

Overview of *Cranichis* (Orchidaceae, Cranichidinae) and allied genera with notes on their Colombian representatives

Marta Kolanowska · Dariusz L. Szlachetko

Received: 4 October 2013 / Accepted: 11 June 2014 / Published online: 3 July 2014
© The Author(s) 2014. This article is published with open access at Springerlink.com

Abstract The diversity of the Neotropical subtribe Cranichidinae comprising mostly terrestrial orchids is still discussed by numerous taxonomists. The actual number of species classified in the genera of this group seems to be underestimated in the light of the recent revisions of the herbarium material. In this paper the taxonomic affinities of three controversial species considered as representatives of *Cranichis*: *Pseudocranichis thysanochila*, *Ocampoa mexicana* and *Exalaria parviflora* are discussed. Three new combinations, one within *Pseudocranichis* and two within *Ocampoa* are proposed. Results of the taxonomic revision of Colombian *Cranichis* are presented together with a key to the national representatives of the genus.

Keywords *Cranichis* · *Exalaria* · *Galeoglossum* · Neotropics · *Ocampoa*

Introduction

The list of Colombian orchids compiled by Ortiz Valdivieso and Uribe Vélez (2007) includes almost 3,000 species and subspecies. This number seems to be underestimated taking into consideration the latest discoveries of new taxa representing various taxonomic groups (Higgins and Viveros 2008; Giraldo and Dalström 2012; Hills and Weber 2012; Kolanowska and Pérez-Escobar 2012; Kolanowska and Szlachetko 2012, 2013a, b; Kolanowska et al. 2012; Pérez-Escobar et al. 2013; Szlachetko and Baranow 2012;

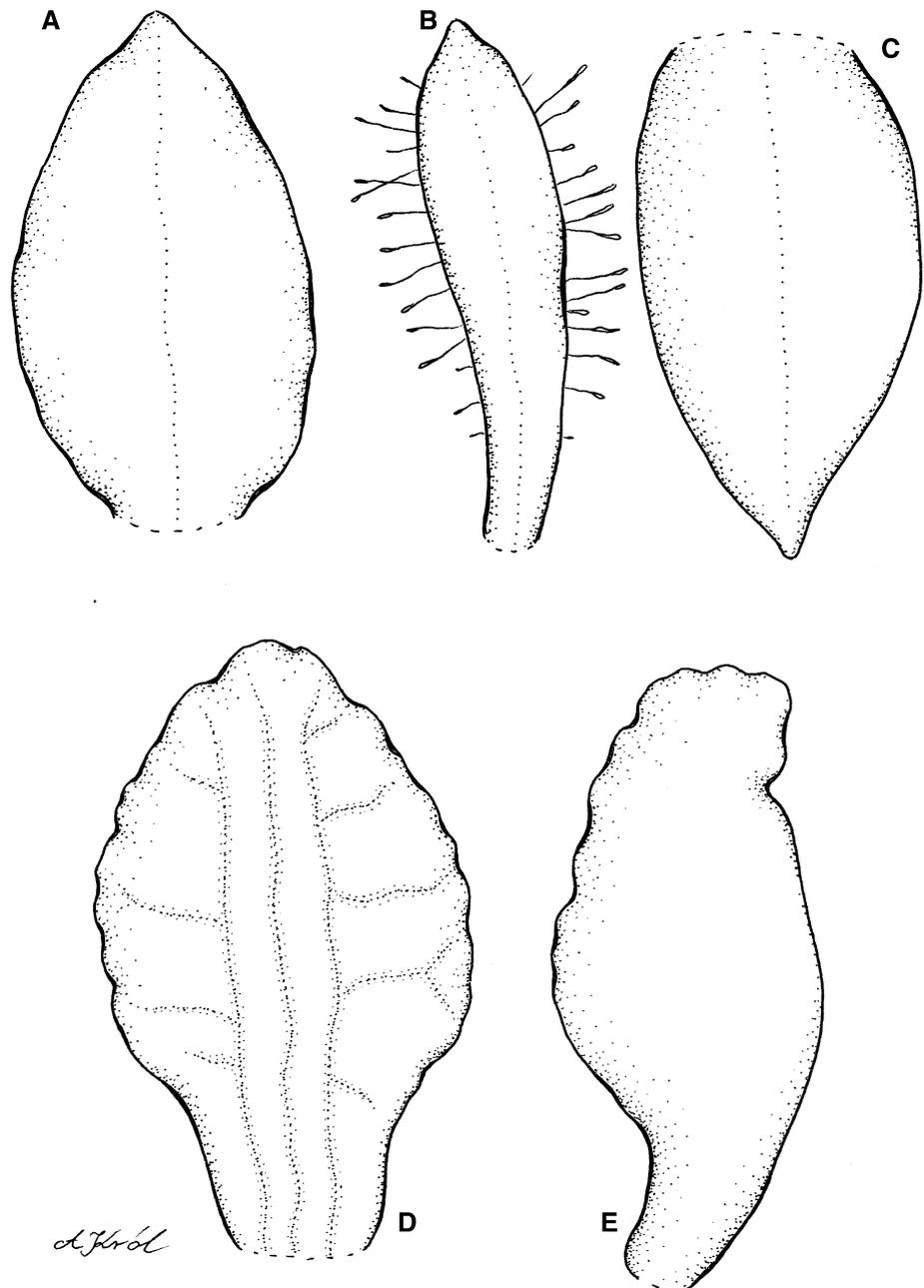
Szlachetko et al. 2013). The best illustration of this situation is the recent revision of *Microchilus* (Goodyerinae) which resulted in the description of over 90 new species (Ormerod 2002, 2005, 2007, 2008, 2009a, b). The limited monitoring of the tropical regions resulting in the insufficient herbarium representation together with the difficulties related to the small size of the perianth parts, complicated lip construction and hiding of taxonomically important characters inside usually tubular flowers makes many spirantheid orchids intractable, but promising object of study.

One of the taxa of which specific diversity remains poorly recognized is *Cranichis* described in the end of XVIII century (Swartz 1788). The nominal species, *C. muscosa* Sw., was selected over 150 years after the formal description (Acuña 1939). The taxonomic position of the genus in Orchidaceae is not questioned. While in the older classification systems (Pfitzer 1889; Bentham and Hooker 1862–1863; Dressler and Dodson 1960), *Cranichis* was placed in a broadly defined tribe Neottieae, currently it is recognized as a member of subtribe Cranichidinae in Cranichideae (Dressler 1981, 1993; Szlachetko 1995; Szlachetko and Rutkowski 2000; Chase et al. 2003). Nevertheless, Dressler (1981, 1993) and Szlachetko (1995) considered Cranichideae as a tribe of subfamily Spiranthoideae based on their morphological characters, while the molecular taxonomists (Chase et al. 2003; Salazar et al. 2003) placed it in Orchidoideae.

The aim of this study was to evaluate the morphological differences between *Cranichis* and allied genera segregated from this taxon in the recent years: *Exalaria* Garay and Romero, *Ocampoa* A. Rich. and Gal. and *Pseudocranichis* Garay. In addition, the results of the revision of Colombian representatives of *Cranichis* s.s. are presented and a key to the national species is provided.

M. Kolanowska (✉) · D. L. Szlachetko
Department of Plant Taxonomy and Nature Conservation,
University of Gdańskul, Wita Stwosza 59, 80-308 Gdańsk,
Poland
e-mail: martakolanowska@wp.pl

Fig. 1 *Cranichis engelii*. **a** Dorsal sepal, **b** petal, **c** lateral sepal, **d** lip, and **e** lip (side view). Drawn by A. Król



Materials and methods

In total about 1,000 herbarium specimens of *Cranichis* and related genera were revised. The material was studied in or borrowed from the following institutions: AAU, AMES, AMO, B, BM, C, CAS, CAY, CICY, COL, CUVC, E, ENCB, F, FLAS, G, GB, HAJB, HB, HEID, HPUJ, HUA, HURP, INB, JAUM, K, L, LE, LINN, M, MA, MEXU, MO, MOL, NY, P, QCA, QCNE, QPLS, RENZ, RPSC, S, SEL, TEFH, TULV, U, UC, UGDA, UPRRP, US, USJ, USM, VALLE, VEN and W.

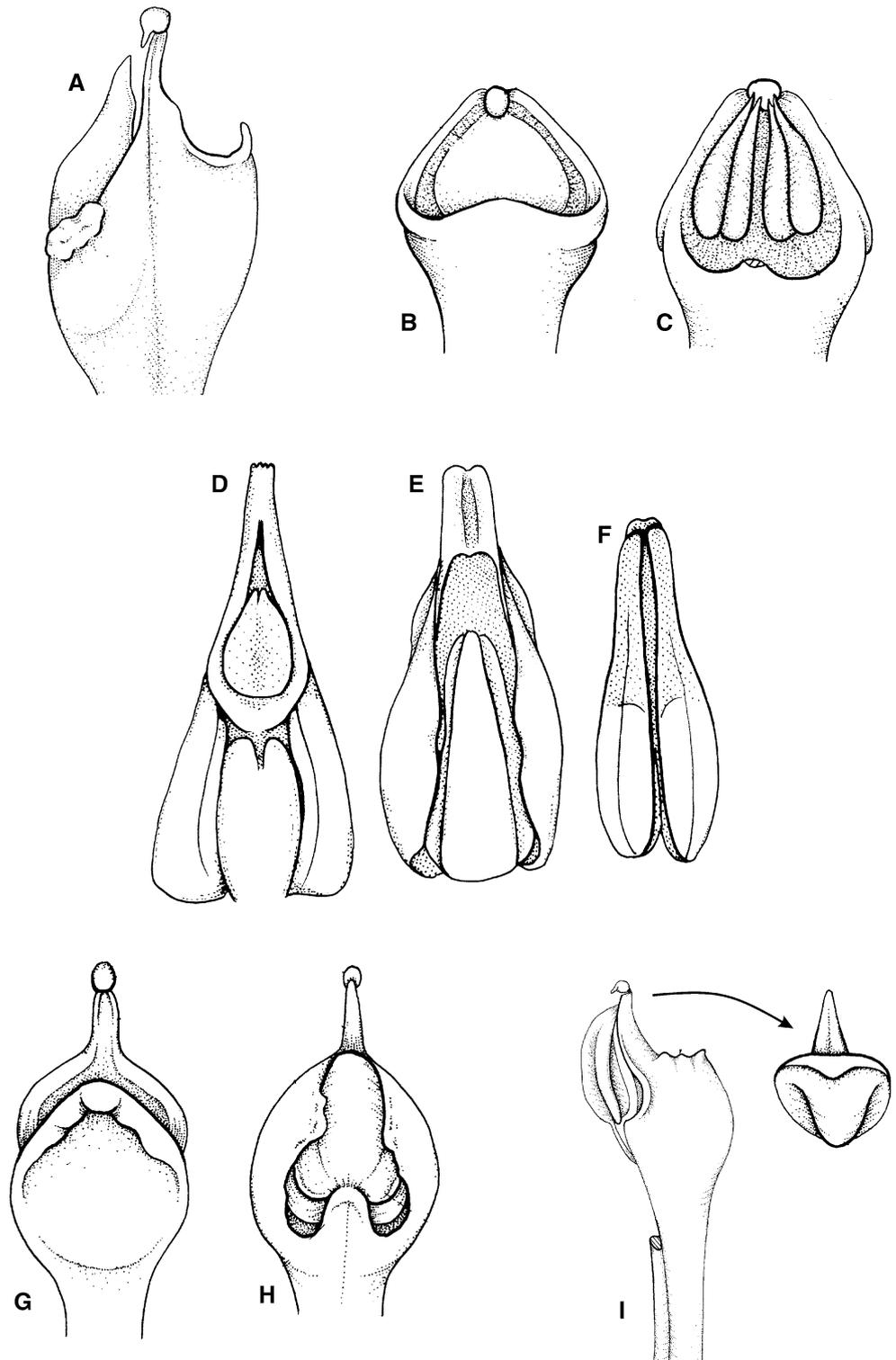
Dried herbarium specimens were examined according to the standard procedures. Every studied sheet was photographed and the data from the labels were taken. Both vegetative and generative characters of each plant were studied. The shape and size of the leaves were examined first, then the arrangement of the inflorescence and the shape and size of the floral bracts and ovary. The morphology of flower and the surface of its elements were examined after softened in boiling water. The stereomicroscope was used to make observations of the perianth parts and their measurements.

Acronyms for herbaria cited in this paper followed *Index Herbariorum* (Thiers continuously updated). The Corel-Draw v.12 software was used for the preparation of the distribution maps.

Classification of cranichid orchids

Cranichidinae sensu Dressler (1981) comprises 15 genera grouped in two alliances corresponding more or less with

Fig. 2 Gynostemium morphology of Cranichidinae representatives: *Cranichis* (a), *Exalaria* (b, c), *Ocampoa* (d–f), *Ponthieva* (g, h) and *Baskervilla* (i)



his later subtribes Prescotttinae and Cranichidinae s.str. (Dressler 1993). Both subtribes differ considerably one from another in the gynostemium and pollinia structure. Prescotttinae are characterized by large, bi-winged clinandrium, completely covering the sides and back of the anther, or occasionally vestigial. Stigma is entire to

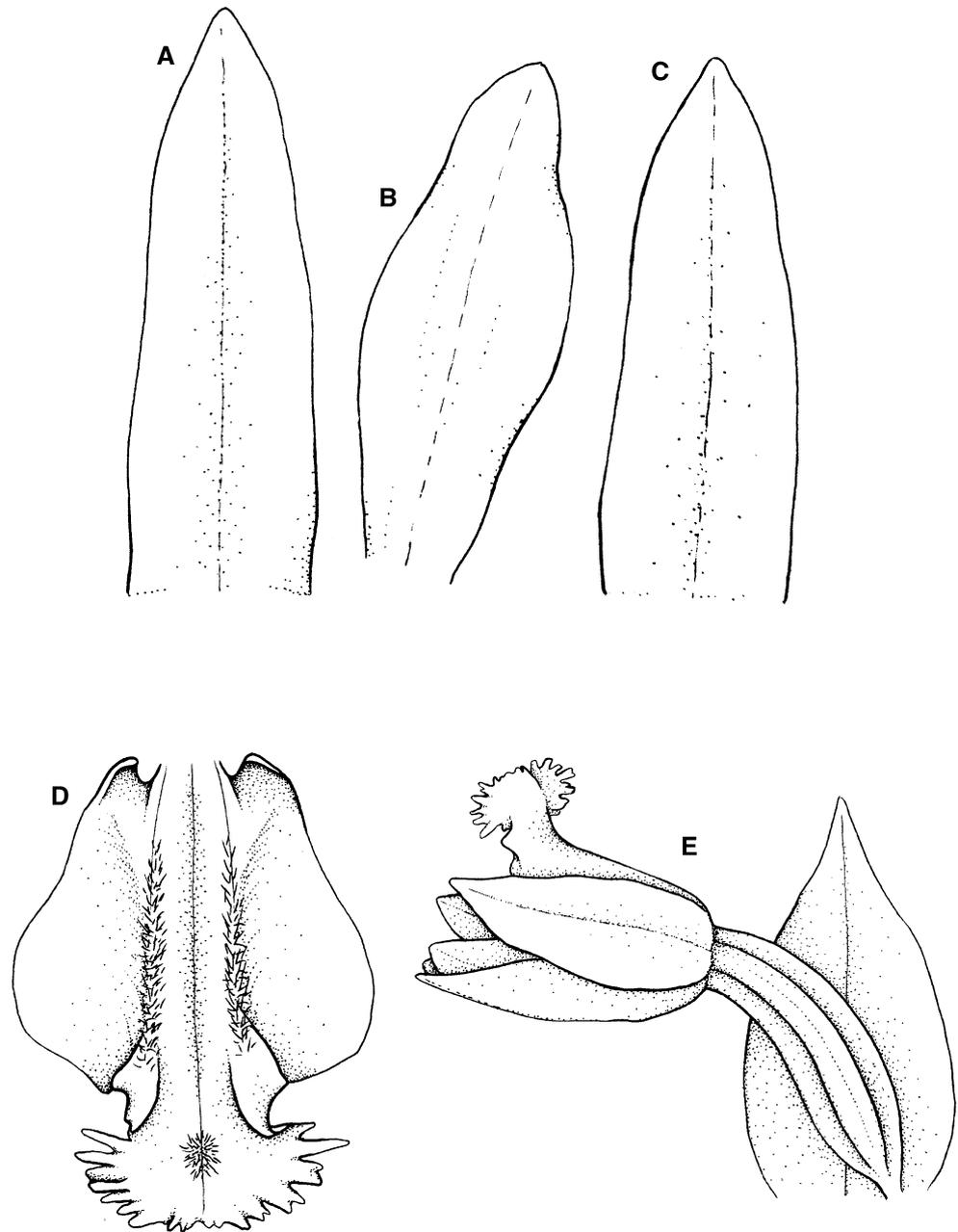
separately bilobed, with lateral lobes well developed to rudimentary and rostellum is shelf-like, soft, thin, erect, obtuse or truncate at the apex. Pollinia in orchids of this group are soft and powdery. Cranichidinae s.str. can be determined as having clinandrium usually stretched between the filament and the apical margin of the stigma,



Fig. 3 a, b *Cranichis ciliata* (Photos by A. Kay); c, d *Exalaria parviflora* (Photos by M. Kolanowska and A. Kay); e, f *Ocampoa mexicana* (Photo by C. Velazco); g, h *Pseudocranichis thysanochila*

Holotype; i, j *Galeoglossum tubulosum* (Photos by F. Muller); k, l *Ponthieva racemosa* (Photos by A. Kay)

Fig. 4 *Pseudocranichis thysanochila*. **a** Dorsal sepal, **b** petal, **c** lateral sepal, **d** lip, and **e** flower (*side view*). Drawn by D.L. Szlachetko



usually detached from the anther. Stigma is horizontal, transversely elliptic to gibbous, deeply concave, and formed of the lateral lobes of the stigma. The prominent rostellum is usually digitate, fleshy, erect, and acute. Pollinia are relatively hard, formed of compact pollen grains.

In both groups the flowers are non-resupinate, but in Prescottinae the lip is usually concave, often fringed along the margins and in Cranichidinae it is fixed, saccate to spurred basally.

Based primarily on the gynostemium structure, mainly rostellum, viscidium and pollinium organization Szlachetko (1995) proposed different placement of

considered subtribes. He included Prescottinae to Spiranthaeae, leaving Cranichideae as a monotypic tribe. Salazar et al. (2009) based on analyses of selected DNA markers combined genera of both subtribes into Cranichidinae s.l.

The subtribe Prescottinae Dressl

Aa Rchb.f., *Altensteinia* Kunth, *Galeoglossum* A. Rich. and Gal., *Gomphichis* Lindl., *Myrosmodes* Rchb.f., *Porphyrostachys* Rchb.f., *Prescottia* Lindl., *Pseudocranichis* Garay, *Stenoptera* C. Presl

The subtribe Cranichidinae Lindl

Baskervilla Lindl., *Cranichis* Sw., *Exalaria* Garay and Romero, *Fuertesilla* Schltr., *Ocampoa* A. Rich. and Gal., *Ponthieva* R.Br., *Pseudocentrum* Lindl., *Pterichis* Lindl., *Solenocentrum* Schltr.

Taxonomic concepts of *Exalaria*, *Ocampoa* and *Pseudocranichis*

While most of the species included in *Cranichis* share similar vegetative and floral characters (Figs. 1, 2a, 3a, b), the taxonomic affinities of the three of them, e.g. *C. thysanochila* Rob. and Greenm., *C. mexicana* (A. Rich. and Galeotti) Schltr. and *C. fertilis* (F. Lehm. and Kraenzl.) Schltr., have been recently discussed and none of these taxa is treated as *Cranichis* at the present day. Their generic affinities are here discussed.

The first one, Mexican *C. thysanochila* (Fig. 3g, h) is distinguished by the bipartite lip with a fringed apex, two thickened and pubescent veins (Fig. 4) on the disc and gynostemium (Fig. 5a–c) with saddle-shaped stigma and short, truncate rostellum. As this species morphologically does not correspond to any other cranichid genus it was elevated to the generic rank by Garay (1982) and named *Pseudocranichis*. The gynostemium morphology (Szlachetko 1995) and the results of the molecular research (Álvarez-Molina and Cameron 2009) confirmed the close relation of *Pseudocranichis thysanochila* with Prescottiinae rather than Cranichidinae. In the genetic level, this species

is nested in *Prescottia*, with strong support for its position as sister to *P. tubulosa* (Figs. 6, 5d, e, 3i, j) from which it differs significantly in the morphological characters. Salazar (2009) proposed the transfer of *P. thysanochila* to the recently restituted genus *Galeoglossum* A. Rich. and Galeotti, together with *Prescottia tubulosa* (Lindl.) L.O. Williams, considering this taxon as a synonymic with *Galeoglossum prescottiioides* A. Rich. and Galeotti. Worth to mention that *Prescottia tubulosa* was described initially also as a member of *Cranichis*. Both *P. thysanochila* and *Galeoglossum tubulosum* are restricted in their distribution to the conifer–oak forests in the mountains of Mexico and Guatemala and they may grow sympatrically (Salazar 2009). Both, according to Salazar (2009), are distinguished from other cranichid orchids by a saddle-shaped stigma with a wet, sticky receptive area at each side, being separated by a dry, non-receptive central portion. Other characters shared by those species are tepals recurved above the middle, the lip base provided with a retrorse, rounded auricle on each side and the ribbon-like pollinia joined at the apex to one another and to a small, ovate or deltate viscidium. Both species, however, differ significantly in the flower morphology. In *Pseudocranichis* tepals are free to the base and the lip is distinctly constricted in the apical third or quarter with a prominent, lacerate apical lobule (Fig. 4). The tepals of *Galeoglossum* are basally connate and lip apical lobule is inconspicuous and entire (Fig. 6). Considering these differences, the generic separation of *Pseudocranichis* from *Galeoglossum* seems to be justified.

There is another species which was considered as a member of *Cranichis*, *Ocampoa mexicana* A. Rich and

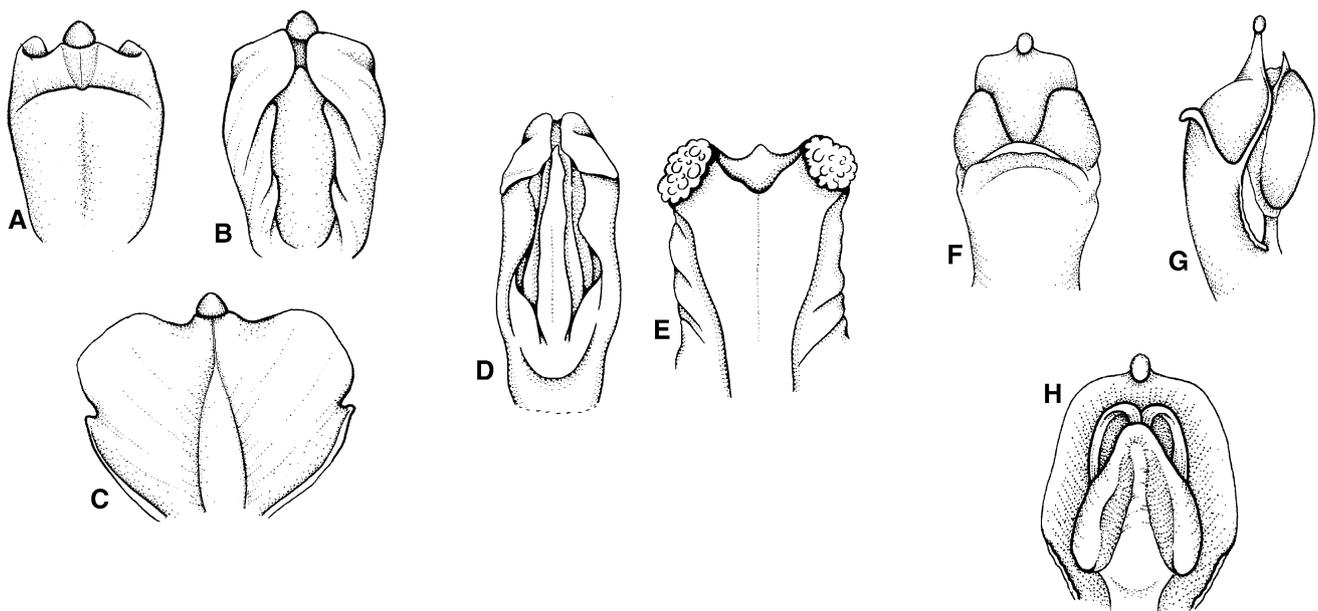
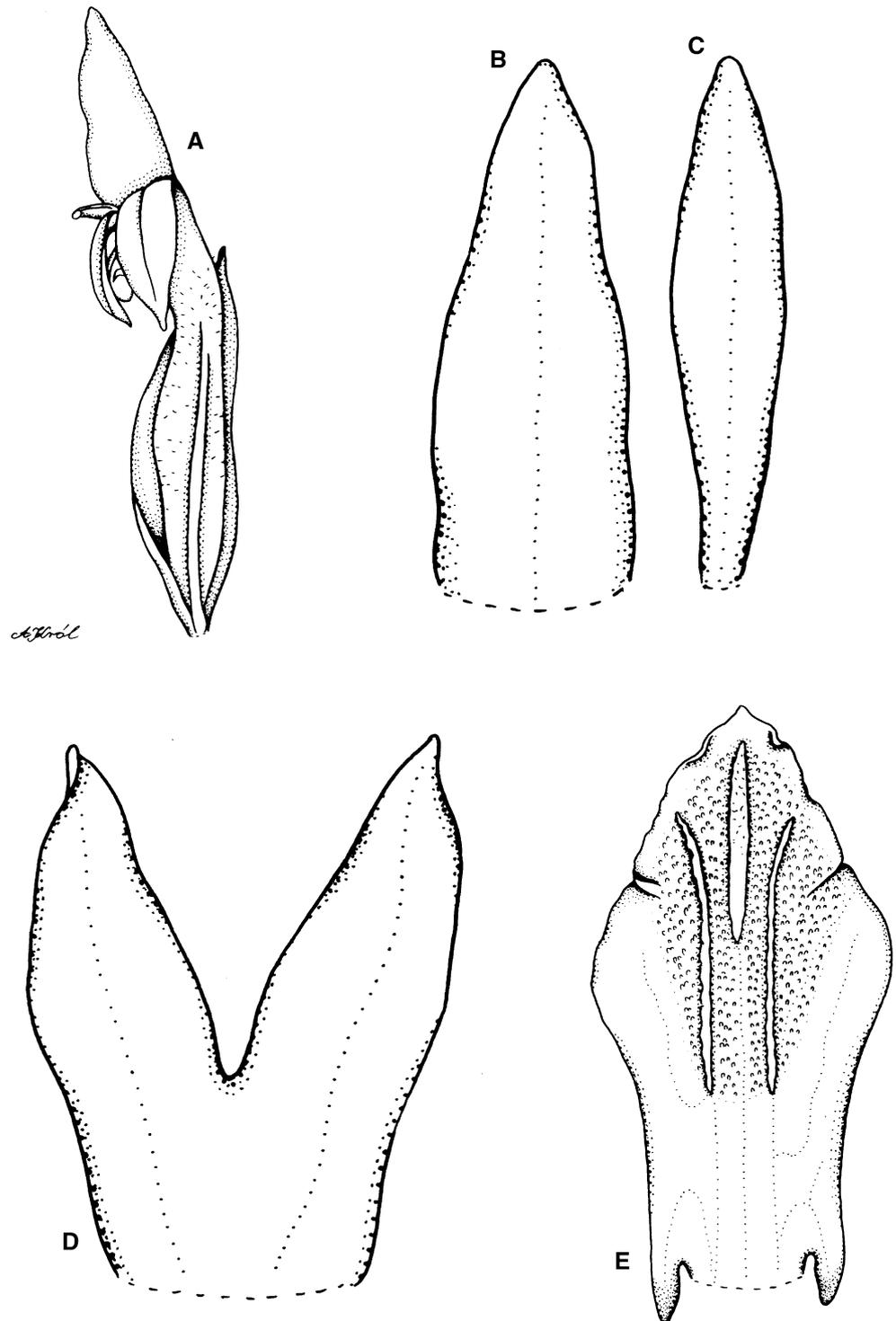


Fig. 5 Gynostemium morphology of Prescottiinae representatives: *Pseudocranichis* (a–c), *Galeoglossum* (d, e) and *Prescottia* (f–h)

Fig. 6 *Galeoglossum tubulosum*. **a** Flower (side view), **b** dorsal sepal, **c** petal, **d** lateral sepals and **e** lip. Drawn by A. Król



Galeotti (Fig. 3e, f). It was embedded into *Cranichis* by Schlechter (1918); however, this replacement was argued by González Tamayo (1995) and Soto (2008). *Ocampo mexicana* differs from *Cranichis* species by the long-clawed, navicular lip lacking branching, coloured veins, the basally auriculate sepals (Fig. 7) and the gynostemium

lacking the wing-like margins (Fig. 2d–f). Its vegetative characters, e.g. concolor, short-petiolate leaves with a conspicuous net of slightly protruding nerves suggest the close relation with *Baskervilla* Lindl. and *Ponthieva* R. Br., however, Bentham and Hooker (1862–1863) noticed the similarity of *Ocampo* to *Prescottia*. The form of perianth

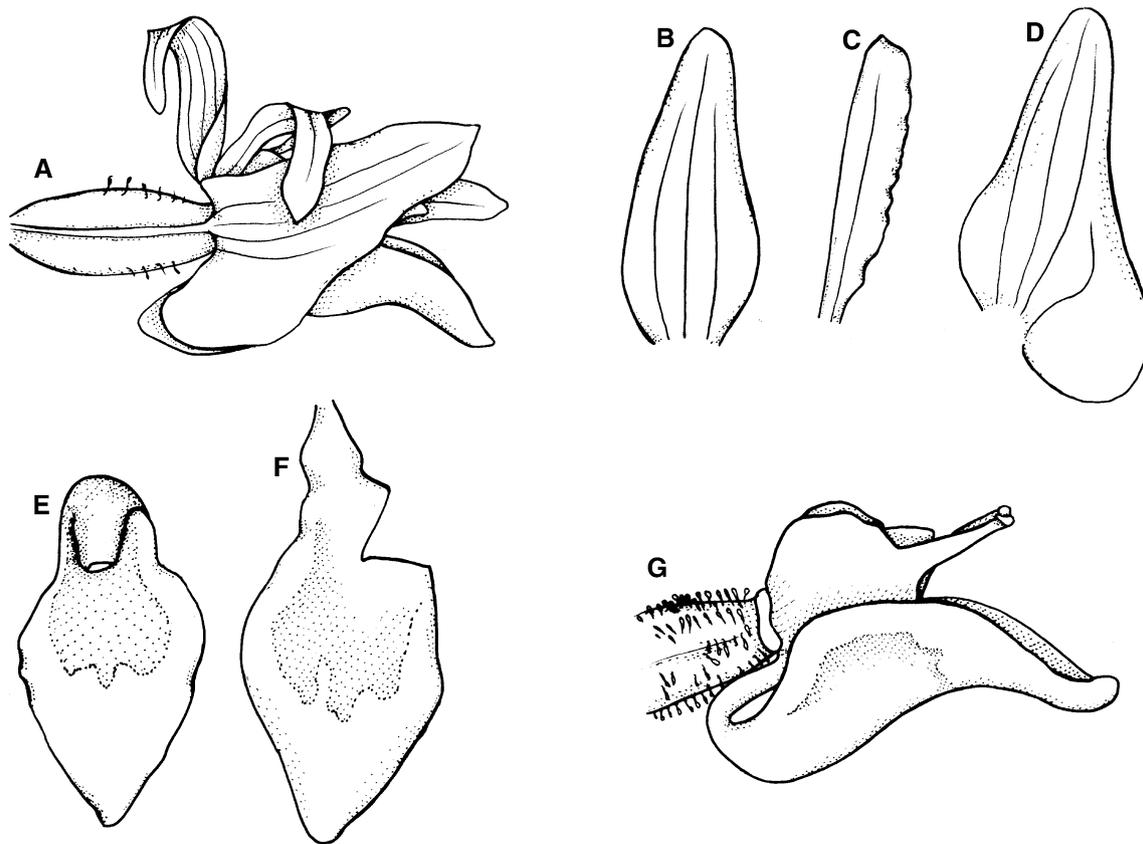


Fig. 7 *Ocampoa mexicana*. **a** Flower (side view), **b** dorsal sepal, **c** petal, **d** lateral sepal, **e** lip, **f** lip (side view) and **g** lip and gynostemium in the natural position. Drawn by P. Baranow

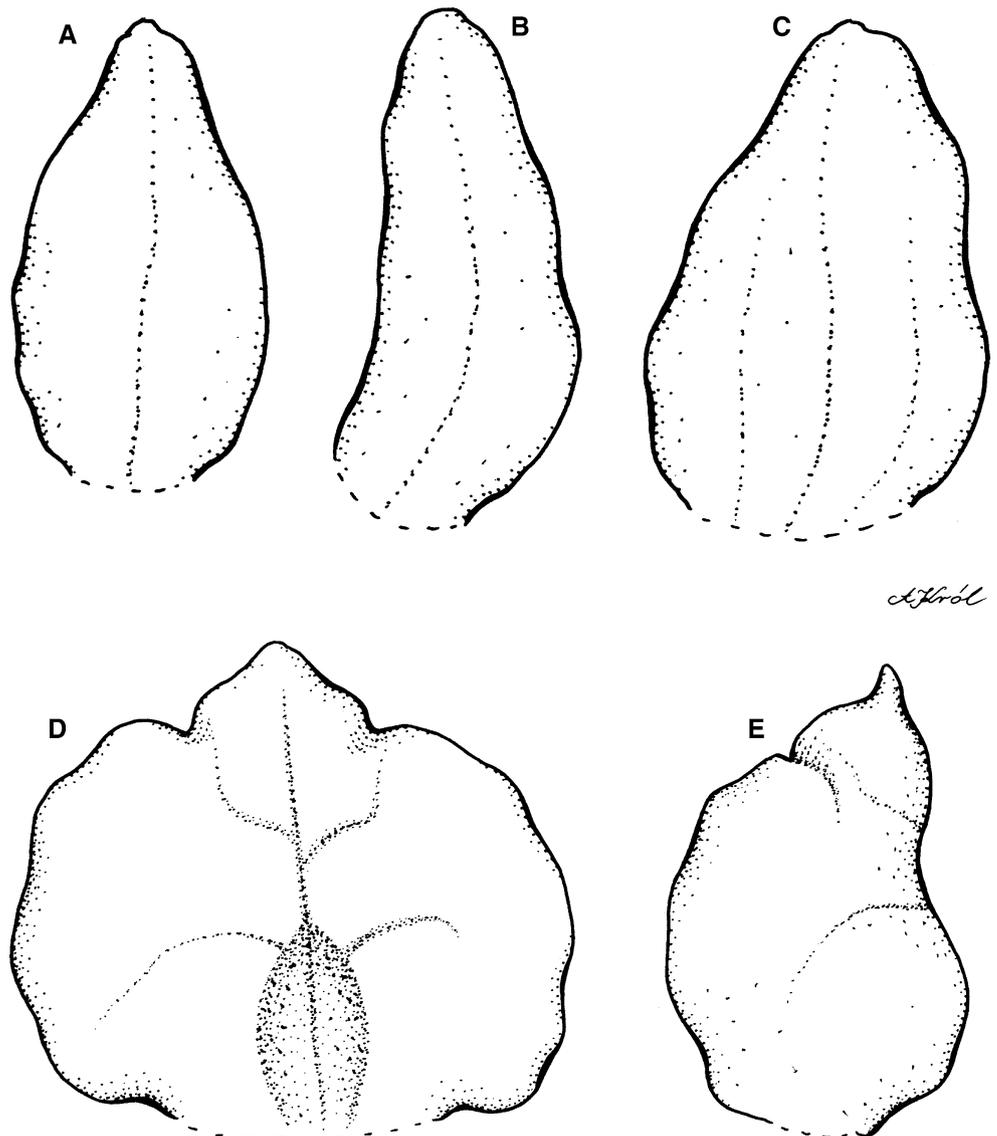
segments, e.g. asymmetric lateral sepals and linear petals, resembles that of *Baskervilla*, but from the latter *O. mexicana* differs by the petals and lip being free from the gynostemium. *Ocampoa* was usually accepted by the orchidologists (Hágsater et al. 2005; Soto 2008); however, recently Salazar et al. (2009) based on the results of the genetic research proposed a transfer of the species into *Ponthieva*, despite essential differences in the flower and gynostemium structures between taxa in question. The gynostemium of *Ponthieva* is stalked, swollen above narrow base, connate with the lip and petals. The petals are strongly asymmetric, clawed and lip variously transformed with various calli.

The last species which does not fit the morphological concept of *Cranichis* is *C. fertilis* (Figs. 3c, d, 8) widely distributed in tropical South America. The most distinctive characters of the plants include the triangular stigma, the bifid rostellum and the lack of hamulus (Fig. 2b, c, Szlachetko and Rutkowski 2000). Based on those features the species was elevated to the generic rank as *Exalaria parviflora* by Garay and Romero-González (1999) and this position was confirmed in the molecular studies of Álvarez-Molina and Cameron (2009, Fig. 9). The concept

of monotypic *Exalaria* was argued by Salazar who transferred *E. parviflora* to *Ponthieva* (Salazar et al. 2009), despite inconsistency of this replacement with the morphological diagnostic characters of the latter genus which includes adnation of the petals above the gynostemium base and the presence of the clawed lip that is often much smaller than tepals. Moreover, the rostellum of *Ponthieva* is truncate (Fig. 2g, h), not bifid like in *E. parviflora*. We believe that since this species cannot be placed within any existing genus, it should be maintain as the monotypic, separate one.

As mentioned before both *O. mexicana* and *E. parviflora* were reassigned recently by Salazar et al. (2009) to the genus *Ponthieva* (Figs. 2g, h, 3k, l, 10) based on the results of the molecular studies in which both taxa were placed in the clade that includes the type of *Ponthieva*. However, the “*Ponthieva* clade” seems to be divided into two groups—within one of them can be found also *Baskervilla colombiana* Garay which, obviously, was not considered by the authors as a member of *Ponthieva* from which it clearly differs by the elongate, slender gynostemium (Szlachetko and Rutkowski 2000). Moreover, while in the Salazar’s strict consensus tree reconstructed by maximum parsimony

Fig. 8 *Exalaria parviflora*.
a Dorsal sepal, **b** petal, **c** lateral
 sepal, **d** lip and **e** lip (*side view*).
 Drawn by A. Król



analysis *Ocampoa* is sister to *Ponthieva ehippium* Rehb. f., in the Bayesian summary cladogram *O. mexicana* is sister to *E. parviflora* receiving high posterior probability value. The inconsistency between the phylogenetic trees together with the obvious morphological differences between *Ponthieva* species and considered taxa encourages to maintain them as separate genera. The comparison of the vegetative and floral characters of *Cranichis*, *Exalaria*, *Ocampoa*, *Pseudocranichis*, *Galeoglossum* and *Ponthieva* is presented in Table 1. The variation in the gynostemium morphology between all genera mentioned before is illustrated in Figs. 2 and 5. The photographs of the discussed taxa are presented in Fig. 3.

From the genera discussed above until now only *Cranichis* and *Exalaria* were reported from Colombia; however, our recent studies revealed the existence of *Ocampoa*

species in the national flora. The results of the recent revision of the Colombian *Cranichis* with the key to the identification of national representatives of the genus are presented in this paper together with the proposals of the new combination within *Ocampoa* and *Pseudocranichis*.

Taxonomic treatment

Considering the usually accepted exclusion of *C. thysanochila*, *C. mexicana* and *C. fertilis* from *Cranichis*, the genus is clearly defined morphologically. Its representatives are easily distinguished from other cranichid orchids by the villous-hairy roots, the distinctly petiolate, suberect or arcuately spreading leaves, non-resupinate flowers, petals much narrower than sepals, and cochleate lip, often

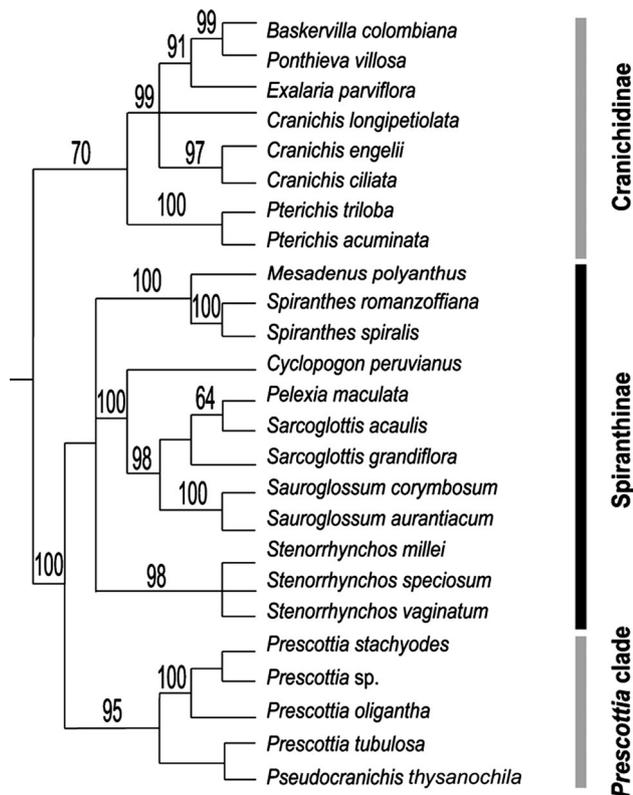


Fig. 9 Fragment of strict consensus of most parsimonious trees presented by Álvarez-Molina and Cameron (2009)

with conspicuously marked, coloured reticulate veins. The gynostemium of those plants is relatively massive, often swollen at the apex, without column-foot. The motile anther is oblong to ovate, 2-chambered and the inconspicuous caudiculae are formed from the apices of pollinia. The clinandrium is usually thick, massive, spacious. The single viscidium is thick and relatively small and the hamulus is usually elongate, finger-like, thick, directed towards the anther (Szlachetko and Rutkowski 2000).

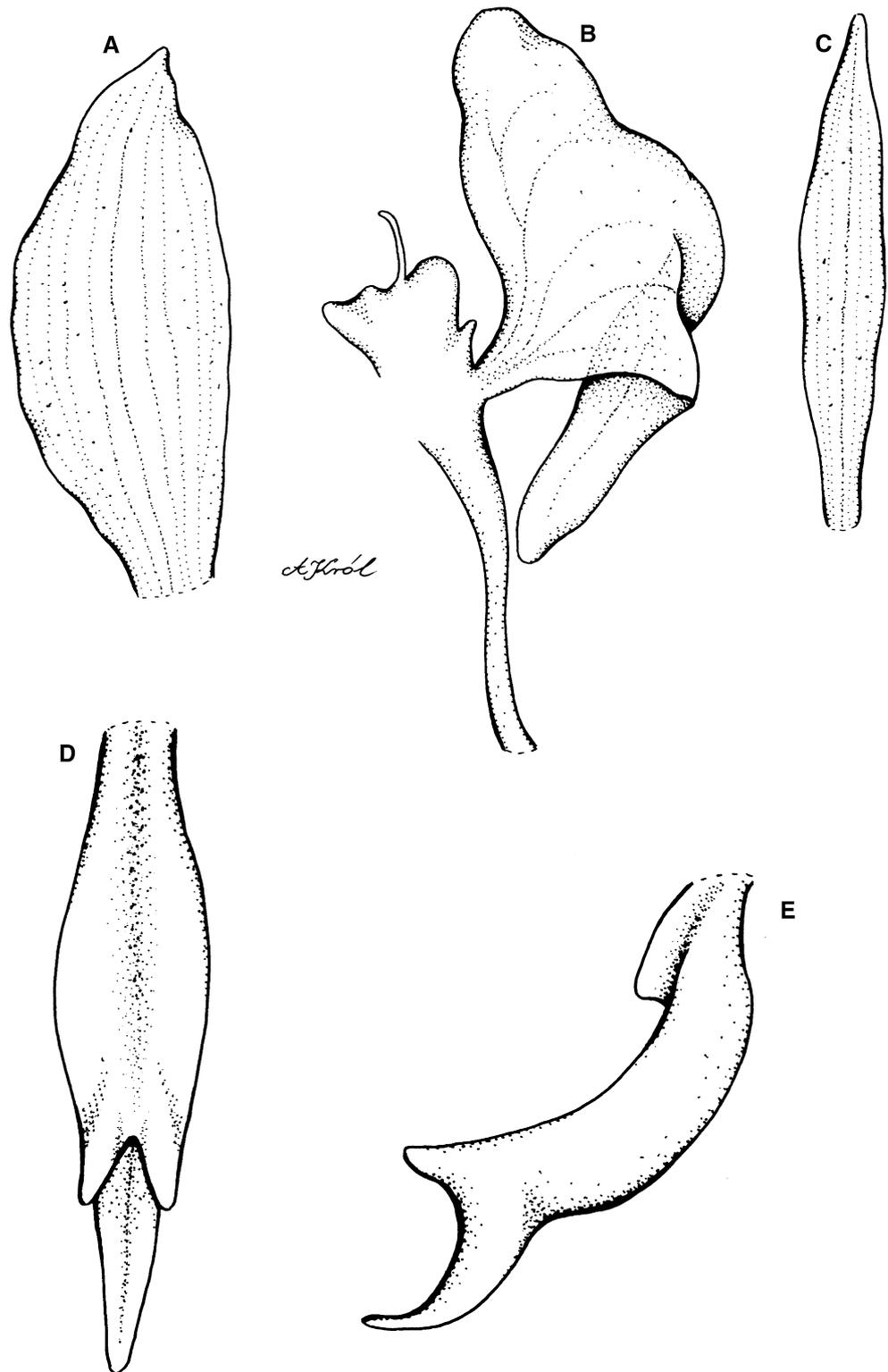
Cranichis representatives grow as terrestrial or litho-phytic plants in lowlands as well as in montane forest, usually in humus and *Sphagnum* tussocks. Some populations were reported as subepiphytic. The altitudinal range of the genus extends from 350 up to 3,000 m a.s.l. (Carnovali and Ramírez-Morillo 2003; Cribb 2003). Currently about 60 known species of the genus are distributed from Florida and Mexico to Bolivia and Argentina. In the Colombian orchid flora 19 species of the genus were found so far. Most of them, except *C. muscosa* and *C. parvula*, were reported from the submontane and montane regions of the country (Ortiz Valdivieso and Uribe Vélez 2007). Plants are common in the litter of the Andean forest and heath and shrubs of subparamo and paramo where they grow in damp and mossy areas. The national species were also reported from pastures and rocky slopes (Dueñas

Gómez and Fernández Alonso 2009). The last comprehensive revision of Colombian *Cranichis* was conducted over 50 years ago (Schneider 1953). Despite the wide geographical range, the novelties within *Cranichis* are rather rare, the most recent description of new species comes from 2004 (Christenson 2004). Our research on Colombian representatives of the genus resulted in description of new entities (Szlachetko and Kolanowska 2013) from this country. We believe that the actual species diversity of *Cranichis* is underestimated and the studies on those small-flowered, terrestrial orchids should be intensified.

Key to Colombian species of *Cranichis*

1. Petals with long hairs or ciliae along the margins.....
 - C. wagneri* (1)
 - 1* Petals without long hairs on the margins..... 2
 2. Petals ciliate..... 3
 - 2* Petals with entire or slightly erose margins, glabrous..... 12
 3. Scape glabrous..... 4
 - 3* Scape glandular or glandular-pubescent..... 6
 4. Petals from a short claw broadly oblanceolate to elliptic.... *C. polyantha* (2)
 - 4* Petals linear-ligulate to oblong-oblanceolate..... 5
 5. Lip midvein unbranched..... *C. engelii* (3)
 - 5* All lip veins branching..... *C. muscosa* (4)
 6. Ovary glandular or papillate..... 7
 - 6* Ovary glabrous..... 9
 7. Lip with spiculate pustules or knob-like projections..... *C. schlimii* (5)
 - 7* Lip without any additional projections on the surface..... 8
 8. Lip broadly ovate, obtuse, nerves 3, main nerves thickened, branches and anastomoses thin *C. brachyblephara* (6)
 - 8* Lip elliptic-ovate in outline, apex truncate with short, triangular, acute apiculus *C. zarucchii* (7)
 9. Inflorescence elongate, raceme 8–12 cm long, longer than the leaf blade..... *C. antioquiensis* (8)
 - 9* Raceme up to 4–7 cm long, shorter than the leaf blade..... 10
 10. Ovary about 5–6 mm long..... 11
 - 10* Ovary up to 11 mm long..... *C. ciliata* (9)
 11. Sepals attenuate towards the apex, petals minutely ciliate along margins, lip longer than wide..... *C. pleioneura* (10)
 - 11* Sepals rounded at the apex, petals pubescent along margins, lip as long as wide..... *C. polyblephara* (11)
 12. Petals margins erose ... *C. picta* (12)
 - 12* Petals margins entire ... 13

Fig. 10 *Ponthieva diptera*.
a Dorsal sepal, **b** petal, **c** lateral
 sepal, **d** lip, **e** lip (*side view*).
 Drawn by A. Król



13. Leaves narrowly oblanceolate to linear-lanceolate ...
C. lehmanniana (13)
 13* Leaves ovate, ovate-lanceolate to orbicular ... 14

14. Leaves usually two, often one of them is much larger
 than another ... *C. diphylla* (14)
 14* Leaves several, subequal in size ... 15

Table 1 Comparative morphology of *Cranichis*, *Exalaria*, *Ocampoa*, *Pseudocranichis*, *Galeoglossum* and *Ponthieva*

	<i>Cranichis</i>	<i>Exalaria</i>	<i>Ocampoa</i>	<i>Pseudocranichis</i>	<i>Galeoglossum</i>	<i>Ponthieva</i>
Leaves	Basal, commonly with a distinct petiole; petiole canaliculate; blade linear-lanceolate to suborbicular, acute to obtuse	Basal, petiolate; petiole canaliculate; blade narrowly ovate-lanceolate, acute to subacuminate	Basal, short-petiolate; petiole alate, canaliculate; blade oblong, elliptic or broadly oblanceolate, acute or obtuse	Basal, sessile; blade ovate, acute	Basal, short-petiolate; petiole alate, canaliculate; blade oblanceolate, acute	Usually basal, sessile or petiolate, erect or patent
Sepals	Similar, externally glabrous or ciliate, free, more or less spreading	Dissimilar, externally pubescent, occasionally shortly connate at the base, spreading	Dissimilar, externally sparsely glandular-papillose or pubescent, connate at the base only, recurved in the upper half	Similar, glabrous, spreading, ringent, lateral sepals shortly connate at the base	Subsimilar, glabrous, lateral sepals prominently connate at the base	Dissimilar, lateral sepals more or less connate basally
Petals	Linear to oblong-spathulate, often ciliate on margin, spreading	Obovate, obtuse, glabrous, spreading	Linear, obtuse slightly sigmoid and oblique, recurved	Broadly spathulate to narrowly obovate, spreading	Linear-spatulate, somewhat oblique, recurved	Asymmetrical, adnate much above the base to the side of the gynostemium
Lip	Sessile or shortly clawed, cochleate, simple	sessile, cymbiform, constricted at the base, then spreading, 3-lobed	With S- or C-shaped claw, concave at the base, constricted and arcuate-recurved above the middle, when spread out ovate to elliptic, broadly rounded and minutely cucullate at the apex	Short-clawed, obovate, cuneate, bipartite, apical part lacerate	Subsessile, pentagonal, canaliculate, with 3 thickened nerves, basally auriculate	Adnate to the lower part of the gynostemium, clawed, lamina abruptly spreading, usually small, fleshy
Gynostemium	Short, erect, relatively massive, often swollen at the apex	Short, erect, relatively massive, swollen at the apex	Short, erect, relatively massive, swollen at the apex	Short, erect, rather slender	Rather slender, erect,	Short and very massive, erect, greatly dilated just below the receptive surface
Anther	Erect, oblong to ovate, motile	Stalked, erect, oblong, motile	Erect, oblong-ovate, hardly motile	Erect, oblong-ovoid, dorsiventrally flattened, hardly motile	Erect, oblong-ovate, motile	Erect, oblong-ovate, motile
Pollinia	4, Ovoid to oblong-ovoid, compact	4, Oblong-ovoid, compact	4, Oblong-clavate, compact	2, Bipartite, oblong-ovoid, powdery	2, Bipartite, oblong-ovoid, powdery	4, Oblong-ovate, compact
Caudiculae	Inconspicuous	Inconspicuous	Inconspicuous	Intralocular, formed from the apical parts of pollinia, rather short	Inconspicuous	Formed from elongate apical parts of pollinia

Table 1 continued

	<i>Cranichis</i>	<i>Exalaria</i>	<i>Ocampoa</i>	<i>Pseudocranichis</i>	<i>Galeoglossum</i>	<i>Ponthieva</i>
Staminodes	Producing a prominent dorsal clinandrium, clinandrium usually thick, massive, spacious	Obscure, free from the filament, connate with the style only	Forming a prominent dorsal clinandrium, clinandrium rather thick, tight	Prominent, conspicuous, fused with the style and the stigma margins and hiding much part of the anther, rather thin	Prominent, conspicuous, fused with the style and the stigma margins and hiding much part of the anther, thin	Wing-like, fused with the filament, or its part, and with the stigma margins forming a prominent dorsal clinandrium, sometimes with thickened lower parts built from ballooned cells
Stigma	Horizontal to subventral, obscurely 3-lobed, confluent, oval to elliptic, flat, usually surrounded by a high, thick rim	Horizontal, obscurely 3-lobed, confluent, elliptic, flat, surrounded by rim	Horizontal, 3-lobed, confluent, ovate, flat, surrounded by rim	Ventral, 3-lobed, confluent, flat, with revolute margins, transversely elliptic, rather small	Ventral, bilobed, both lateral lobes receptive, small, separated by sterile, dried part	Horizontal to subhorizontal, transversely elliptic, flat, but surrounded by thickened margins of lateral stigma lobes
Rostellum	Erect, finger-like to triangular, acute to blunt, rather thick and massive; remnant truncate at the apex in most species	Short, erect, broadly triangular, blunt; remnant sinuous at the apex	Elongate, erect, narrowly triangular, blunt; remnant truncate at the apex	Formed from the apical portion of the middle stigma lobe, slightly grooved below viscidium; remnant truncate, foveolate	Formed from the apical portion of the middle stigma lobe; remnant shortly apiculate, foveolate	Finger-like, erect, rather soft and fleshy, canaliculate; truncate at the apex after the removal of pollen mass
Viscidium	Viscidium single, detachable, cellular, thick, relatively small; hamulus usually well-seen, elongate, finger-like, thick, directed towards the anther	Viscidium single, detachable, cellular, small; hamulus obscure	Viscidium single, detachable, cellular, very small; hamulus very obscure	Viscidium single, detachable, cellular, multi-layered, very small, ovoid; hamulus absent	Viscidium single, detachable, cellular, multi-layered, very small, ovoid; hamulus absent	Single, detachable, rather small. Hamulus small, triangular, acute, directed towards the anther

15. Petals elliptic, widest near the middle ... *C. gibbosa* (15)

15* Petals lanceolate to oblong-oblancoelate, widest near the base or near the apex ... 16

16. Floral bracts subequal or longer than ovary ... *C. lehmannii* (16)

16* Floral bracts shorter than ovary ... 17

17. Leaf blade elliptic to orbicular; petiole 0.4 cm long ... *C. tenuis* (17)

17* Leaf blade broadly ovate to broadly elliptic; petiole at least 1 cm long ... 18

18. Petiole up to 2.5 cm long, lip unlobed ... *C. parvula* (18)

18* Petiole up to 9 cm long, lip 3-lobed at apex ... *C. pulvinifera* (19)

1. *Cranichis wagneri* Rchb.f.

Linnaea 41: 19. 1877; Type (*hoc loco designatus*): Venezuela. *Wagner s.n.* (Lectotype: W!). - Ames and Correll, *Fieldiana, Bot.* 26(1): 86–87. 1952. - Schweinfurth, *Fieldiana, Bot.* 30(1): 116–117. 1958. - Foldats in Lasser, *Fl. Venezuela, Orchid.* 15(1): 422. 1969.

Reference material—Colombia. Valle del Cauca. Mpio. Yumbo. Dapa, Jorge Negret farm, 35 min from el Rodadero station. Alt. 2,074 m. 3°32′54.9″N 76°35′15.4″W. Apr 2012. *E. Parra s.n.* (VALLE!).

2. *Cranichis polyantha* Schltr.

Repert. Spec. Nov. Regni Veg., Beih. 7: 61. 1920; Type (Garay 1978: 203): Colombia. *Madero 22* (B†, Lectotype: AMES).

Reference material—Colombia. Cauca. *Sine loc.* Alt. 2000 m. *Madero s.n.* (B†); *Sine loc.*, *Madero 22* (B†, AMES).

- 3. *Cranichis engelii*** Rchb.f.
 Linnaea 41: 19. 1876; Type (Garay 1978: 196): Venezuela. Merida. *Engel s.n.* (Lectotype: W!).
 Reference material—Colombia. Norte de Santander. *Sine loc.* (Schlechter 1920).
- 4. *Cranichis muscosa*** Sw.
 Prodr.: 120. 1788; Type (Garay 1978: 202): Jamaica. *Swartz s.n.* (Lectotype: BM!; Isotype: W!).
 Reference material—The occurrence of this species in Colombia was reported by Dueñas Gómez and Fernández Alonso (2009).
- 5. *Cranichis brachyblephara*** Schltr.
 Repert. Spec. Nov. Regni Veg., Beih. 7: 58. 1920; Type (*hoc loco designatus*): Colombia. *Madero s.n.* (B†).
 Reference material—Colombia. Cauca. *Sine loc.* Alt. 3,000 m. *Madero s.n.* (B†).
- 6. *Cranichis zarucchii*** Szlach. and Kolan.
 Plant Syst. Evol. 299: 981. 2013; Type: Colombia. *Zarucchi, Brant and J. Castano 5694* (Holotype: COL!).
 Reference material—Colombia. Antioquia. Mpio. Sonsón. Km 11 of road Sonsón-Nariño. 25 km from Nariño, near km post 151 marking distance from Bogotá. Pluvial subparamo vegetation. 542'N, 7515'W. Alt. 2,780 m. 1 Apr 1987. *Zarucchi, Betancur and F.J. Roldan 5177* (COL!).
- 7. *Cranichis schlimii*** Rchb.f.
 Linnaea 41: 19. 1877; Type (Garay 1978: 206): Venezuela. *Funck and Schlim 1238* (Lectotype: W!).
 Reference material—Colombia. Valle del Cauca. Mpio. El Cerrito. I.P. Auji, hacienda La Pajosa. Alt. 2,800 m. 22 May 1990. *S. Sarria, M.T. Sierra and J. Rivas 1422* (CUVC!).
- 8. *Cranichis antioquiensis*** Schltr.
 Repert. Spec. Nov. Regni Veg., Beih. 7: 57. 1920; Type (Garay 1978: 189): Colombia. *Madero 168* (B†; Lectotype: AMES-drawing).
 Reference material—Colombia. Antioquia. *Sine loc.* Alt. 2,000 m. *Madero s.n.* (B†); *Sine loc. Madero 168* (B†; AMES-drawing).
- 9. *Cranichis atrata*** Schltr.
 Repert. Spec. Nov. Regni Veg., Beih. 7: 58. 1920; Type: Colombia. *Madero s.n.* (B†).
 Reference material—Colombia. Cauca. *Sine loc. Madero s.n.* (B†).
- 10. *Cranichis pleioneura*** Schltr.
 Repert. Spec. Nov. Regni Veg., Beih. 7: 60. 1920; Type: Colombia. *Madero s.n.* (B†).
 Reference material—Colombia. Cauca. *Sine loc.* Alt. 2,500 m. *Madero s.n.* (B†).
- 11. *Cranichis polyblephara*** Schltr.
 Repert. Spec. Nov. Regni Veg., Beih. 7: 61. 1920; Type: Colombia. *Lehmann 2812* (B†).
 Reference material—Colombia. Cauca. Bei Popayán. Alt. 1,600–1,900 m. May 1883. *Lehmann 2812*. (B†).
- 12. *Cranichis picta*** Rchb.f.
 Linnaea 41: 52. 1877; Type (Garay 1978: 203): Ecuador. *Jameson s.n.* (Lectotype: W!).
 Reference material—Colombia. Volcan de Pasto. Alt. 3,000 m. 14 Feb 1880. *Lehmann 476* (W!).
- 13. *Cranichis lehmanniana*** (Kraenzl.) L.O. Williams
 Lilloa 3: 477. 1938. - *Goodyera lehmanniana* Kraenzl., Bot. Jahrb. Syst. 26: 498. 1899; Type (Garay 1978: 199): Colombia. *Lehmann 6149* (Lectotype: K!).
 Reference material—Colombia. Nariño. *Lehmann 6149* (K!). Cauca. *Sine loc.* (Schlechter 1920).
- 14. *Cranichis diphylla*** Sw.
 Nov. Gen. Sp. Prodr.: 120. 1788; Type (Garay 1978: 192): Jamaica. *Swartz s.n.* (Lectotype: BM!; Isotype: W!).
 Reference material—The occurrence of this species in Colombia was reported by Dueñas Gómez and Fernández Alonso (2009).
- 15. *Cranichis gibbosa*** Lindl.
 Ann. Nat. Hist. 15: 385. 1845; Type (Garay 1978: 198): Ecuador. *Hartweg 1435* (Lectotype: K-L!, Isotypes: AMES, K!, NY, W!).
 Reference material—the occurrence of this species in Colombia was reported by Ortiz Valdivieso and Uribe Vélez (2007).
- 16. *Cranichis lehmannii*** Rchb.f.
 Otia Bot. Hamb. 1: 4. 1878; Type (Garay 1978: 199): Ecuador. *Lehmann 77* (Lectotype: W!).
 Reference material—Colombia. Antioquia. Mpio. Frontino, Corregimiento de Nutibara, zona de Murrí, Alto de Cuevas. Alt. 1,000–1,850 m. 14 Feb 1991, *R. Callejas and al. 9899* (HUA—Dueñas Gómez and Fernández Alonso 2009).
- 17. *Cranichis tenuis*** Rchb.f.
 Flora 48: 274. 1865; Type (*hoc loco designatus*): Cuba. *Wright 1478* (Lectotype: W!).
 Reference material—The occurrence of this species in Colombia was reported by Ortiz Valdivieso and Uribe Vélez (2007).
- 18. *Cranichis parvula*** Renz
 Candollea 11: 259, Fig. 8b. 1948; Type (Garay 1978: 202): Colombia. *Renz 4159* (RENZ).
 Reference material—Colombia. Boyacá. Alt. 500 m. 10 Oct 1938. *Renz 4159* (RENZ). Meta. Alt. 500–700 m. 10 Oct 1939. *Renz 4124* (RENZ).
- 19. *Cranichis pulvinifera*** Garay
 Fl. Ecuador 9: 204, Fig. 61 A. 1978; Type: Colombia. *Bristol 1227* (Holotype: AMES).
 Reference material—Colombia. Putumayo. *Bristol 1227* (AMES).
 Taxonomic transfers

Our study on cranichid orchids revealed the necessity of three taxonomic transfers.

***Pseudocranichis cactorum* (Salazar and Chávez-Rendón) Szlach. and Kolan., comb. Nov.**

Basionym: *Galeoglossum cactorum* Salazar and Chávez-Rendón, Syst. Bot. 36(2): 262. 2011.

Notes. The lateral sepals of this species are free and its lip is distinctly constricted in the apical part with a prominent, dentate apical lobule. The close relationship of this species with *P. thysanochila* was also confirmed in the molecular tree presented by Salazar et al. (2011).

***Ocampoa carlos-parrae* (Szlach. and Kolan.) Szlach. and Kolan., comb. Nov.**

Basionym: *Cranichis carlos-parrae* Szlach. and Kolan., Pl. Syst. Evol. 299: 979. 2013.

***Ocampoa crumenifera* (Garay) Szlach. and Kolan., comb. Nov.**

Basionym: *Cranichis crumenifera* Garay, Caldasia 8: 518. 1962.

Notes. Both *Cranichis carlos-parrae* and *C. crumenifera* should be transferred to *Ocampoa* based on the presence of C-shaped, long lip claw and basally auriculate sepals.

Acknowledgments The curators and staff of the cited herbaria are thanked for their kind hospitality and assistance during visits and for making specimens available on loan. We are grateful to Anna Król and Przemysław Baranow for preparing the illustrations and to Andreas Kay, Fred Muller and Carlos Velazco for providing photos of the studied orchids. The research described here has been supported by the Polish Ministry of Science and Higher Education (research grant no. 8124/B/PO1/2011/40) and Synthesys grants (GB-TAF-2445 and AT-TAF-2483).

Open Access This article is distributed under the terms of the Creative Commons Attribution License which permits any use, distribution, and reproduction in any medium, provided the original author(s) and the source are credited.

References

- Acuña J (1939) Catalogo descriptivo de las Orquideas Cubanas. Bol Tcn Estac Exp Agron, Santiago de las Vegas 60:48
- Álvarez-Molina A, Cameron KM (2009) Molecular phylogenetics of Prescottiinae s.l. and their close allies (Orchidaceae, Cranichidae) inferred from plastid and nuclear ribosomal DNA sequences. Am J Bot 96(5):1020–1040
- Bentham G, Hooker JD (1862–1863) Genera Plantarum ad exemplaria imprimis in Herbariis kewensibus servata definita, 3 vols. A. Black, London
- Carnevali G, Ramírez-Morillo IM (2003) *Cranichis*. In: Steyermark JA, Berry PE, Yatskievych K, Holst BK (eds) Flora of the Venezuelan Guayana. Myrtaceae–Plumbaginaceae, vol 7. Missouri Botanical Garden Press, St. Louis, p 287
- Chase MW, Cameron KW, Barrett RL, Freudenstein JV (2003) DNA data and Orchidaceae systematics: a new phylogenetic classification. In: Dixon KW, Kell SP, Barrett RL, Cribb PJ (eds) Orchid conservation. Natural History Publications, Kota Kinabalu, pp 69–89
- Christenson EA (2004) Deux nouvelles Orchidees terrestres d'Equateur. Richardiana 4(3):134–138
- Cribb P (2003) *Cranichis*. In: Pridgeon AM, Cribb PJ, Chase MW, Rasmussen FN (eds) Genera Orchidacearum, vol 3. Oxford University Press, Oxford, p 33
- Dressler RL (1981) The orchids, natural history and classification. Harvard University Press, Cambridge
- Dressler RL (1993) Phylogeny and classification of the orchid family. Dioscorides Press, Portland
- Dressler RL, Dodson CH (1960) Classification and phylogeny in the Orchidaceae. Ann Mo Bot Gard 47:25–68
- Dueñas Gómez HC, Fernández Alonso JL (2009) Sinopsis de la subfamilia Spiranthoideae (Orchidaceae) en Colombia, parte II. Rev Acad Colomb Cienc 33:157–181
- Garay LA (1982) A generic revision of the Spiranthinae. Bot Mus Leaf Harv Univ 28:277–425
- Garay LA, Romero-González G (1999) Schedulae Orchidium II. Bot Mus Leaf Harv Univ 4(2):475–488
- Giraldo G, Dalström S (2012) A new and extraordinary *Cyrtochilum* (Orchidaceae: Oncidiinae) from Colombia. Lankesteriana 12(3):137–142
- González Tamayo R (1995) *Ocampoa* (Orchidaceae): postliminium du genre. L'Orchidophile 26(118):169–175
- Hágsater E, Soto MA, Salazar GA, Jiménez R, López MA, Dressler RL (2005) Orchids of Mexico. Instituto Chinoín, Mexico City
- Higgins WE, Viveros P (2008) A new Phragmipedium from Colombia. Lankesteriana 8(3):89–92
- Hills HG, Weber MH (2012) *Dressleria morenoi* (Orchidaceae, Catasetinae): a new species from Colombia. Phytoneuron 103:1–5
- Kolanowska M, Pérez-Escobar OA (2012) A new species of *Lockhartia* (Orchidaceae) from Colombia. Syst Bot 37(2):347–351
- Kolanowska M, Szlachetko DL (2012) A new species of *Psilochilus* (Triphoreae, Orchidaceae) from Colombia. Syst Bot 37(2):352–355
- Kolanowska M, Szlachetko DL (2013a) *Fernandezia ortiziana* (Orchidaceae), a new species from Colombia. Ann Bot Fennici 50:68–70
- Kolanowska M, Szlachetko DL (2013b) *Pterichis moralesii* (Cranichidinae, Orchidaceae), a new species from Colombia. Ann Bot Fennici 50:111–114
- Kolanowska M, Pérez-Escobar OA, Parra Sánchez E (2012) A new species of *Campylocentrum* (Orchidaceae: Angraecinae) from Colombia. Lankesteriana 12(1):9–11
- Ormerod P (2002) Taxonomic changes in Goodyerinae (Orchidoideae). Lindleyana 17:189–238
- Ormerod P (2005) Studies of neotropical Goodyerinae (Orchidaceae). Harvard Pap Bot 9(2):391–423
- Ormerod P (2007) Studies of neotropical Goodyerinae (Orchidaceae) 2. Harvard Pap Bot 11(2):145–177
- Ormerod P (2008) Studies of Neotropical Goodyerinae (Orchidaceae) 3. Harvard Pap Bot 13:55–87
- Ormerod P (2009a) Notulae Goodyerinae (IV). Taiwania 54(1):45–51
- Ormerod P (2009b) Studies of Neotropical Goodyerinae (Orchidaceae) 4. Harvard Pap Bot 14(2):111–129
- Ortiz Valdivieso P, Uribe Vélez C (2007) Galería de Orquídeas de Colombia, CD edn. Asociación Bogotana de Orquideología, Bogotá
- Pérez-Escobar OA, Kolanowska M, Parra-Sánchez E (2013) *Lepanthes elizabethae* (Pleurothallidinae, Orchidaceae), a new species from Colombia. Phytotaxa 79(2):58–62
- Pfitzer EHH (1889) Orchidaceae. Die natürlichen Pflanzenfamilien. Wilhelm Engelmann, Leipzig
- Salazar GA (2009) DNA, morphology, and systematics of *Galeoglossum* (Orchidaceae, Cranichidinae). In: Pridgeon AM, Suarez

- JP (eds) Proceedings of the Second Scientific Conference on Andean Orchids. Universidad Técnica Particular de Loja, Loja, pp 161–172
- Salazar GA, Chase MW, Soto MA, Ingrouille M (2003) Phylogenetics of Cranichideae with emphasis on Spiranthinae (Orchidaceae, Orchidoideae): evidence from plastid and nuclear DNA sequences. *Am J Bot* 90:777–795
- Salazar GA, Cabrera LI, Madriñán S, Chase MW (2009) Phylogenetic relationships of Cranichidinae and Prescottiinae (Orchidaceae, Cranichideae) inferred from plastid and nuclear DNA sequences. *Ann Bot* 104:403–416
- Schlechter R (1918) Kritische Aufzählung der bisher aus Zentral-Amerika bekanntgewordenen Orchideen; E. Aufzählung der Gattungen und Arten, part I (*Selenipedium*—*Isochilus*). *Beih Bot Centralbl* 36:421–520
- Schneider M (1953) El Género *Cranichis* (Orchidaceae) en Colombia. *Caldasia* 6(27):11–18
- Soto M (2008) *Ocampoa mexicana*. In: Hágsater E, Soto M (eds) Orchids of Mexico, part 4. *Icones Orchidacearum* 10: pl. 1055
- Swartz O (1788) Nova genera species Plantarum seu Prodrromus descriptionum Vegetabilium maximam partem incognitorum quae sub itinere Indiam Occidentalem annis 1783–1787. Acad.M.Swederi, Stockholm
- Szlachetko DL (1995) Systema Orchidalinum. *Fragm Flor Geobot Suppl* 3:1–137
- Szlachetko DL, Baranow P (2012) Four new species of *Cleistes* (Orchidaceae, Vanilloideae) from Colombia. *Ann Bot Fennici* 49(5–6):377–382
- Szlachetko DL, Kolanowska M (2013) New species of the genus *Cranichis* (Orchidaceae, Cranichidinae) from Colombia. *Pl Syst Evol* 299(5):979–983
- Szlachetko DL, Rutkowski P (2000) *Gynostemia orchidalium* I. Apostasiaceae, Cyripediaceae, Orchidaceae (Thelymitroideae, Orchidoideae, Tropidioideae, Spiranthoideae, Neottioideae, Vanilloideae). *Acta Bot Fennica* 169:1–379
- Szlachetko DL, Mytnik-Ejsmont J, Baranow P (2013) Drei neue *Epistephium*-Arten (Orchidaceae, Vanilloideae). *Die Orchidee* 64(1):14–18
- Thiers B (continuously updated) Index Herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>