspond to the three topologies probably as a result of convergent evolution of morphological characters and they decided to maintain a polyphyletic *Coelogyne*. In the case of the *Odontoglossum* complex, it could be proposed to lump *Odontoglossum* s.s. with *Symphyglossum*; however, in our opinion flower morphology of *Symphyglossum*, i.a. connation of the lateral sepals, adnation of the petals to the gynostemium, lip basally adnate to the gynostemium, and callus form allow to preserve it as a separated genus.

Another option for classification of the second subclade (B) mentioned above would be to unite *Collare-stuartense*, *Cochlioda*, and *Solenidiopsis* together with *Odontoglossum tenuifolium* and *O. povedanum* in one genus; however, such taxon would not be possible to identify morphologically. As we revealed above, just two gynostemium characters are common for *Collare-stuartense*, *Cochlioda*, and *Solenidiopsis*; however, all those plants are similar in their vegetative characters as they produce approximate, flattened pseudobulbs. On the other hand, the pseudobulbs of *Odontoglossum tenuifolium* are aggregated to alternate and unlike the three genera above and *O. povedanum*, its sepals are connate to about 1/3 of their length. Only in *Odontoglossum tenuifolium* and *O. povedanum* the column part is pubescent, at the base in the former and below the stigma in the latter. More differences between representatives of the five taxa are observed in their flower morphology, e.g., flower resupination, fusion of the lip with the gynostemium, and lip ornamentation.

As mentioned before, the concept of *Oncidium* s.l. proposed by molecular taxonomists is ill-defined in morphological terms and the *Odontoglossum* complex is not the only controversial group included in *Oncidium* s.l. A similar situation is observed i.a. in *Sigmatostalix* and *Heteranthocidium* (Szlachetko and Kolanowska in press). The generic limits within *Oncidium* s.l. is the subject of an ongoing study.

Conclusions

While we do not underestimate the importance of molecular data in phylogenetic research, the results of molecular studies should be taken with caution in classification of organisms to avoid creation of ill-defined taxonomic units. Recognition of distinctive characters which have evolved in a group is essential to understand evolution (Brummitt 2006). This point of view is shared by numerous authors (e.g., Sosef 1997; Brummitt and Sosef 1998; Brummitt 2003; Dias et al. 2005; Nordal and Stedje 2005) who state that traditional classification is the optimal tool for cataloging biodiversity and requires recognition of paraphyletic

taxa. As highlighted by Brummitt (2014), “confusion has arisen in systematics from the failure to appreciate that taxonomy, which groups organisms into ranked taxa (families, genera, etc.), is essentially different from grouping them into clades. (...) Merely because one taxon falls phylogenetically within the clade of another taxon at the same rank does not necessarily mean that it must be included in it taxonomically.” Ultimately, neither cladogram nor a phylogenetic tree is a classification. Subjective decisions must always be taken to impose the limits and rank of taxa (Brummitt 1996).

It is difficult to accept the rather categorical statement by Chase (2009) and Neubig et al. (2012) that floral morphology has to be forgone in Oncidiinae because it is highly plastic and subject to shifts in pollinators. While pollinator-mediated selection has been suggested to play a major role for the origin and maintenance of the species diversity in orchids (Johnson 2006; Schiestl 2012; Xu et al. 2012), it should be noted that in situ observations of pollination of oncidoid orchids are rather scarce and the assumptions about the animals transferring their pollen are based mostly on flower morphology which has been proven to be misleading in numerous plant species (e.g., Williams and Adam 2010; Waser et al. 1996), including orchids (e.g., Kolanowska 2012).

Chase (2009) postulated that the vegetative traits in combination with a few floral characters should constitute the basis for generic delimitation, but the delineation within Oncidiinae proposed by the authors does not comply with this approach. According to Chase (2009), “the only reliable distinction between *Cyrtorchilum* and *Oncidium/Odontoglossum* is their habit; in *Cyrtorchilum*, pseudobulbs are round in cross section with numerous leaves subtending them as well as two or more apically (...) whereas in *Oncidium/Odontoglossum* they are ancipitous, usually without subtending leaves, and only 1–2 apically.” This is incorrect—in most of *Odontoglossum* species the pseudobulbs are subtended by foliaceous sheaths and the bifoliate pseudobulbs are often observed in both *Cyrtorchilum* and *Oncidium/Odontoglossum*. On the other hand, Williams et al. (2001) based on molecular data decided to incorporate representatives of *Psycmorchis* Dodson & Dressler and *Stacyella* Szlach. into *Erycina* Lindl. despite obvious vegetative dissimilarities between those taxa. Unlike *Stacyella* and *Erycina*, species of *Psycmorchis* s.s. do not produce pseudobulbs. Pseudobulbs of *Stacyella* representatives are subtended by several foliaceous bracts and the apical leaf lacks articulation, while *Erycina* produces several papyraceous sheaths and the leaf/leaves are articulate at the base (Kolanowska and Szlachetko 2014). Another orchid taxon lately discussed in the context of the generic delimitation, *Fernandezia* s.l., consists of monopodial plants growing in montane and high-montane habitats (Kolanowska and Szlachetko in press). These

orchids share general habit form—their stems are concealed by the leaf sheaths, the leaves are conduplicate, distichous, and articulate. The differences are observed in the inflorescence arrangement and flower morphology (i.a. gynostemium structure, perianth segments' connation).

In our opinion, floral characters are still important taxonomic and diagnostic attributes in orchid taxonomy and specifically in Oncidiinae provided that they are studied carefully. As there is no vegetative character defining *Oncidium* sensu latissimo, we postulate to reject the broad concept of *Oncidium* presented by Chase et al. (2008).

Taxonomic treatment

Key to taxa of the *Odontoglossum* alliance

- 1a. Stigma partially hidden by rostellum, hence appears to be bilobed 2
 1b. Stigma unlobed 3
 2a. Flowers resupinate *Cochlioda*
 2b. Flowers non-resupinate *Solenidiopsis*
 3a. Clinandrium 3-lobed, middle lobe exceeding the anther *Collare-stuartense*
 3b. Clinandrium obscure, not exceeding the anther 4
 4a. Lateral sepals connate for over third of their length *Symphoglossum*
 4b. Lateral sepals free or shortly connate 5
 5a. Gynostemium pubescent 6
 5b. Gynostemium glabrous 7
 6a. Lip apical half abruptly recurved
 *Odontoglossum tenuifolium*
 6b. Lip apical part deflexed
 *Odontoglossum povedanum*
 7a. Lip basal part parallel to the gynostemium *Odontoglossum* s.s.
 7b. Lip basal part perpendicular to the gynostemium 8
 8a. Tabula infrastigmatica missing, staminodes digitate *O. chrysomorphum* group
 8b. Tabula infrastigmatica prominent, staminodes ear-like *O. obryzatum* group

Cochlioda Lindl. Fol. Orchid. 4: 1. 1853. —TYPE: *Cochlioda densiflora* Lindl. Fig. 3.

Pseudobulbs approximate, oblong to ovate, flattened, 1–2-foliolate, at the base with several sheaths. Leaves coriaceous or fleshy. Inflorescence produced from the axil of the upper leaf-sheath, few-flowered. Flowers resupinate. Sepals and petals subsimilar, free, spreading. Lip 3-lobed, united with the gynostemium down the middle; lateral lobes oblong to subquadrate; middle lobe ovate; disk with two pairs of diverging lamellae. Gynostemium elongate,

erect, stout. Column part ca. 5 times longer than anther, almost terete, fused with lip along midvein almost to stigma base. Anther incumbent, operculate, dorsiventrally slightly compressed, ellipsoid, 2-chambered. Connective narrow, rather thick. Pollinia 2, obliquely obovoid-ellipsoid, deeply and unequally cleft, hollow inside, hard. Apical clinandrium prominent, 3-lobed, exceeding anther, margin entire. Stigma transversely elliptic, deeply concave, partially hidden by rostellum, hence appears to be bilobed. Rostellum pendent, digitate, built of thick tissue, rounded at apex. Viscidium single, oblong, multilayered, sticky on outer surface. Tegula single, obtriangular-obovate, thin, lamellate. Rostellum remnant with apical, oblique, shallow plate surrounded by fovea.

Notes: The species of this genus share similar characters in the gynostemium structure with *Solenidiopsis*, especially receptive surface divided into two parts by a pendent rostellum. Both genera, however, can be easily separated by the torsion of the flowers (resupinate in *Cochlioda* and non-resupinate in *Solenidiopsis*) and flower coloration (bright in *Cochlioda* and dull brownish-green in *Solenidiopsis*), which is probably caused by adaptation to different pollinators. Previously postulated synonymization of *C. beyrodtiana* under *C. densiflora* (Dalström 2001) should be rejected based on the outcomes of analysis of Neubig et al. (2012) which indicates that *C. beyrodtiana* is sister to all other representatives of the genus.

A genus of about six Andean species distributed from Ecuador to Peru and Bolivia. Populations were found growing at the altitudes of 1800–2700 m; however, some plants were reported from lower elevations of about 1200 m.

Solenidiopsis Senghas, Orchidee (Hamburg) 37: 274. 1986. —TYPE: *Solenidiopsis tigroides* (C.Schweinf.) Senghas. Fig. 4.

Pseudobulbs approximate, pyriform to ovate, flattened, 1–3-leaved, at the base with several sheaths. Leaves coriaceous or fleshy. Inflorescence produced from the axil of the upper leaf-sheath, several- to many-flowered. Flowers non-resupinate. Sepals and petals subsimilar, spreading, free. Lip 3-lobed, fused to the base of gynostemium through a short, central keel; lateral lobes ovate to subquadrate; middle lobe ovate; disk with two pairs of diverging lamellae. Gynostemium elongate, erect, robust. Column part ca. 3 times longer than anther, fused with lip along midvein in lower third, ventral surface below stigma grooved and pubescent, with prominent wings on both anther sides, wings thin, delicate, more or less denticulate on margins. Anther sub-apical, incumbent, operculate, dorsiventrally compressed, ellipsoid-ovoid, 2-chambered. Connective narrow, apically elongate. Pollinia 2, almost ellipsoid, slightly dorsiventrally flattened, unequally cleft, empty inside, hard. Apical

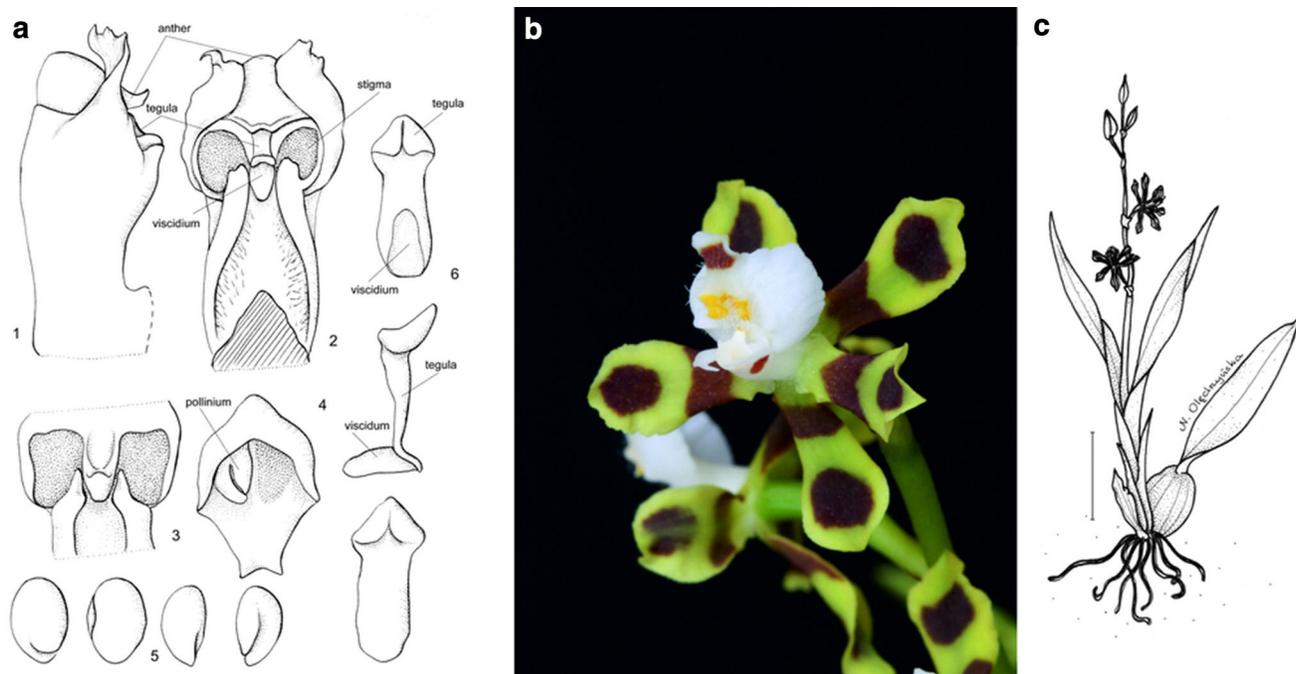


Fig. 4 **a** Gynostemium of *Solenidiopsis tigroides* (C.Schweinf.) Senghas. 1 Gynostemium, side view; 2 gynostemium, bottom view; 3 rostellum remnant; 4 anther; 5 pollinia, various views, 6 Tegula and viscidium, various views (Szlachetko and Mytnik-Ejsmont 2009).

b Flower of *Solenidiopsis tigroides*. Photo by Guido Deburghgraeve. **c** *Solenidiopsis flavobrunnea*—habit. Scale bar 3 cm. Redrawn by N. Ołędryńska from Bennett and Christenson (1993)

clinandrium obscure. Stigma transversely elliptic, deeply concave, partially divided by rostellum into two lobes, hence appears to be bilobed. Rostellum pendent, digitate, built of thick tissue, rounded at apex. Viscidium single, oblong, sticky, soft. Tegula single, oblong, thin, lamellate, pocket-like at apex. Rostellum remnant with apical, oblique, shallow plate surrounded by narrow fovea, canaliculated on dorsal surface.

Notes: This is the only representative of the *Odontoglossum* clade with non-resupinate flowers. The lip morphology of *Solenidiopsis* species reminds somewhat those of *Cochlioda* and *Odontoglossum povedanum*. Their lip is 3-lobed with callus consisting of two pairs of diverging lamellae. Unlike *Solenidiopsis*, flowers of *Cochlioda* and *O. povedanum* are resupinate. Furthermore, those genera can be easily distinguished by the gynostemium structure. In *Solenidiopsis* and *Cochlioda*, the receptive surface is split into two parts and it is entire in *O. povedanum*. Also, only in *O. povedanum* the gynostemium is pubescent. In *Solenidiopsis*, the apical, prominent wings on both anther sides are delicate, with more or less denticulate margins. They prominent wings are missing in both *Cochlioda* and *O. povedanum*.

A genus of about five (Dalström 1999) Peruvian species growing at altitudes of 2000–3100 m.

Collare-stuartense Senghas and Bockemühl, J. Orchideenfr. 4: 73. 1997. —TYPE: *Collare-stuartense multi-stellare* (Rchb.f.) Senghas & Bockemühl. Fig. 5.

Pseudobulbs approximate, ovate, flattened, 1–2-leaved, at the base with several sheaths. Leaves coriaceous or fleshy. Inflorescence produced from the axil of the upper leaf-sheath, several- to many-flowered. Flowers resupinate. Sepals and petals subsimilar, free, spreading. Lip 3-lobed, free from the gynostemium; lateral lobes ovate to subquadrate; middle lobe ovate; callus consisting of several short, diverging lamellae. Gynostemium erect, elongate, slender. Column part 2.5 times longer than anther, fused at its basal third with lip, obscurely winged near stigma, with two digitate projections just below stigma, glabrous. Anther subventral, incumbent, operculate, ellipsoid-ovoid, dorsoventrally flattened, obscurely 2-chambered. Connective narrow, slightly apically elongate, with thick knob-like appendix at top. Pollinia 2, almost ellipsoid-obovoid, hard, unequally and deeply cleft. Apical clinandrium prominent, exceeding anther, irregularly dentate on margins with two digitate projection at anther apex. Stigma large, elliptic, deeply concave. Rostellum shortly conical-digitate in middle, ligulate, blunt, pendent. Viscidium single, rather small, oblong-elliptic, thick. Tegula single, linear, thin, lamellate, laterally squeezed at apex, forming narrowly triangular

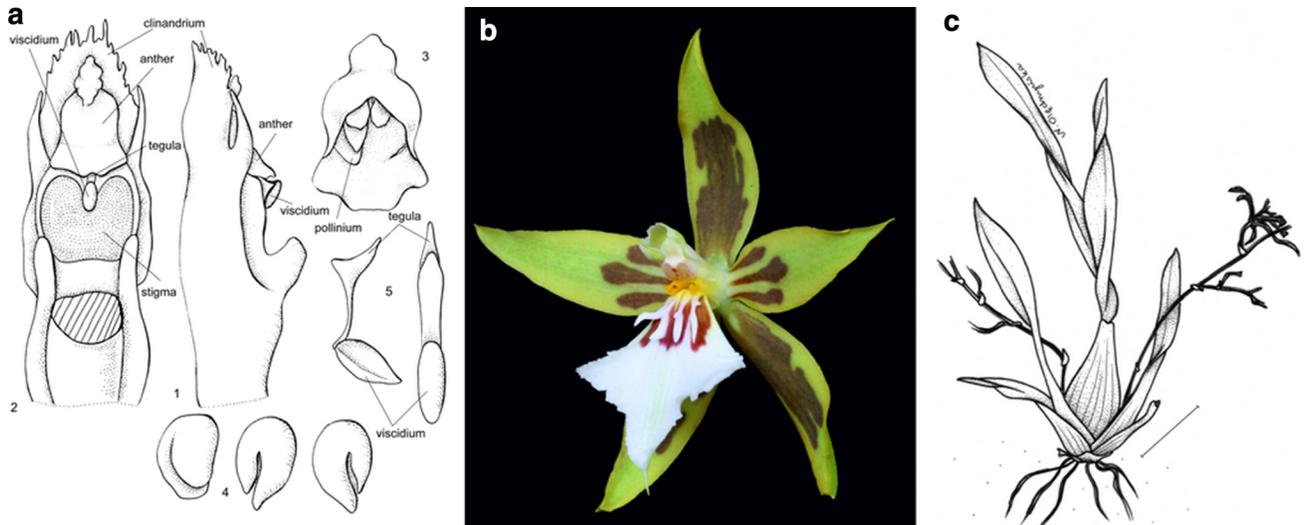


Fig. 5 a Gynostemium of *Collare-stuartense multistellare* (Rchb.f.) Senghas & Bockemühl. 1 Gynostemium, side view; 2 gynostemium, bottom view; 3 anther; 4 pollinia, various views; 5 tegula and viscidium, various views (Szlachetko and Mytnik-Ejsmont 2009).

b Flower of *Collare-stuartense multistellare* (Rchb.f.) Senghas & Bockemühl. Photo by Guido Deburghgraeve. **c** *Collare-stuartense multistellare*—habit. Scale bar 5 cm. Redrawn by N. Olędryńska from Dodson (1984)

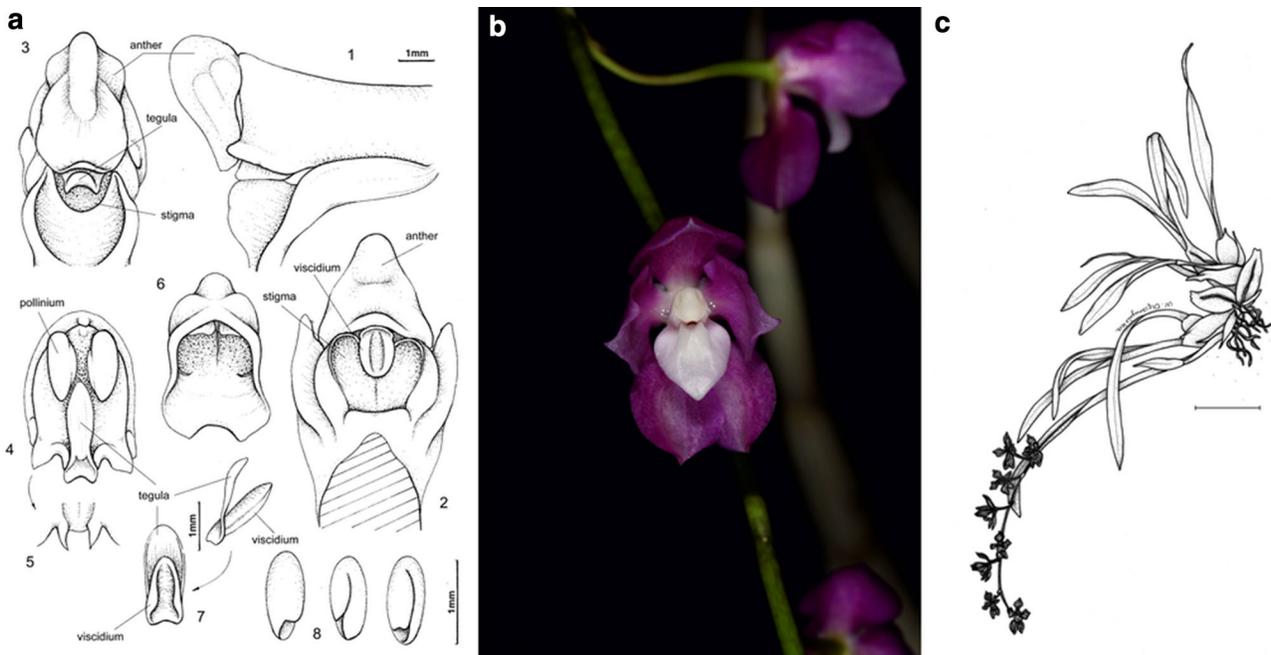


Fig. 6 a Gynostemium of *Symphyglossum sanguineum* (Rchb.f.) Schltr. 1 Gynostemium, side view; 2 gynostemium, bottom view; 3 gynostemium, front view; 4 gynostemium, front view, anther removed; 5 rostellum remnant; 6 anther; 7 tegula and viscidium,

various views; 8 pollinia, various views (Szlachetko and Mytnik-Ejsmont 2009). **b** Flower of *Symphyglossum strictum* (Cogn.) Schltr. Photo by J. Varigos. **c** *Symphyglossum ecuadorensis*—habit. Scale bar 6 cm. Redrawn by N. Olędryńska from Dodson and Dodson (1980)

projection. Rostellum remnant bilobulate at middle, with oblique shallowly concave plate between acute lobules.

Notes: *Collare-stuartense* and *Odontoglossum* share similar characters of the lip, especially in the structure of the callus, which consists of several mostly digitate projections. Both genera can be easily distinguished by the

gynostemium morphology, especially the clinandrium, which is prominent, 3-lobed in *Collare-stuartense*, with the middle lobe exceeding the anther. The apical clinandrium of *Odontoglossum* is narrow and obscure.

A genus of about seven species distributed from Ecuador to Peru and Bolivia. The altitudinal range extends from

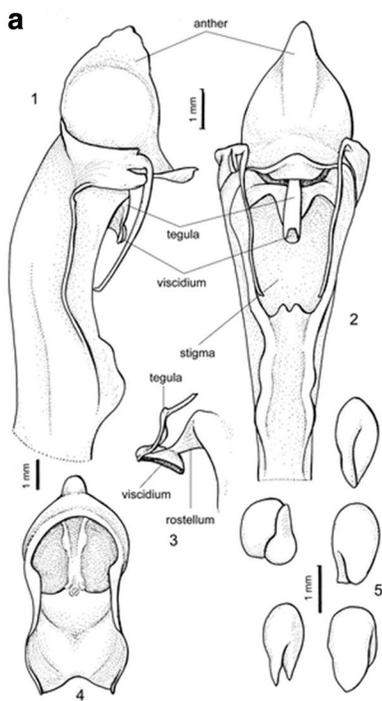


Fig. 7 **a** Gynostemium of *Odontoglossum odoratum* Lindl. 1 Gynostemium, side view; 2 gynostemium, bottom view; 3 rostellum, side view; 4 anther; and 5 pollinia, various views (Szlachetko and Mytnik-Ejsmont 2009). **b** Flower of *Odontoglossum epidendroides* Lindl.

Photo by Guido Deburghgraeve. **c** *Odontoglossum epidendroides*—habit. Scale bar 10 cm. Redrawn by N. Olędrzyńska from Dodson and Bennett (1989)

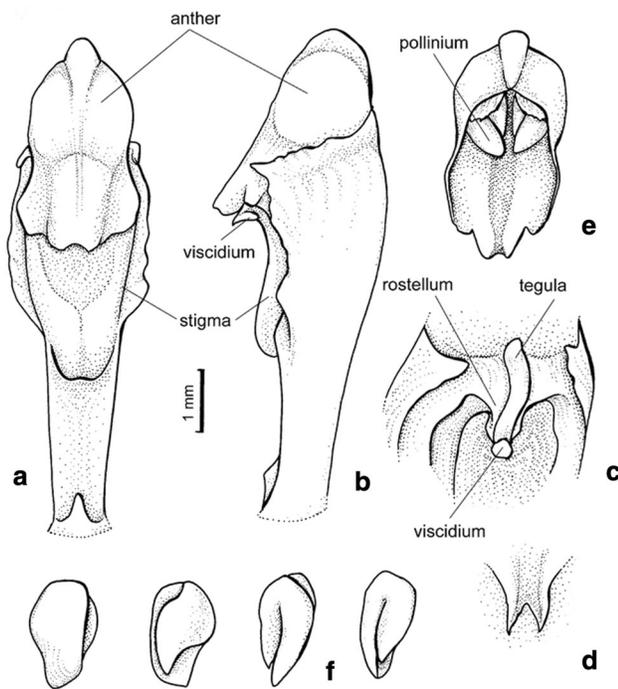


Fig. 8 Gynostemium of *Odontoglossum crinitum* Rchb.f. **a** Gynostemium, bottom view; **b** gynostemium, side view; **c** rostellum; **d** rostellum remnant, front view; **e** anther; and **f** pollinia, various views (Szlachetko and Mytnik-Ejsmont 2009)

2000 to 2800 m. The revision of the available material indicated the necessity for one additional transfer to *Collare-stuartense*.

Collare-stuartense ariasii (Dalström) Szlach. & Kolan., **comb. nov.** ≡ *Odontoglossum ariasii* Dalström, Selbyana 22: 137. 2001. —TYPE: Peru, Junín, cloud forest near Huasahuasi, ca. 2600 m a. s. l., field collected by M. Arias, 20 Feb 2001, S. Dalström 2502 (holotype: SEL [n.v.]

Symphyglossum Schltr., Orchis 13: 8. 1919. —TYPE: *Symphyglossum sanguineum* (Rchb.f.) Schltr. Fig. 6.

Pseudobulbs aggregated, oblong-ovoid, flattened, 2-leaved, at the base with several sheaths. Leaves coriaceous or fleshy. Inflorescence produced from the axil of the upper leaf-sheath, few- to many-flowered. Flowers resupinate. Sepals and petals subsimilar, lateral sepals connate to about the middle, petals adnate to the gynostemium. Lip entire, basally adnate to the gynostemium; lateral lobes ovate to subquadrate; middle lobe ovate; callus consisting of a pair of plates at the base of lip free part. Gynostemium elongate, gently upcurved in upper half, rather robust. Column part ca. twice as long as anther, fused with lip just below stigma, winged near stigma, wings with margins entire. Anther subapical, operculate, ellipsoid, slightly dorsiventrally flattened, obscurely 2-chambered. Connective narrow,

Fig. 9 *Odontoglossum povedanum* P.Ortiz. *a* Lateral sepal, *b* petal, *c* dorsal sepal, *d* lip, *e* gynostemium, and *f* flower. Scale bars 10 mm. *g* Habit. Scale bar 20 mm. Redrawn by N. Ołędryńska from Ortiz Valdivieso (1997). *h* Flower. Photo by Guido Deburghgraeve

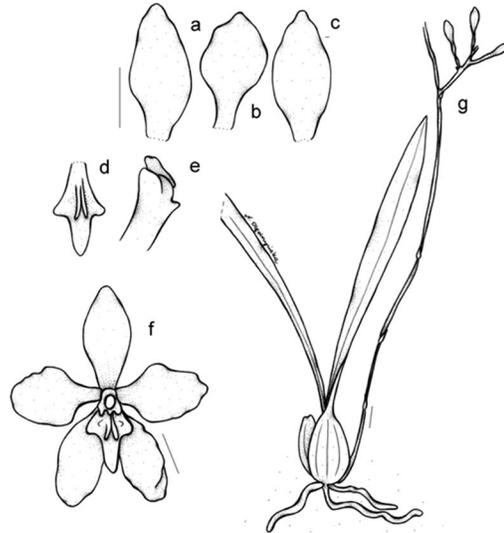


Fig. 10 *Odontoglossum tenuifolium* Dalström *a* Habit. Scale bar 5 cm. *b* Petal, *c* dorsal sepal, *d* lateral sepals, and *e* flower. Scale bars 5 mm. *f, g* Gynostemium various views. Scale bars 3 mm. *h* Flower.

Scale bar 5 mm. Redrawn by N. Ołędryńska from Dalström (1996). *i* Flower. Photo by Guido Deburghgraeve



thickened on dorsal surface and apically elongate. Pollinia 2, oblong-ellipsoid, hard, unequally and deeply cleft. Apical clinandrium narrow. Stigma relatively small, elliptic, slightly concave. Rostellum rather short, ovate, rounded at apex. Viscidium single, oblong-ellipsoid, thick, fleshy, grooved on outer surface. Tegula single, longer than viscidium, oblong, thin, lamellate, flat. Rostellum remnant bilobulate at apex, canalculated on dorsal surface.

Notes: This is the only genus of the *Odontoglossum* clade with simple lip. Moreover, both lateral sepals are connate to about the middle, and both petals are adnate to the gynostemium forming a kind of funnel, which probably plays a role in pollination.

A genus of about six species distributed from Ecuador to Peru between 1200 and 2600 m of altitude.

Odontoglossum Kunth, Nov. Gen. Sp. 1: 350. 1816. —TYPE: *Odontoglossum epidendroides* Kunth. Figs. 7, 8.

Pseudobulbs approximate, usually ovoid or elliptic-oblong, compressed, 1–3-leaved, the bases enveloped in a few distichous, papery or foliaceous sheaths. Leaves coriaceous or fleshy. Inflorescences produced from the bases of the pseudobulbs, usually elongate, erect or arching, few- to many-flowered racemes or panicles. Flowers resupinate. Sepals subequal, usually spreading, usually free. Petals usually subequal to the dorsal sepal but sometimes broader. Lip 3-lobed or entire, the base continuous with the base of the gynostemium; lateral lobes (if present) spreading or erect, middle lobe usually deflexed, less frequently spreading; callus at the base of the lip variously cristate, denticulate, lamellate. Gynostemium elongate, erect to gently arched near middle, slender. Column part ca. 1.5–3.5 times longer than anther, obscurely winged near stigma, with various appendages near or just above stigma. Anther subapical to subventral, incumbent, operculate, ellipsoid, obscurely 2-chambered. Connective narrow, more or less thickened and apically elongate, occasionally forms a dorsal crest. Pollinia 2, obliquely ellipsoid, dorsiventrally flattened, hard, unequally and deeply cleft. Apical clinandrium narrow. Stigma elliptic, deeply concave, partially hidden by rostellum. Rostellum rather short, conical-digitate in middle, ligulate, pendent, obtuse. Viscidium single, oblong-ellipsoid, thick, fleshy. Tegula single, slightly longer than viscidium, oblong, thin, lamellate, flat. Rostellum remnant bilobulate at middle, with oblique shallowly concave plate between acute lobules, canalculated on dorsal surface.

Notes: The genus can be confused with *Collare-stuartense*, from which however it can be separated by gynostemium morphology.

Incertae sedis

As mentioned before, two species, *Odontoglossum tenuifolium* and *O. povedanum*, are not closely related to other representatives of the subclade B. Also their morphology does not allow their classification in any of the existing genera. It is possible that each of these two species could be placed in its own genus, but we think it is premature considering current available data.

Odontoglossum povedanum P.Ortiz, Orquideologia 20: 321. 1997. —TYPE: Colombia, Santander, Suaita. Vado Real, ca. 2000 m a. s. l., collected by E. Poveda in Dec 1995, flowering in Bogotá in May 1996, *P. Ortiz 1070* (holotype: HPUJ [n.v.]). Fig. 9.

Notes: This species described as *Odontoglossum* was transferred to *Collare-stuartense* by Szlachetko and Górniak (2006); however, unlike *Odontoglossum* and *Collare-stuartense*, in *O. povedanum* the column part below the stigma is pubescent. While in the original drawing presented by Ortiz

Valdivieso (1997) the pseudobulbs are not subtended by foliaceous sheaths, the photographs of this species taken by G. Deburghgraeve show that these structures occur in *O. povedanum*. According to information provided by Deburghgraeve, the flowering of this plant starts from the most distal part of the inflorescence and the side branches gradually develop from the most proximal internodes. The simple lip callus with pubescent disk places it in a rather isolated position within *Odontoglossum* clade that is also supported by molecular analyses (Neubig et al. 2012).

Odontoglossum tenuifolium Dalström, Lindleyana 11: 114. 1996. —TYPE: Bolivia, Chapare, between Cochabamba and Villa Tunari, 1950 m a. s. l., 7 Jan 1994, S. Dalström and J. Sönnemark 2012 (holotype: SEL [n.v.]; isotype: K [n.v.]). Fig. 10.

Notes: This species differs from all other members of *Odontoglossum* clade by its flower morphology, especially the abruptly recurved apical half of the lip with two digitate appendages. It is noteworthy that *O. tenuifolium* is similar to *Rusbyella* and *Dasyglossum* in both vegetative and floral characters. It differs, however, from both genera in having the lower part of the gynostemium pubescent. Additionally, it is easily separable from *Rusbyella* by the lip morphology. It would be a good example of convergence in flower morphology between rather distantly related genera if subsequent molecular studies confirm this situation.

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Compliance with ethical standards

The authors declare that there are no conflicts of interest. This article does not contain any studies with human participants or animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

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Comments from Dalström, Higgins and Deburghgraeve on Kolanowska & Szlachetko:

Problems with generic delimitation in the *Odontoglossum* complex (Orchidaceae, Oncidiinae) and an attempt for a solution

From page 24, column 1, paragraph 2

“Only *Symphyglossum* and *Odontoglossum tenuifolium* produce aggregated pseudobulbs.”

1: Both the terms “aggregated” and “approximate” in reference to how the pseudobulbs are positioned to each other refer to pseudobulbs being clustered and/or close together, which is basically the same thing. To use these terms to distinguish groups of *Odontoglossum* from each other is not helpful. Besides, *Odontoglossum tenuifolium* is the only species known today that has a creeping rhizome. *Odontoglossum sanguineum* does not have a creeping rhizome.

From page 24, column 1, paragraph 3

“*Odontoglossum hallii* Lindl. appears in two different branches of the tree provided by Neubig et al. (2012)—most probably due to incorrect identification of the samples.”

2: One of the two “*Odm. hallii*” (B2529) is *Odm. paniculatum*, which is placed where it is supposed to be, next to *Odm. epidendroides*.

From page 26, column 1, paragraph 1

“*Odontoglossum tenuifolium* and *O. povedanum* successively are sisters to other representatives of this subclade.”

3: Both *Odm. povedanum* and *Odm. tenuifolium* (and *Odm. koechlinianum*), and most likely *Odm. aurarium* would have to be monotypic genera if we accept *Cochlioda*, *Collarestuartense* and *Solenidiopsis* as distinct on a generic level. We do not like that approach and much prefer keeping them together but in separate sections. They breed easily with each other, which proves that they are indeed very closely related, so from a historical, horticultural and registration point of view it makes sense to keep them in the same genus.

From page 26, column 1, paragraph 1

- “The third subclade (Fig. 2—subclade C) in

- cludes *Oncidium chrysomorphum* Lindl., *O. schmidtianum* Rchb.f., *O. trinasutum* Kraenzl., and *O. tipuloides* Rchb.f.”

4: The “*Onc. schmidtianum*” here is misidentified and is actually *Odm. tipuloides*. The real *Onc. schmidtianum* appears to be a good *Oncidium*.

From page 26, column 1, paragraph 1

- “The fourth subclade (Fig. 2--subclade D) embraces *Oncidium boothianum* Rchb.f., *O. obryzatum* Rchb.f., *O. obryzatooides* Kraenzl., and *O. zelenkoanum* Dressler & Pupulin, i.e., species classified by taxonomists in genus *Oncidium*.”

5: We would have to give new names for both of these groups, which would be unfortunate because two of the species: *Odm. pictum* (as “*obryzatum*”) and *Odm. tipuloides*, are morphologically virtually inseparable. It makes no sense to place them in separate genera. How would you justify that when they are so similar and closely related? Keeping them in the same genus, defined by vegetative and morphologic features, but in separate series based on molecular work makes more sense to us.

From page 26, column 2, last paragraph

“All species of the first subclade (A) of *Odontoglossum* s.l. mentioned in the previous section, i.e., *Odontoglossum* s.s., except *Symphyglossum* can be characterized by a series of common characters. The lip is divided into two parts. The basal one is channel formed and parallel with the gynostemium, and the apical part is bent in a knee-like manner, thereby perpendicular to the lower one. The apical part is geniculate, denticulate, and undulate along margins, and at the base of lamina adorned with various, usually horn-like to digitate projections showing a complex pattern. Other segments of the flower are usually subsimilar, narrower than lip, and undulate along margins. The gynostemium is erect or gently arched, stout, narrowly . . .”

6: It is not as easy to distinguish this large and florally polymorphic group as it is described here. The shape of the lip in relation to the column varies considerably and, species in the *harryanum* complex, for example, do not have a similar lip attachment as described by the authors. Also, members of what we consider to be the Section Articulatum (*epidendroides*, *crispum*, *cruentum*, etc.) have a flexible lip and in general a very “spiny” lip callus, while members of the Section Canaliculatum (*constrictum*, *cirrhosum*, *blandum* etc.) have a rigid attachment and in general have a much simpler lip callus. But genetically, they are very closely related, and they frequently produce natural hybrids. So to us, it makes more sense to keep them in the same genus but in separate sections, which appear to reflect different pollination syndromes.

From page 27, column 1, paragraph 1

“*Symphyglossum* is a genus of two species, . . .”

7: I do not know which other species they refer to, but as far as we can see, there is only one *Odm.* (“*Symphyglossum*”) *sanguineum* with nothing else even remotely similar. There are two *Cyrtochilum* species: *C. distans* and *C. linguiforme* (which is the older name for *C. umbrosum*) that have been included in “*Symphyglossum*” earlier by Dunsterville and Garay, but these species are not closely related to the real and original “*Symphyglossum*”, which is embedded in *Odontoglossum* section Canaliculatum, according to Chase’s cladogram.

From page 27, column 1, paragraph 1

“... but differs from all other species of the group in having simple lip callus consisting of two keels running from the lip center toward the gynostemium, hence forming a channel, basally connate lateral sepals, and gynostemium devoid of any projections.”

8: This description also matches *Odm. tenuifolium* and *Odm. velleum*.

From page 27, column 1, paragraph 2

“Shared characters for the second subclade (B)”

9: To keep these visually easily separated groups together as a single genus, different from *Odontoglossum sensu strictu* (“subclade A”) is inconsistent if you base the characteristics on flower morphology.

But to separate them into distinct genera is not practical either, mostly because of one species that unites *Collarestuartense* with *Solenidiopsis* and *Cochlioda*, and that is *Odm. koechlinianum*. This little species has features from all the others and belongs somewhere at the base of the *Collarestuartense sensu lato* branch. We believe it is better to keep them together as odontoglossums but in separate sections (Section Coloratum for “*Cochlioda*”; Section Parviflorum for “*Solenidiopsis*” and Section Lobulatum for “*Collarestuartense*”). This allows us to keep them together with *Odm. koechlinianum* as well, wherever its final molecular and, hence, taxonomic resting place will be.

Unfortunately, we do not have any published DNA sequencing results from this tiny-flowered species but Kurt Neubig has told us (unpublished) that it belongs somewhere along the “*Collarestuartense*” *sensu lato* branch, where we also expected it to end up based on overall morphology. If you separate these different sections/groups into distinct genera you have to accept *Odm. koechlinianum*, *Odm. povedanum* and *Odm. tenuifolium* as separate monotypic genera. You will also have to accept *Odm. aurarium* as a monotypic genus because it originally appeared in an early cladogram at the base of the “*Collarestuartense*” branch.

From page 27 column 2, last paragraph

“*Symphyglossum strictum*.”

10: “*Symphyglossum strictum*” is just another synonym for *Odm.* (“*Symphyglossum*”) *sanguineum*.

From page 28, column 1, paragraph 1

“... however, in our opinion flower morphology of *Symphyglossum*, i.a. connation of the lateral sepals, adnation of the petals to the gynostemium, lip basally adnate to the gynostemium, and callus form allow to preserve it as a separated genus.”

11: *Odontoglossum sanguineum* is deeply embedded in Section Canaliculatum of *Odontoglossum*. You cannot create a separate monotypic genus for this species without creating polyphyletic genera, which is something we do not accept. The “specialized” color and flower morphology of this species is just an adaptation to a different, possible bird-pollination

syndrome. This has happened earlier as well, which created the Section Coloratum (“*Cochlioda*”).

From page 28, column 1, paragraph 2

“Another option for classification of the second sub-clade (B) mentioned above would be to unite *Collarestuartense*, *Cochlioda*, and *Solenidiopsis* together with *Odontoglossum tenuifolium* and *O. povedanum* in one genus; however, such taxon would not be possible to identify morphologically.”

12: This is correct and is the reason why we accept them all as *Odontoglossum* but separated as Section Coloratum, Section Parviflorum and Section Lobulatum, which includes the Astranthum series, the Povedanum Series and the Tenuifolium Series. You have more flexibility in the taxonomy of the lower levels where we do not have sufficient data to sort the molecular details for the species. It is more user-friendly (I believe), therefore, to separate the lower levels based on visual flower morphology until we know more.

From page 28, column 1, paragraph 2

“On the other hand, the pseudobulbs of *Odontoglossum tenuifolium* are aggregated . . .”

13: The pseudobulbs of *Odm. tenuifolium* are slightly distant on a creeping rhizome and quite different from the growth habit of all other species in the genus *sensu lato*.

From page 28, column 1, paragraph 2

“Only in *Odontoglossum tenuifolium* and *O. povedanum* the column part is pubescent, at the base in the former and below the stigma in the latter.”

14: Many different species in different Sections of *Odontoglossum sensu lato* have a column that is variably pubescent.

From page 28, column 2, paragraph 1

“Merely because one taxon falls phylogenetically within the clade of another taxon at the same rank does not necessarily mean that it must be included in it taxonomically.”

15: If a taxon falls within the same clade and on the same level as a group of other taxa, as in the case of *Odm.* (“*Symphyglossum*”) *sanguineum*, we do not be-

lieve in separating it into a monotypic and polyphyletic genus simply based on a pollination syndrome, which has modified the flower morphology. We have to accept that even relatively closely related species can have different-looking flowers. That is when vegetative features are revealing.

From page 28, column 2, paragraph 1

“Ultimately, neither cladogram nor a phylogenetic tree is a classification. Subjective decisions must always be taken to impose the limits and rank of taxa (Brummitt 1996).”

16: We agree with Brummitt here but also strongly believe that basing the taxonomic classification on available molecular data is both helpful and strongly supportive as long as the data are based on correctly identified voucher plants, which is not always the case. Subjective opinions are acceptable when deciding where to “cut the branches” in the cladogram. Do we prefer large or small genera? I personally do not think, however, that Brummitt meant that it is OK to pick a single taxon, which is deeply embedded in a larger group of species on the same level, and separate it as a distinct monotypic genus just because the flower looks different.

From page 29, column 1, paragraph 2

“In our opinion, floral characters are still important taxonomic and diagnostic attributes in orchid taxonomy and specifically in Oncidiinae provided that they are studied carefully. As there is no vegetative character defining *Oncidium sensu lato*, we postulate to reject the broad concept of *Oncidium* presented by Chase et al. (2008).”

17: We basically agree with Kolanowska and Szlachetko here, but have to insist that vegetative distinguishing features do exist in some cases that make a preliminary identification of many groups of species relatively easy even when dealing with dried and sterile specimens. You just have to learn where to look! We are utilizing this fact in the taxonomic treatment of *Odontoglossum sensu lato* in our monographic treatment *The Odontoglossum Story*.

From page 33, column 2, last paragraph

“A genus of about six species distributed from Ecuador to Peru between 1200 and 2600 m of altitude.”

18: We only recognize one species that belongs in “*Symphyglossum*”, which we consider to be a good but “different-looking” *Odontoglossum*.

Summary

We (Wesley Higgins, Guido Deburghgraeve and I) basically agree with Kolanowska and Szlachetko (K&S) that the Chase *et al.* transfer of several genera into *Oncidium* is not acceptable. It creates an unnecessarily large genus, is not user-friendly when it comes to identifying different groups of species and the result creates a nondefinable genus. We disagree with K&S, however, when accepting *Collaestuartense*, *Cochlioda*, *Solenidiopsis* and what have to be described as separate monotypic genera *Odm. aurarium*, *Odm. povedanum* and *Odm. tenuifolium* as distinct on a generic level.

We do not accept polyphyletic genera and prefer to keep *Odm. sanguineum* in *Odontoglossum* Section Canaliculatum, where molecular evidence currently shows it is embedded. We believe that using genetic and evolutionary true monophyly as a sound principle for taxonomic treatments, in general, is a sound strategy.

We also prefer to include the two smaller clades at the base of the *Odontoglossum sensu lato* DNA tree as part of *Odontoglossum*, which are left without a status by K&S in their article. If they are excluded, they will have to be accepted as two new genera with some members belonging in different genera which are virtually inseparable. We, therefore, prefer to include them in *Odontoglossum* as Section Oncidioides; separated only as the Pictum Series and the Chrysomorphum Series. If these groups are placed in *Oncidium sensu strictu* by K&S, based on flower resemblance alone, additional polyphyletic genera are created, which we do not accept.

In our treatment of *Odontoglossum sensu lato*, we have tried to find an acceptable compromise between Chase’s “super *Oncidium*” and a more “digestible” and traditional view of these orchids. We try to avoid creating new genera in general and monotypic ones in particular, we try to utilize both visible plant and flower morphology in creating identification keys, and we base our decisions on biologically true monophyletic clades. We believe that using a combination

of molecular evidence (when based on correctly identified specimens) combined with overall morphology and any other available source of information is the way to go. It is not a perfect solution that will please everybody, but Nature does not always collaborate with us in making it easy to understand evolution. We can only do our best, base our decisions on available data and experiences, and hope that the taxonomy makes sense to others as well.

A Comparative Analysis of Four Populations of *Odontoglossum crispum* Lindl. in Colombia.

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Introduction

Chase *et al.* (2008) state regarding the genus *Odontoglossum* Kunth: “we favor fewer, larger genera (“lumping”), which we believe is easier for users of a system of classification to manage and use. Narrowly circumscribed genera, regardless of how homogenous, result in a system that only specialists can readily and effectively use.” Therefore, Chase *et al.* (2008) “lumped” many of the species recognized in the genus *Odontoglossum* into the genus *Oncidium* Sw. Kew (WCSP, 2008) recognizes this lumping of species of *Odontoglossum* into the genus *Oncidium*.

Odontoglossum crispum Lindl. was transferred to the genus *Oncidium* by Chase & Williams (2008). The epithet was occupied by *Oncidium crispum* Lodd. Therefore, the later synonym, *Odontoglossum alexandrae* Bateman was applied to the species. The name accepted by KEW is *Oncidium alexandrae* (Bateman) Chase & Williams.

We find the comments of Dalström (2012) on this subject relative: “When Chase and others transferred orchid genera *Cochlioda* Lindl., *Odontoglossum* Kunth, *Sigmatostalix* Rchb. f., and *Solenidiopsis* Senghas into *Oncidium* Sw., in Lindleyana (Chase *et al.* 2008), based on molecular evidence (Williams *et al.* 2001a, 2001b, Chase *et al.* 2009), a rather strange situation developed, seen from a taxonomic point of view. Many different looking plants (some mistakenly from the distantly related genus *Cyrtochilum* Kunth) with very different flower morphology, ended up in

the same genus. In fact, the flowers are so different from each other that it becomes virtually impossible to visually define the genus *Oncidium*, and to separate it from many other genera in the *Oncidiinae*.”

Dalström (2012) adds: “I therefore prefer to treat the visually recognizable species in genera *Cochlioda* Lindl., *Odontoglossum* and *Solenidiopsis* Senghas as a separate and single genus/clade rather than sinking them into a large “waste-basket *Oncidium*.”

Additionally, we here add the comments of Kolanowska & Szlachetko (2016) concerning Chase’s transfer of *Odontoglossum* to *Oncidium*. “Detailed analyses of morphology of the species included in phylogenetic analyses conducted by Neubig *et al.* (2012) indicated that the *Odontoglossum* clade consists of some genera easily distinguishable morphologically. We propose to maintain *Cochlioda*, *Solenidiopsis*, *Collare-stuartense* Senghas & Bockemühl, *Symphoglossum* Schltr., and *Odontoglossum* as separate genera, and therefore we postulate to reject Chase *et al.*’s (2008) proposal to include the *Odontoglossum* complex in *Oncidium*.”

Relative to this discussion are the comments of Brummitt (2014), “Confusion has arisen in systematics from the failure to appreciate that taxonomy, which groups organisms into rank taxa (families, genera, etc.), is essentially different from grouping them into clades. Merely because one taxon falls phylogenetically within the clade of another taxon at the same rank does not necessarily mean that it must

be included in it taxonomically.” Ultimately, neither cladogram nor a phylogenetic tree is a classification. Subjective decisions must always be taken to impose the limits and rank of taxa (Brummitt 1996).

Genera included in *Oncidium* by Chase *et. al.* (2008).

origin possibly with *Odontoglossum odoratum* and states that *O. odoratum* “being remotely concerned in the parentage” implying introgression. However, the reference to *O. odoratum* is questionable and is probably a misidentification of *Odontoglossum gloriosum* Linden & Rchb. f.



***Sigmatostalix* Rchb. f.**



***Solenidiopsis* Senghas**

Poirier (1906) states that “every grower of experience would refuse collections of *O. crispum* in which *Odontoglossum luteopurpureum* Lindl. is seen, as its presence would be an indisputable proof that the crispums will be pure *Alexandrae*, the form with small, starry-like flowers from the Fusagasugá region. Poirier states that the Velez region has yielded the finest forms of *O. crispum* because there are no *O. luteopurpureum* in the region.



***Symphyglossum* Schltr.**



***Cochlioda* Lindl.**

Poirier (1906) also states that the indians who range the mountains, collect the plants and bring them to sell in the districts and that he has not seen any *O. crispum* in several of the districts where collectors buy the plants from the indians reselling the plants and stating that the plants are from there.

In the *Orchid Review* (1906) in reference to the Poirier (1906) article is the following: “The author (Poirier) makes some remarks

We here agree with Dalström and Kolanowska & Szlachetko to continue to recognize *Odontoglossum crispum* and reject *Oncidium alexandrae* (Bateman) Chase & Williams.

Veitch (1887) gives accounts of early collections of *Odontoglossum crispum* from two localities, Pacho, north of Bogota and Fusagasugá south of Bogota and states that most of the finest spotted varieties have been received from Pacho and from Fusagasugá have been received the white and mauve tinted forms. Veitch clearly makes a distinction between the plants from the two localities. Veitch also describes plants from among the importations that are of hybrid

about hybridization, admitting the possibility that some of the spotted forms may be hybrids between *O. crispum* and *O. Adrianae* (natural hybrid between *Odontoglossum nobile* Rchb. f. and *O. luteopurpureum*), and he alludes to *Andersonianum*, *Coradinei* and *Ruckerianum* as species, though they are clearly natural hybrids.”

Variation in *Odontoglossum luteopurpureum* Lindl.



Odontoglossum luteopurpureum Lindl.



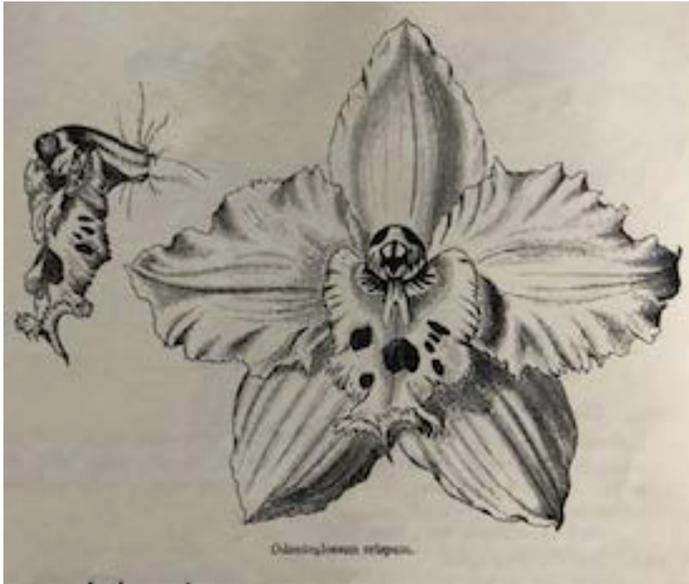
Odontoglossum luteopurpureum Lindl.



Odontoglossum luteopurpureum Lindl.



Odontoglossum gloriosum Linden & Rchb. f.



***Odontoglossum crispum* Lindl. (Veitch 1887).**

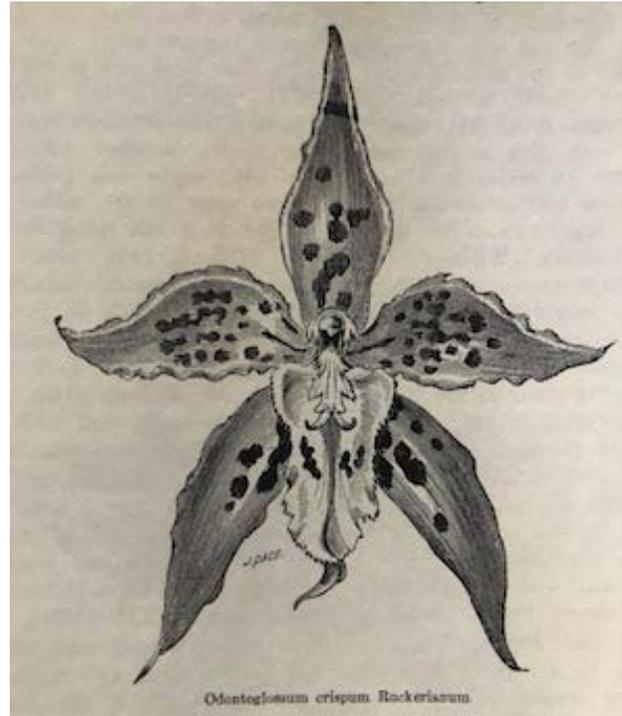


***Odontoglossum crispum Andersonianum*
From Veitch 1887.**

The early literature clearly distinguishes morphologically the localities with the implication that hybrids exist, and introgression has occurred. This paper analyzes flowers of plants from the localities recognized by Veitch and Poirier; Velez, Fusagasugá (Cabrera), Pacho and an additional locality in the department of Putumayo to determine the range of variation and if any of the populations merit being described as new taxa.

Materials and Method

Four plants were chosen for study from each locality representing the range of variation found at each lo



***Odontoglossum crispum Ruckerianum*
From Veitch 1887.**

cality: Velez, Santander; Cabrera, Fusagasugá, Cundinamarca; Villa Gomez, Pacho, Cundinamarca; San Francisco, Putumayo. Plants from cultivation were not used because of the extensive line breeding that has been done with selected plants to increase the quality of the flowers.

Icons were constructed from each flower from each locality which, included the flower, labellum with column, labellum with crest, close-up of crest and crest side view.

Individual icons were then constructed comparing, from each locality the flowers, labellum with column, labellum with crest, close-up of crest and crest side view.

Discussion

There has been more written on the concept and definition of a species than almost any other subject in botany. The traditional definition of a species is a “diagnosable distinct, reproductively isolated, cohesive, or exclusive groups of organisms” in which “boundaries between species in sympatry are maintained by intrinsic barriers to gene exchange” however, “these boundaries may not be uniform in space, in time, or across the genome” (Harrison and Larson, 2014). According to Baack *et al.* (2007) hybridization, the



Odontoglossum crispum Lindl.
from Villa Gomez, Pacho.



Odontoglossum crispum Lindl.
from Villa Gomez, Pacho.



Odontoglossum crispum Lindl.
from Villa Gomez, Pacho.

production of offspring from interspecific mating, occurs in 25% of plant species and 10% to 30% according to Mallet (2005).

Hybridization and introgression in plants has been found to be common. A genome analysis of introgression (the transfer of genes between species mediated primarily by backcrossing) in plants ranging from oaks to orchids has demonstrated that a substantial fraction of their genomes has alleles from related species (Baack *et al.*, 2007).

Hybridization can lead to rapid genomic changes, including chromosomal rearrangements, genome expansion, differential gene expression, and gene silencing (Baack *et al.*, 2007). Hybridization can be a creative evolutionary process, allowing genetic novelties to accumulate faster than through mutation alone (Anderson and Hubricht, 1938; Martinsen *et al.*, 2001). These changes in the genome can lead to rapid selection of new ecological traits that will change the genome structure providing populations a means of coping with environmental change or evolving novel adaptations.

Mutations are rare, around 10^{-8} to 10^{-9} per generation per base pair (Abbott *et al.*, 2013). Therefore, it will take considerable time for novel adaptations to evolve by mutation and natural selection.

Hybridization may contribute to speciation through the formation of new hybrid taxa, whereas introgression of a few loci may promote adaptive divergence and facilitate speciation (Mallet, 2005). Hybridiza-

tion and introgression can lead to speciation in much less time than mutation and natural selection.

Closely related species tend to hybridize more often (Price & Bouvier, 2002; Gourbière & Mallet, 2010) suggesting that hybridization and introgression, via adaptation, are more likely to contribute to speciation in rapidly speciating taxa such as in the genus *Encyclia* Hook. and *Odontoglossum*.

A large amount of introgressed variation is deleterious, and in most cases, hybridization has no impact. However, when large numbers of hybridizations occur among closely related species, there is a greater chance that some will result in adaptation and speciation. In the Orchidaceae, the pollination vector is one of the main determining factors if hybridization and introgression results in speciation.

Hybridization and introgression have been found to be common in the subtribe Laeliinae and especially in the genus *Encyclia* Hook. (Sauleda & Adams, 1983; 1984; Sauleda, 2016; 2016a). Many natural hybrids occur in the genus *Odontoglossum* and in many species a high degree of variation can be observed possibly due to hybridization and introgression.

A recent addition to the orchid flora of Colombia, *Odontoglossum portillae* Bockemühl (Uribe-Velez & Sauleda, 2020) from Ecuador demonstrates the high degree of variation which occurs in species of the genus *Odontoglossum*.



Variation in *Odontoglossum portillae* Bockemühl from Ecuador.
Photograph courtesy of Guido Deburghgraeve.



Odontoglossum crispum Lindl. Plant photographed near type locality in 2010.

Locality on holotype: “In the woods between the villages of Zipaquirá and Pacho in the Provincia of Bogotá.”

The flowers pictured above closely match the illustration by Veitch of *O. crispum*. However, the type specimen (Holotype, K) is a plant with an inflorescence having several lateral branches, a rare occurrence in the species.



Odontoglossum crispum Lindl. Holotype at K.

The type specimen is atypical of most of the plants found at the localities studied. The majority of the plants do not have branched inflorescences. However, there are plants with branched inflorescences in the Fusagasugá population that match the holotype. These branched inflorescences can be explained as a result of introgression with *O. gloriosum*.



Odontoglossum crispum Lindl. from Fusagasugá. Branched form is nicknamed “cola de pato”.



Comparison of Flowers of Representative Individuals from each locality.

A comparison of representative flowers from each locality tends to support the statement by Poirier that the forms from Fusagasugá are smaller and have “starry-like flowers”. The comment that the finest forms come from Velez is difficult to verify because plants with round petals and full form are found at all the localities except Fusagasugá. Spotted flowers were found at all the localities. In the general shape the flowers from Fusagasugá are consistently star-shaped but this difference is not sufficient to merit describing the population as a new taxon. The shape of the labellum, the shape of the sepals and petals varied in each population not demonstrating any clear consistent difference between populations.

Labellum Comparison



Fusagasugá



Pacho



Putumayo



Velez

Comparison of Shape of the Labellum of the Flowers of Representative Individuals from each locality.

The size and shape of the labellum was not consistent in each population and therefore, could not be used to characterize the population.

Crest Comparison



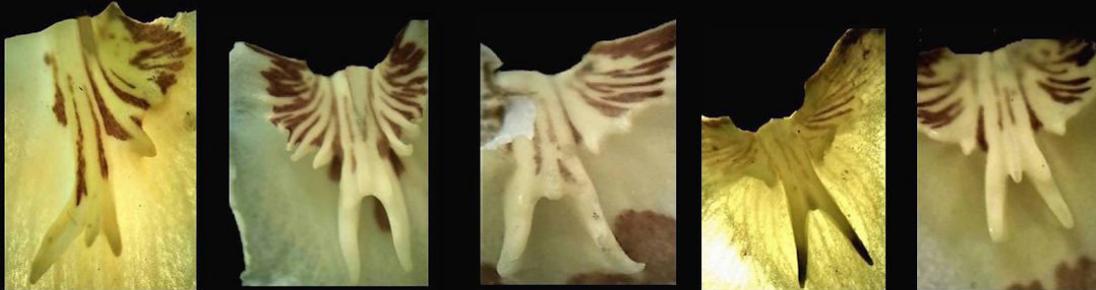
Fusagasugá



Pacho



Putumayo



Santander

Comparison of the Crest of the Flowers of Representative Individuals from each locality.

A comparison of representative crests from each population demonstrates a wide range of variation within each population. The lateral lamellae of the callus vary in size and length as do the two central lamellae and a third central lamellae is not always present.

**Labellum - Crest
Comparison - Individual**



Fusagasugá



Pacho



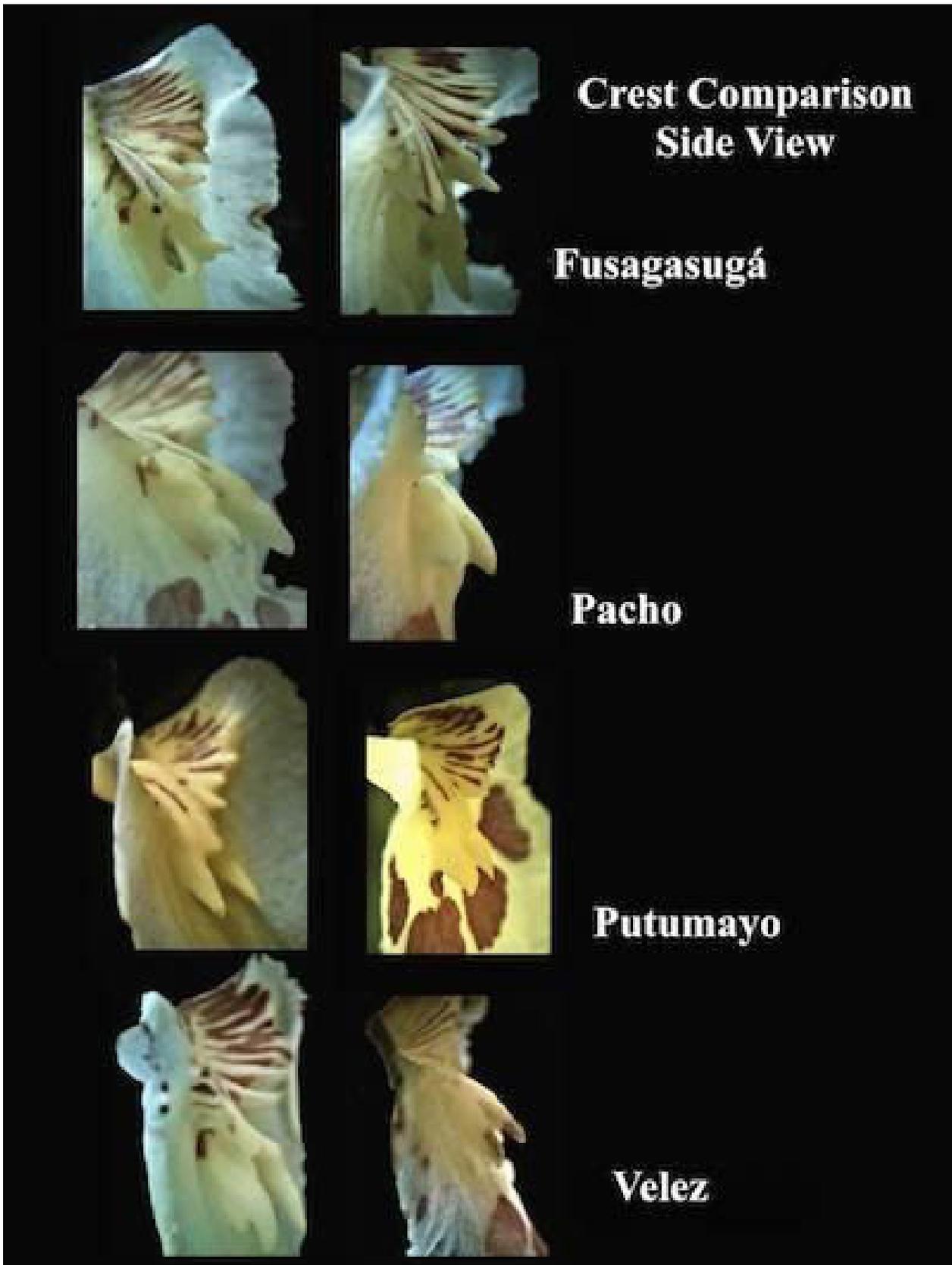
Putumayo



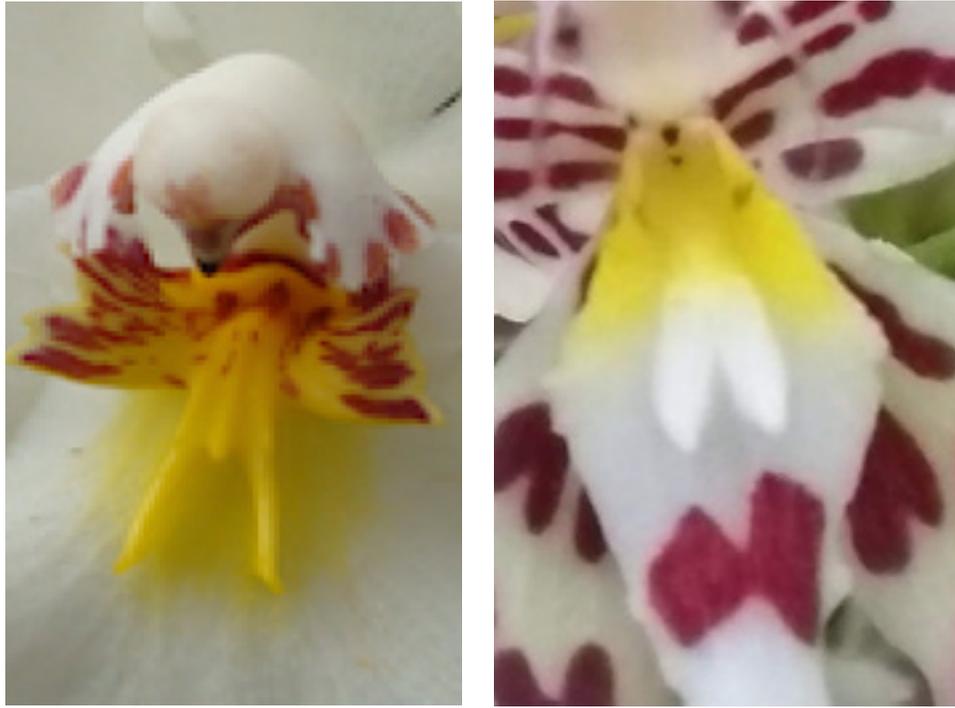
Velez



Comparison of Labellum and Crest of Flowers of a Representative Individual from each locality.



Comparison of Side View of Crests of Flowers of a Representative Individual from each locality.



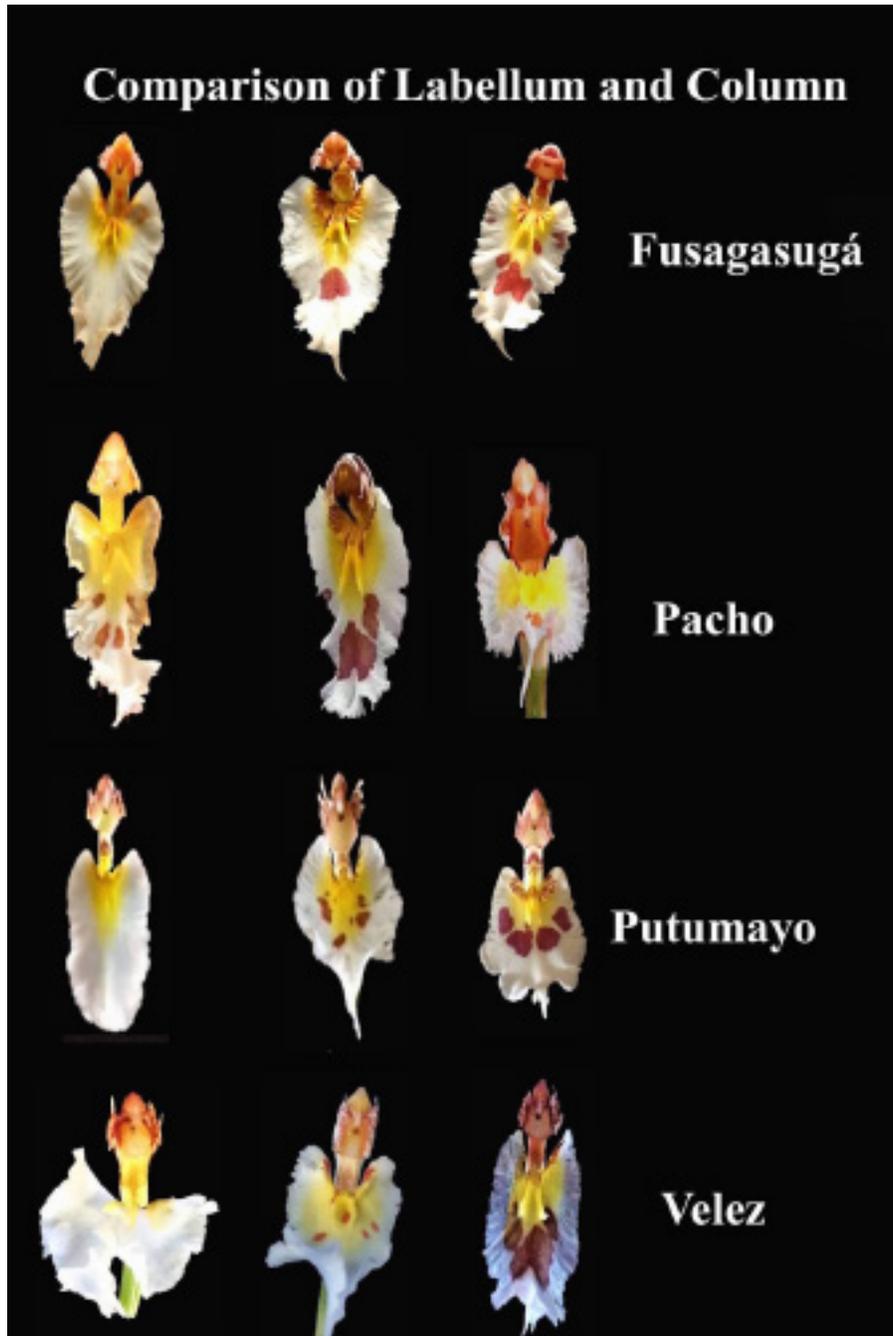
Crest of *Odontoglossum nobile* Rchb. f. and *Odontoglossum gloriosum* Linden & Rchb.

In populations of *O. crispum* from Pacho, in the side view of the crest introgression involving *O. gloriosum* can be observed. Introgression with *O. nobile* can be observed in almost all the populations.

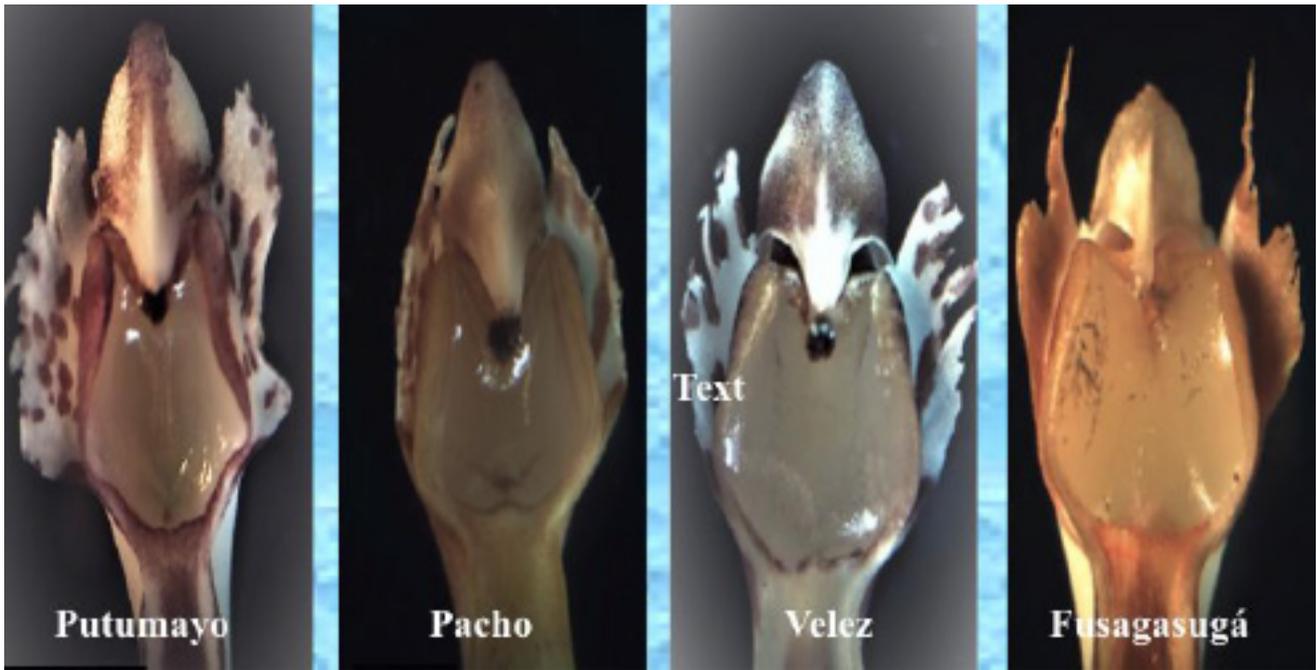


Comparison of Close-up of Crest of Selected Individuals from each locality.

Many individuals from Pacho and Velez have crests with short lateral fan-like lamellae, where many individuals from Fusagasugá and Putumayo have longer lateral lamellae and a long central pair of lamellae with a third short central lamella. The crests of some individuals from Pacho lack the pronounced central lamella and the plants from Velez have a short blunt central lamella. The shape of the lamellae of both Fusagasugá and Putumayo may be due to hybridization and introgression as Poirier suggested. There appear to be definite differences when observing the crests of only selected individuals from the four localities. However, in general the range of variation within each locality is too wide to define each population exactly or describe as new taxa.



Comparison of Labellum and Column of Flowers of Representative Individuals from each locality.



Comparison of Column Structure of Selected Individuals from each locality.

Individuals with distinctly different wings on the column can be found in all four populations. The wings of Putumayo and Velez are the most similar with Pacho having the same broad wings but much reduced in size. Some of the wings of the plants from Fusagasuga have a long thin frontal termination. However, these differences are not consistent in the populations, a wide range exists.

The plants from Fusagasugá demonstrate the greatest variation in the lamellae of the crest and in the wings of the column. The variation found in the lamellae and starry-like shape may be due to introgression with *O. luteopurpureum* and the frontal projections of the wings due to introgression with *O. odoratum*.

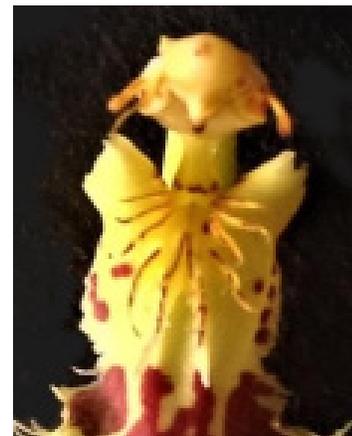
An analysis of the patterns of the lamellae on the labellum of several species of *Odontoglossum* in the sub-genus *Odontoglossum* shows similarities. Similar patterns of the lamellae can be found in individuals of *O. crispum* in the four localities.



***Odontoglossum epidendroides* Kunth**



***Odontoglossum cristatellum* Rchb. f.**



***Odontoglossum hallii* Lindl.**



*Odontoglossum
sceptrum* Rchb. f. & Warsz.



*Odontoglossum
hunnewellianum* Rolfe



Odontoglossum paniculatum
Dalström & Deburghgr.



Odontoglossum tripudians Rchb. f. & Warsz.

Conclusion

Individuals can be chosen from each locality to demonstrate a distinct pattern of differences. Comparing these selected individuals which, do not represent the total variation of the population, an argument could be made to classify each population as different taxa.

These differences in the lamellae and wings of the column can be of great importance when considering the pollinator of each population. The pollinator is the determining factor as to if these populations will evolve into different taxa. A study of the pollinators needs to be made in situ to determine the level of iso-

lation between the populations and if pollinators are selecting distinct forms within the populations.

In conclusion, the four populations can be distinguished if only comparing selected individuals however, if all of the individuals in the population are considered, a wide range of variation occurs without specific consistent characters that could be used to define the populations. Therefore, they are not “diagnosable distinct” enough, to be considered distinct taxa. In addition, the degree of reproductive isolation between the populations is not known. The high degree of variation found at each locality is a direct result of introgression. A report by Florent Claes in the

Orchid Review (1906) lists at the Fusagasugá region *O. luteopurpureum*, *O. gloriosum*, *Odontoglossum lindleyanum* Rchb. f. & Warsz. and *Odontoglossum lindenii* Lindl. sympatric with *O. crispum*. In the Pacho region Claes lists *O. gloriosum*, *O. lindleyanum*, *O. luteopurpureum*, *O. xhunnewellianum* and *Odontoglossum wallisii* Linden & Rchb. f. as sympatric with *O. crispum*. Introgression with these species would account for the variation found in *O. crispum* at the localities.

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Note – Issue No. 77. *Orchid Review* (1906) lists at the Fusagasugá region *O. luteopurpureum*, *O. gloriosum*, *Odontoglossum lindleyanum* Rchb. f. & Warsz. and *Odontoglossum lindenii* Lindl. sympatric with *O. crispum*. In the Pacho region Claes lists *O. gloriosum*, *O. lindleyanum*, *O. luteopurpureum*, *O. xhunnewellianum* and *Odontoglossum wallisii* Linden & Rchb. f. as sympatric with *O. crispum*. Introgression with these species would account for the variation found in *O. crispum* at the localities.