

# Eight new species of *Gomphichis* (Orchidaceae, Spiranthoideae) from Colombia

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**Abstract** Eight new species of the genus *Gomphichis* from Colombia are described. Each species is illustrated, and detailed habitat and distribution data are provided. A distribution map of the new species is presented. A dichotomous key for determination of the *Gomphichis* species in northern South America is provided. Conservation status assessments are provided for each species; current International Union for Conservation of Nature (IUCN) Red List categories and criteria are listed. A brief discussion of spiranthoid orchids taxonomy, conservation status of species, endemism in the Andes and paramo are presented.

**Keywords** Andes · IUCN categories · Orchidaceae · *Gomphichis* · Taxonomy · Paramo

## Introduction

Field expeditions and botanical explorations of Colombian flora started in the second half of the eighteenth century; however, Colombia is still one of the South American countries lacking a complete orchid flora and one of the most megadiverse countries considering its flora (Forero 1988; Mittermeier et al. 2004). It is estimated that Colombia

harbours about 10 % of the world's biodiversity (Miani and Fajardo 2001), including almost 25,000 vascular plant species, which gives the country the second place considering the diversity of flora (Bernal et al. 2007). Approximately, nearly 30 % of native representatives of Colombian plants are considered to be endemic (Davis et al. 1997; Porup et al. 2009). Orchids, occurring in almost every habitat, are as much as 10 % of the vascular plants of this country (Kress 1986).

The main factor driving Colombia's biodiversity richness is the specific geographic position in northwestern South America. Colombia is the only country in South America bordering Panama; thus its territory is a meeting place of representatives of the fauna and flora of both American continents. Furthermore, this region has a great climatic and topographic complexity resulting from the presence of the Andean mountain ranges crossing the country and influence of both the Caribbean Sea and the Pacific Ocean. A landscape variety of Colombia and significant differences in local habitat conditions associated with substantial differences in elevation, temperature, precipitation and sun exposure allow the occurrence of virtually every ecosystem of the planet known (Miani and Fajardo 2001).

*Gomphichis* Lindl. is one of the orchid genera occurring in Colombia. It is a genus including about 30 species reported from Costa Rica, Brazil, Guyana and western South America from Venezuela to Bolivia. In the most recent work, (Ortiz Valdivieso and Uribe Vélez 2007) noted 13 species for Colombia, but in our opinion this number is underestimated, as evidenced by this and previous work (Szlachetko et al. 2013). The representatives of *Gomphichis* inhabit mountain regions mainly between 1,700 and 3,600 m a.s.l. They occur on damp grassy slopes, cliffs, in thickets, woodland margins, along roadsides,

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upper montane forest and even in open Andean páramo (Pridgeon et al. 2003).

Dressler (1990) placed *Gomphichis* within the subtribe Prescottiinae Dressler with few mainly high Andean genera (*Aa* Rchb.f., *Altensteinia* Kunth, *Myrosmodes* Rchb.f., *Porphyrostachys* Rchb.f., *Prescottia* Lindl., and *Stenoptera* C.Presl) distinguishing them from Cranichidinae Lindl. by having, *Spiranthes*-type velamen, laminar rostellum, soft pollinia, and lack of humulus (Álvarez and Cameron 2001; Álvarez-Molina and Cameron 2009; Dressler 1990, 1993; Szlachetko and Rutkowski 2000). Szlachetko (1995) accepted the conception of Prescottiinae proposed by Dressler (1990), but suggested adding *Pseudocranichis* Garay to this subtribe and to rank all Prescottiinae under the tribe Spirantheae Endl.

The subtribe Prescottiinae is a subject of an ongoing taxonomic work conducted by our team for years (Mytnik-Ejsmont et al. 2012; Szlachetko et al. 2013; Szlachetko and Nowak 2013). The collected specimens are identified based on the comparison with the type material and original descriptions. The results of our recent herbarium studies (2009–2012) revealed the discovery of eight new species of *Gomphichis* in Colombia and they are presented in this paper.

## Materials and methods

The examined material was prepared by using a stereomicroscope with standard classical taxonomy methods. The morphological descriptions and comparisons were based on the study of *Gomphichis* specimens from AMES, B, BM, COL, CUVC, K, MO, P, VALLE, W and those collected during the field expeditions by Szlachetko (2005–2013), and Kolanowska (2009–2011). Standard procedure of preparing the herbarium material to facilitate stereomicroscopic observation was applied. The following vegetative characters of individual plants were analysed: stem (height, shape, presence of glandular hairs), leaves (number, size, shape), sheaths (number, shape, size), inflorescence (size, density), floral bracts (size, shape, presence of glandular hairs), flowers, taken from the middle part of the inflorescence (size of pedicel and ovary, presence of mentum, size and shape of lateral sepals, dorsal sepal, petals, and lip), as well as gynostemium (height and shape of column, presence of column foot, pattern of hair cover of column part). Particular parts of the flower were rehydrated, dissected, measured and drawn under a stereomicroscope. The results were then analyzed and compared with the type material, diagnoses and original illustrations. The database of the drawings and photographs of all studied specimens are available in the first author's archives. A key for determination of the *Gomphichis* species in northern South America is dichotomous. Acronyms of

herbaria followed Holmgren and Holmgren (1998). To draw the distribution map and prepare line drawings, CorelDRAW Graphics Suite 12 was used. The IUCN categories were assigned according to IUCN (2011) guidelines.

## Taxonomic treatment

A key to the *Gomphichis* species in northern South America

1. Lip sessile or clawed, in the latter case claw very short and wide.....2
- 1\* Lip clawed, claw narrow.....16
2. Petals as wide as or wider than dorsal sepal.....3
- 2\* Petals distinctly narrower than dorsal sepal.....9
3. Petals elliptic or oblong–elliptic with broad base, sessile.....4
- 3\* Petals elliptic–obovate or obovate, attenuate towards base, shortly petiolate.....5
4. Lip with prominent furrow along midnerve, with two fleshy and thick keels along its margins, gynostemium pubescent dorsally, ciliate ventrally.....*G. pseudogoodyeroides*
- 4\* Lip with massive cushion-like thickening in the apical half, which is sulcate in front, gynostemium ciliate on both surfaces.....*G. salamancae*
5. Petals densely pubescent on the outer surface.....6
- 5\* Petals glabrous or sparsely pubescent on the outer surface.....8
6. Lip widest near the middle, attenuate gradually towards triangular apex, gynostemium densely pubescent on both surfaces.....7
- 6\* Lip widest at the rounded apex, attenuate towards the base, shortly mucronate, gynostemium ciliate at the base on the ventral surface.....*G. epiphytica*
- 7\* Lip with massive cushion-like inconspicuously sulcate thickening in apical half.....*G. altissima*
- 7\* Lip with disc thickened along midvein, margins membranaceous.....*G. alba*
8. Leaves linear–lanceolate, lip widest at base, broadly obovate in outline, apical half with two cushion-like thickening separated by furrow, petals pubescent along margins.....*G. carlos-parrae*
- 8\* Leaves obliquely elliptic–lanceolate, lip widest near the middle, pentagonal in outline, with thickened central and apical part, petals ciliate along margins...*G. viscosa*
9. Lip with large or small, but prominent subglobose or oblong basal thickenings.....10
- 9\* Lip without any basal thickenings.....15
10. Basal thickenings massive, very large, 1/3 of the whole lip length.....*G. magnicallosa*
- 10\* Lip basal thickenings much smaller.....11

11. Lip narrowly obovate.....12  
 11\* Lip not as above.....13  
 12. Lip widest near the middle, apical part densely pubescent on the inner surface, petals ciliate on both margins, 1-nerved.....*G. renziana*  
 12\* Lip widest at the base, apical part papillate, petals pubescent on both margins, obscurely 3-nerved.....*G. valida*  
 13. Petals long-pubescent along inner margin and ciliate along outer margins, 1-nerved.....*G. fernandezii*  
 13\* Petals ciliate on the outer margins, 3-nerved, rarely obscurely 3-nerved.....14  
 14. Lip as long as wide or wider.....*G. traceyae*  
 14\* Lip distinctly longer than wide.....*G. goodyeroides*  
 15. Lip oblong–ligulate in outline, densely pubescent on margins, cochleate and slightly thickened at apex.....*G. schneideri*  
 15\* Lip not as above.....*G. jaramilloi*  
 16. Lip wider than long.....17  
 16\* Lip longer than wide.....18  
 17. Lip lateral lobes obliquely orbicular, petals ciliate along margins.....*G. longifolia*  
 17\* Lip lateral lobes obliquely triangular, petals ciliate along both margins near the middle, base and apex glabrous.....*G. monstrosa*  
 18. Petals wider than sepals.....19  
 18\* Petals narrower than sepals.....22  
 19. Petals prominently clawed.....20  
 19\* Petals sessile, with broad base.....21  
 20. Petals and sepals subacute, sepals 1-nerved.....*G. lozanoii*  
 20\* Petals and sepals obtuse, obscurely 3-nerved.....*G. brachystachys*  
 21. Petals suborbicular–elliptic, lip lateral lobes obliquely rhombic–elliptic, truncate at apex.....*G. costaricensis*  
 21\* Petals elliptic–lanceolate, Lip lateral lobes elliptic, rounded at apex.....*G. hetaerioides*  
 22. Petals widest near the middle, attenuate towards acute apex and towards base.....23  
 22\* Petals more or less oblong–elliptic to linear–ligulate, rounded at the apex.....26  
 23. Lip oblong–ligulate, almost as wide at the base as near the apex.....*G. crassilabia*  
 23\* Lip more or less pentagonal in outline, distinctly wider at base than at the apex.....24  
 24. Lip lateral lobes triangular, subacute.....*G. scaposa*  
 24\* Lip lateral lobes rounded.....25  
 25. Petals pubescent on both margins, ciliate on the outer surface.....*G. lancipetala*  
 25\* Petals ciliate along margins only.....*G. macbridei*  
 26. Petals linear–ligulate.....27  
 26\* Petals oblong–elliptic.....28

27. Inflorescence laxly several-flowered, petals ciliate along margins.....*G. bogotensis*  
 27\* Inflorescence densely many-flowered, petals ciliate along margins.....*G. caucana*  
 28. Leaves arranged along stem, decreasing in size upwards.....*G. foliosa*  
 28\* Leaves gathered in the basal rosette.....29  
 29. Petals 3-nerved, lip apical part papillate along margins, gynostemium pubescent just below stigma towards the base.....*G. cundinamarcae*  
 29\* Petals 1-nerved, lip apical part densely ciliate along margins, gynostemium ciliate in the lower half only.....*G. adnata*

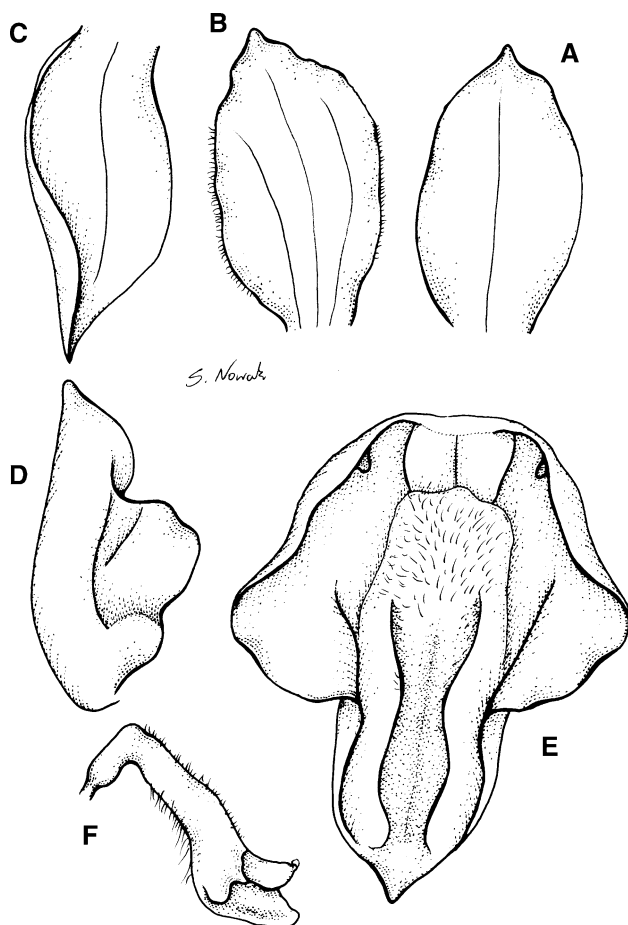
### Taxonomic treatment

*Gomphichis pseudogodyeroides* S. Nowak and Szlach., *sp. nov.* (Fig. 1)

*Gomphichis pseudogodyeroides* is related to *G. goodyeroides* Lindl., but the former have elliptic petals wider than dorsal sepal and lip with prominent furrow along midnerve, with two fleshy and thick keels along its margins.

Type: *H. Garcia Barriga 17592*—Colombia, Cundinamarca, Sasaima, San Bernardo, Quebrada La Maria y Rio Dulce, elev. 1,750–1,950 m (20–30 Nov 1962), (COL! holotype).

Plants up to 100 cm tall, erect, rather stout. Leaves basal, petiolate; petiole to 8 cm long, rather wide; blade up to 23 cm long and up to 3.5 cm wide; oblong–lanceolate or linear–lanceolate, acute to subacute. Scape erect, several sheathed, glabrous below, glandular above. Spike up to 15 cm long, cylindrical, densely many flowered. Flowers pubescent externally especially towards the base. Floral bracts up to 9 mm long, ovate–lanceolate, acute, pubescent. Ovary 5 mm long, sessile, ovoid, densely tomentose. Dorsal sepal up to 6 mm long, 2.5 mm wide, concave, oblong–elliptic, acuminate to shortly apiculate. Petals up to 5 mm long and 2.7 mm wide, elliptic with broad base and acute apex, sessile, margins ciliate except base and apex, 3-nerved. Lateral sepals up to 6 mm long and 3 mm wide, obliquely ovate–elliptic, acute to acuminate, concave. Lip up to 6 mm long in total, divided into hypochile and epichile; hypochile 4 mm long, 5 mm wide, trapezoid in outline, thick and papillate in the centre, with two small thickenings at the base; epichile 2 mm long, 1 mm wide, oblong–elliptic, acute, with prominent furrow along midnerve, with two fleshy and thick keels along its margins. Gynostemium 5 mm long, pubescent dorsally, ciliate ventrally.



**Fig. 1** *Gomphichis pseudogodyeroides* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [H. Garcia Barriga 17592 (COL); drawn by S. Nowak]

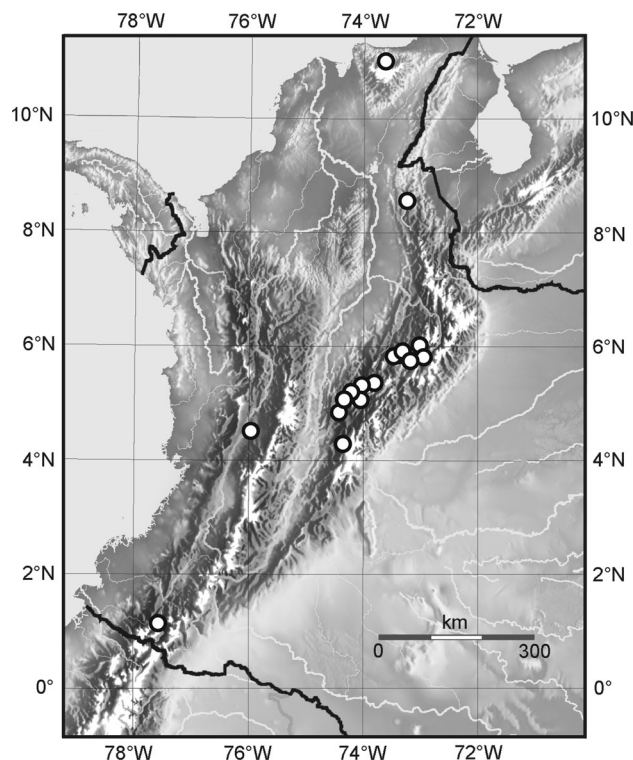
**Ecology:** Terrestrial in paramo, subparamo with *Weinmannia tomentosa*. Flowering time: January, March, June–August, October–November.

**Distribution:** Colombia (Boyacá, Cesar, Cundinamarca, Magdalena, Nariño, Norte de Santander, Quindío). Elev. 1,050–3,410 m (Fig. 2).

**Etymology:** An allusion to the similarity of *Gomphichis goodyeroides*.

**Conservation status:** According to the IUCN Red List (IUCN 2011), the species can be assigned as near threatened (NT). The species is known from several localities; however all of them are limited to high Andean páramo, which is heavily impacted (Davis et al. 1997), so there is not much potential habitat. Therefore, in our opinion, continuing decline in extent and area of occurrence is expected.

**Representative specimens:** *G. Huertes G. and L. A. Camargo G. 6832*—Colombia, Boyaca, Mpio. de Arcabuco, páramo, elev. 3,300 m (3 Jan 1970), (COL!); *H. Schmidt-Mumm 77*—Colombia, Boyaca, Mpio. de



**Fig. 2** Distribution map of *Gomphichis pseudogodyeroides* S. Nowak and Szlach. in Andean Colombia

Arcabuca, entre Tunja y Arcabuco, elev. 2,900 m (6 Jun 1961), (COL!); *D. Stancik, H. Mendoza and S. Medina 1202*—Colombia, Boyaca, Mpio. Villa de Leyva, Vereda La Capilla, Finca Manantiales de Iguaque, 5°41'N, 73°29'W, elev. 2,600 m (5 Nov 1998), (COL!); *A. Etter and L. G. Baptiste 907*—Colombia, Boyaca, Mpio. de Boavita, Cañon del Chicamocha, Bosque Chulavita, elev. 3,000 m (2 Oct 1991), (COL!); *L. A. Camargo G. and G. Huertas G. 7793*—Colombia, Boyaca, Mpio. de Santa Rosa de Viterbo, Cordillera Oriental, cerros orientales vecinos a la poblacion, elev. 2,780 m (13 Jan 1981), (COL!); *A. M. Cleef 2240*—Colombia, Boyaca, páramos al NW de Belen, subida al Alto de las Cruces, hacia San José de la Montana, subpáramo seco 5 km NW de Belen, elev. 3,410 m (5 Mar 1972), (COL!); *H. Garcia Barriga and R. Jaramillo M. 20686*—Colombia, Cesar/Norte de Santander, Cordillera Oriental, Jurisdicciones Cerro de Oroque, elev. 3,000–3,900 m (22–27 Jul 1974), (COL!); *D.R. Jimenez and S. Cortés 130*—Colombia, Cundinamarca, Mpio. de Tausa, Vereda Lagunitas, Cerro San Isidro, elev. 3,140 m (8 Jul 1998), (COL!); *S. Hernandez M. 366*—Colombia, Cundinamarca, Mpio. de Subachoque, Finca El Cerro (Vereda El Tobal), en un bosque predominantemente de encenillos (*Weinmannia tomentosa*), sobre el suelo, en un colchón de musgo, elev. 2,960 m (3 Nov 1998), (COL!); *L. Uribe U. 330*—Colombia, Cundinamarca, Cerca a

Zipaquirá, elev. 2,700 m (1939), (COL!); J.L. Fernandez Alonso, H. Cardozo and M. Arevalo 11594—Colombia, Cundinamarca, Bogotá-Chocontá, Represa del Sisga, Pasando el Puente Metálico, elev. 2,600 m (20 Aug 1994), (COL!); M. Schmidt 128—Colombia, Cundinamarca, Zipacón, elev. 2,700 m, (COL!); L. Uribe U. 6001—Colombia, Cundinamarca, Suba, Colinas al oriente, vertiente hacia la sabana de Bogotá, elev. 2,700 m (12 Nov 1967), (COL!); H. Garcia Barriga 17592—Sabana de Bogota, Chia, La Capilla, elev. 2,700 m, (COL!); R. Castañeda 7549—Colombia, Magdalena, Cordillera Oriental, Camino de Codazzi a Machiques, antes de la frontera, elev. 2,400 m (11 Mar 1959), (COL!); L.E. Mora 2301—Colombia, Narino, en la carretera entre Barbaocoas y Junín, elev. 1,050 m (7 Aug 1962), (COL!); Kapuler and Hascall 240—Colombia, Quindio, *Sine loc.*, common species not collected, i.e. those on mud wall, rather those from trees included, (Aug 1964), (COL!).

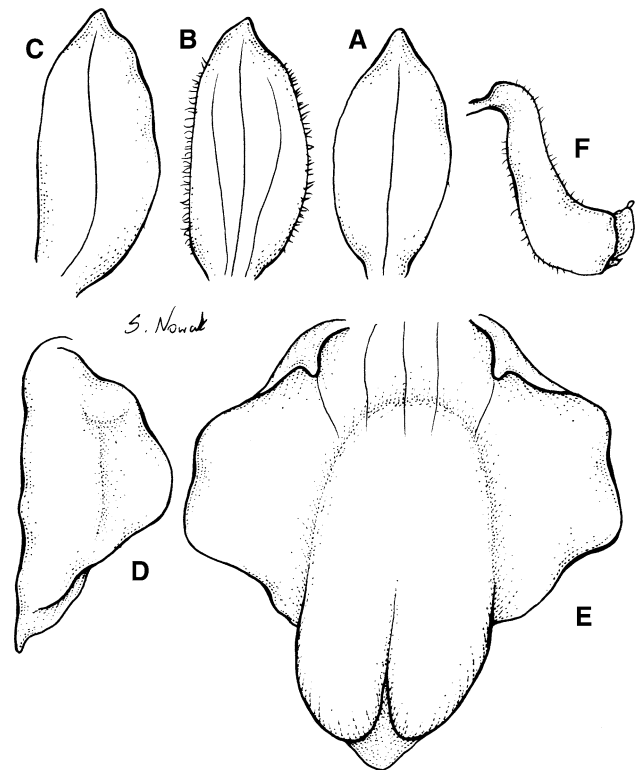
Notes: One of the most common *Gomphichis* species in Colombia. It is easily separable from its closest relative *G. goodyeroides* by the lip and petals form. The petals of *G. pseudogoodyeroides* are elliptic and wider (up to 2.7 mm) than dorsal sepal (up to 2.5 mm), in contrast to *G. goodyeroides* where petals are obovate and narrower (up to 2.2 mm) than dorsal sepal (up to 3 mm). Lip of the new species is explicitly divided into hypochile and epichile (vs. more or less constricted at the apex in *G. goodyeroides*), in the centre of basal half thick and papillate (vs. pair of tomentose, cushion-like thickenings in the apical half). Additionally, epichile part of *G. pseudogoodyeroides* lip with prominent furrow along midnerve and two fleshy, thick keels along its margins, which are absent in *G. goodyeroides*.

***Gomphichis salamancae*** S. Nowak and Szlach., *sp. nov.* (Fig. 3)

Species related to *Gomphichis goodyeroides*, from which it differs by sessile, elliptic or oblong-elliptic petals with broad base, and lip with massive cushion-like thickening in the apical half, which is sulcate in front, gynostemium ciliate on both surfaces.

Type: H. Garcia Barriga 20219—Colombia, Cundinamarca, Guasca, Paramo de Guasca, elev. 2,800 m (19 Nov 1971), (COL! holotype).

Plants up to 70 cm tall, erect, slender. Leaves three basal and one cauline, petiolate; petiole up to 12 cm long, rather wide; blade up to 16 cm long and up to 2.5 cm wide, oblong-lanceolate or linear-lanceolate, acute. Scape erect, several sheathed, glabrous below, glandular above. Spike up to 6 cm long, cylindrical, densely many flowered. Flowers pubescent externally especially towards the base. Floral bracts up to 12 mm long, ovate-lanceolate, acute,



**Fig. 3** *Gomphichis salamancae* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [H. Garcia Barriga 20219 (COL); drawn by S. Nowak]

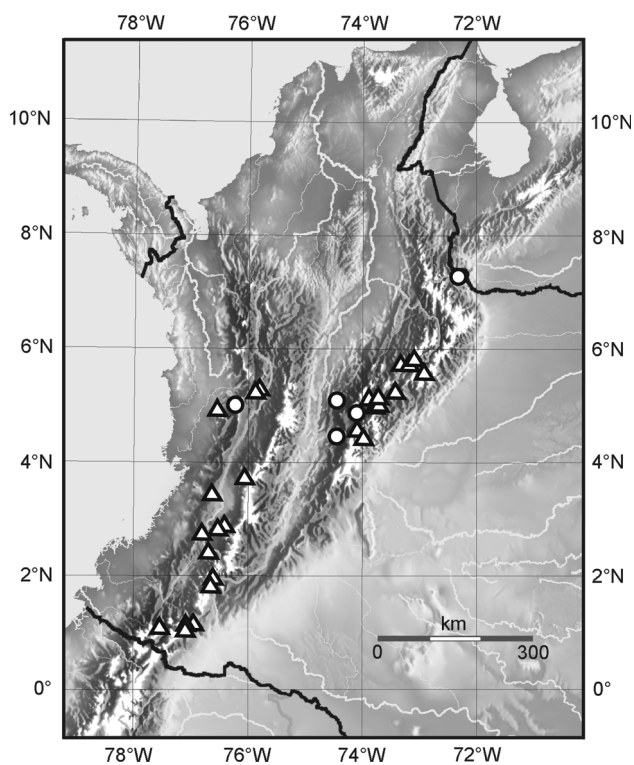
pubescent. Ovary 5 mm long, sessile, ovoid, densely pubescent. Dorsal sepal up to 6 mm long, 2.7 mm wide, concave, oblong-elliptic, subacute. Petals up to 5 mm long and 3 mm wide, elliptic (or oblong-elliptic) with broad base and subacute apex, sessile, somewhat oblique, margins ciliate except base and apex, 3-nerved. Lateral sepals up to 6.5 mm long and 3 mm wide, obliquely ovate-elliptic, subobtuse, concave. Lip up to 6.5 mm long in total, divided into hypochile and epichile; hypochile 4 mm long, 7 mm wide, transversely elliptic in outline, lateral lobes truncate, with two small thickenings at the base; epichile 2.5 mm long, 2 mm wide, elliptic, acute, with massive cushion-like thickening, which is sulcate in front. Gynostemium 5 mm long, ciliate on both surfaces.

Ecology: Terrestrial in páramo, subpáramo with *Weinmannia tomentosa*, *Diplostephium*, *Myrsine* and *Cavendishia*. Flowering time: February, September, November.

Distribution: Colombia (Cundinamarca, Norte de Santander, Risaralda). Elev. 400–3,000 m (Fig. 4).

Etymology: Dedicated to Sonia Salamanca Villegas, in the past a very active collector of Colombian plants and Andean vegetation plants.

Conservation status: According to the IUCN Red List (IUCN 2011), *Gomphichis salamancae* can be assigned as



**Fig. 4** Distribution map of *Gompichis salamancae* S. Nowak and Szlach. (circle) and *G. carlos-parrae* S. Nowak and Szlach. (triangle) in Andean Colombia

vulnerable (VU B1ab(i,iii)). The species is known only from five localities. An extent of its occurrence is about 39,000 km<sup>2</sup>, but all of locations are restricted to high Andean páramo, which is heavily impacted (Davis et al. 1997) and it may be a reason that real EOO (suitable habitat for species) is much narrower.

Representative specimens: *M. Hernandez Schmidt 1034*—Colombia, Cundinamarca, Mpio. de Subachoque, Vereda Tobál, finca El Cerro, en un bosque de porte bajo dominado por *Weinmannia tomentosa*, y con presencia de *Diplostegium*, *Myrsine* y *Cavendishia*, (11 Nov 2002), (COL!); *M. Schneider 692*—Colombia, Cundinamarca, El Retiro, elev. 2,950 m (27 Sep 1953), (COL!); *J. L. Fernández Alonso, C. J. Orozco and P. Galvis 11845*—Colombia, Norte de Santander, Via Toledo hacia vereda Sta Isabel, subida de la Finca Palo Colorado (hacia el subpáramo) al Páramo de Santa Isabel, elev. 3,000–3,800 m (3 Nov 1994), (COL!); *J. H. Torres, O. Rangel, P. Franco, A. M. Cleef and S. Salamanca 217*—Colombia, Risaralda, Mpio. de Santuario, Vereda Las Colonias, 400 m arriba del campamento, elev. 2,910 m (2 Feb 1983), (COL!).

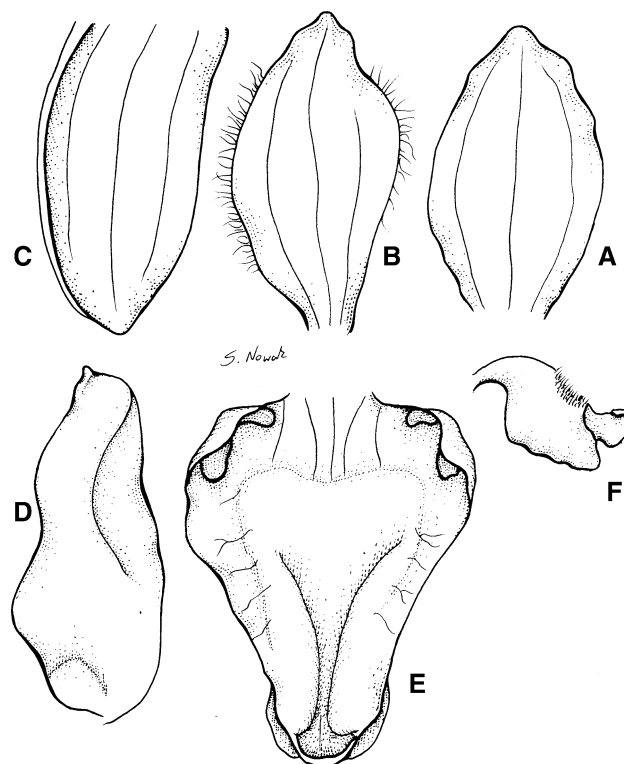
Notes: It is related to *Gompichis goodyeroides* and *G. pseudogoodyeroides* from which it differs in the lip and petals. The petals of *G. salamancae* are elliptic and wider (up to 3 mm) than dorsal sepal (up to 2.7 mm) as the same

as *G. pseudogoodyeroides*, but in contrast to *G. goodyeroides* where petals are obovate and narrower than dorsal sepal. Epichile of the lip of the new species with massive cushion-like thickening, which is sulcate in front (vs. prominent furrow along midnerve and two fleshy, thick keels along its margins in *G. pseudogoodyeroides* and absence of such structures in *G. goodyeroides*). Additionally, gynostemium of *G. salamancae* is ciliate on both surfaces (vs. pubescent dorsally, ciliate ventrally in *G. pseudogoodyeroides* and *G. goodyeroides*).

***Gompichis carlos-parrae* S. Nowak and Szlach., sp. nov.** (Fig. 5)

*Gompichis carlos-parrae* has lip very similar to *G. valida* Rchb.f., but differs from the latter in having very long leaves, petals as long as dorsal sepal and gynostemium strongly swollen above narrow base and densely ciliate below stigma.

Type: *Langenheim 3475*—Colombia, Boyaca, near Buenos Aires (Station 95) in Páramo de La Rusia on road between Duitama and Charalá, ecotone between cloud forest and paramo, elev. 3,650 m (17 Aug 1953), (COL! holotype).



**Fig. 5** *Gompichis carlos-parrae* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [J. Langenheim 3475 (COL); drawn by S. Nowak]

Plants up to 110 cm tall, robust. Leaves numerous, basal and few cauline, without prominent petiole, up to 40 cm long and 1.5 cm wide, linear-lanceolate, acute, erect, tapering towards vaginate base. Scape erect, several sheathed, terminated densely many-flowered cylindrical spike. Flowers rather large, densely hirsute externally. Floral bracts up to 15 mm long, oblong-elliptic, acute, sparsely glandular. Ovary up to 10 mm long, cylindrical to fusiform, pubescent. Dorsal sepal up to 8.5 mm long and 4.6 mm wide, ovate-oblong, obtuse, 3-nerved. Petals up to 8.5 mm long and 4.1 mm wide, from a cuneate base obliquely elliptic-obovate or obovate, attenuate towards base, shortly petiolate, externally as well as along the margins subdensely pubescent along the expanded portion, otherwise glabrous or sparsely pubescent on the outer surface, 1-nerved. Lateral sepals up to 9 mm long and 5 mm wide, obliquely elliptic-oblong, obtuse, 3-nerved. Lip up to 10 mm long and 8 mm wide, from a cuneate base broadly obovate in outline, sessile, widest at base, apical half with two cushion-like thickening separated by furrow, apex foveolate, base with two, thickenings. Gynostemium 3.5 mm long, much swollen above narrow base, ciliate below stigma.

Ecology: Terrestrial in páramo, grassy páramo with *Calamagrostis effusa*, woodland with *Weinmannia microphylla* and *Clethra bicolor*. Flowering time: January–December.

Distribution: Colombia (Boyacá, Caldas, Cauca, Chocó, Cundinamarca, Huila, Nariño, Putumayo, Risaralda). Elev. 2,850–3,800 m (Fig. 4).

Etymology: Dedicated to Dr. Carlos Parra, the Curator of the National Herbarium of Colombia, Bogota.

Conservation status: According to the IUCN Red List (IUCN 2011), the species can be assigned as near threatened (NT). The species is known from several localities, however all of them are limited to high Andean páramo similarly to *Gomphichis pseudogoodyeroides*, but *G. carlos-parrae* is characterized by much more restricted elevation requirements.

Representative specimens: *J. Farfan s.n.*—Colombia, Boyaca, Mpio. de Chinavita, Cerro Mamapacha, Vereda Mundo Nuevo, elev. 3,000 m (27 Jul 2001), (COL!); *O. Rangel 11660 et al.*—Colombia, Boyaca, Mpio. Duitama. Vereda El Carmen, El Rosal. Cerca a la Recebra, bosque de *Weinmannia microphylla* y *Clethra bicolor*, elev. 3,390 m (17 Mar 1994), (COL!); *Stancik 1670*—Colombia, Boyaca, Mpio. de Sotaquirá, Páramo Chontales, shrubby–grassy páramo on the summit (S slopes) of the ridge, elev. 3,100 m (15 Dec 1998), (COL!); *A. M. Cleef 9423*—Colombia, Boyaca, Peña de Arnical, N de Vado Hondo, lajas de arenisca del lado SE, elev. 3,470 m (6 Apr 1973), (COL!); *R. Castañeda 3025*—Colombia, Caldas, Navarco, elev. 3,000 m (12 Sep 1951), (COL!); *G. Reina, L. Pito, S.*

*Tombe, R. Hurtado, A. Chilo and Chilo 447 and 447a*—Colombia, Cauca, Mpio. Silvia, Pitayo, sobre la via que del crucero de Asnenga conduce Mosoco, area Especial de Manejo Páramo de Moras, Vegetación subpáramo y páramo, elev. 3,000–3,600 m (4 Mar 2000), (COL!); *M.P. Córdoba and L. Bernal 2432*—Colombia, Cauca, Mpio. de Toribio, Corregimiento de Tacueyo, Páramo de Santo Domingo, Cordillera los Alpes, 2°57'47.82"N, 76°07'57.22"W, elev. 3,495 m (16 Dec 2002), (COL!); *Downer 104*—Colombia, Cauca, Macizo Central Colombiano, Alto del Buey, Farallones, elev. 3,600–3,800 m (22 Feb 1979), (COL!); *J. Cuatrecasas 18926*—Colombia, Cauca, Cordillera Central, vertiente occidental, Cabeceras del Rio Palo, quebrada del Rio Lopez, Quebrada del Duende, elev. 3,400–3,450 m (2 Dec 1944), (COL!); *C. Cristancho 956*—Colombia, Cauca, transecto cabaña INDERENA-Páramo de Letreros-Laguna de Santiago (Mirador), elev. 3,200–3,640 m (15 Feb 1987), (COL!); *J. Idrobo, P. Pinto and H. Bischler 3105*—Colombia, Cauca/Huila, Macizo Colombiano, Páramo de Las Papas, Colinas al SE de la Laguna La Magdalena sobre el cerro La Corona y El Boquerón, vertiente Magdalena, elev. 3,330–3,520 m (8 Sep 1958), (COL!); *J. H. Torres, O. Rangel, P. Franco, A. M. Cleef and S. Salamanca 1824*—Colombia, Choco, Macizo del Tamaná, bajando del paso al valle de las Mirlas, elev. 3,700 m (10 Feb 1983), (COL!); *J. L. Fernandez Alonso, J. Groenendijk, D. Cortés and G. Peñalzo 19054*—Colombia, Cundinamarca, Mpio. de Suesca-Nemocón, Hacienda Susatá, zona seca con restos de bosque andino y subpáramo, elev. 2,850–2,950 m (23 Aug 2000), (COL!); *Y. Figueroa C. and N. Garcia 582*—Colombia, Cundinamarca, Bogotá, Localidad 5, Usme, sector del Embalse de Chisacá, alrededores del rio Tunjuelo, Vereda las Margaritas, 4°20'N, 74°15'W, elev. 3,000–3,200 m (19 Jun 2005), (COL!); *Y. Figueroa C., J. Mora, T. Vivas and O. Vargas 804*—Colombia, Cundinamarca, Bogotá, Localidad 5, Usme, sector del Embalse de Chisacá, Vereda Las Margaritas, 4°20'N, 74°15'W, elev. 3,000–3,200 m (6 Oct 2005), (COL!); *P. Franco, J. Betancur and A. Neira 6146*—Colombia, Cundinamarca, Santafé de Bogotá DC, Sumapaz, corregimiento San Juan, vereda Capitolio, finca La Pradera, 4°17'N, 74°12'W, elev. 3,150–3,200 m (27 Feb 1999), (COL!); *O. Haught 5758*—Colombia, Cundinamarca, road to E of Guasca, elev. 3,100 m (23 May 1947), (COL!); *Da Ros s.n.*—Colombia, Cundinamarca, Guavio, Guasca, Páramo de Guasca, Carretera de Bogotá, elev. 3,100 m (3 Jan 2001), (COL!); *M.P. Córdoba, C. Lopez and L. Bernal 2973*—Colombia, Cundinamarca, Mpio. de Chocontá, 5°4'58.7"N, 73°44'13.7"W, elev. 2,850 m (29 Nov 2003), (COL!); *B. Cesar 9431*—Colombia, Huila, Al Alto de la Linea, 2°47'07"N, 76°01'26"W (4 Dec 1993), (COL!); *B. Cesar 9449*—Colombia, Huila, Al Alto de la Linea, 2°47'07"N, 76°01'26"W (6 Dec 1993), (COL!); *A.*

*Fernandez and K. E. Knoth 1025*—Colombia, Nariño, a lo largo de la carretera de Pasto a Sibundoy, elev. 2,600–2,800 m (5 Jan 1952), (COL!); *D. Stancik 2795*—Colombia, Nariño, Mpio. Túquerres, Volcán Azufral, road from the vereda San Roque Alto to Laguna Verde, km 6, grassy páramo (*Calamagrostis effusa*, *Cortaderia*, *Diplostephium*), elev. 3,800 m (5–9 Mar 1999), (COL!); *A. Muñoz and B. Ramirez 312*—Colombia, Nariño/Putumayo, Mpio. de Santiago, Vereda San Antonio de Bellavista, Páramo del Bordoncillo, 1°11'N, 77°06'W, elev. 3,200–3,400 m (17 Apr 1993), (COL!); *J. Cuatrecasas 11729*—Colombia, Putumayo, Alta Cuenca del Rio Putumayo, filo de la Cordillera entre El Encano y Sibundoy, Páramo de San Antonio del Bordoncillo, 1°11'N, 77°06'W, elev. 3,250 m (4 Jan 1941), (COL!); *D. Stancik 3427*—Colombia, Risaralda, Mpio. de Santuario, NP Tatamá, patches of the grassy paramo (*Calamagrostis effusa*) between of the matorral, elev. 3,750 m (23 Sep 1999), (COL!); *W.G. Vargas 8676*—Colombia, Tolima, Mpio. de Cajamarca, Corregimiento de Anaime, Páramo de Valles, elev. 3,500 m (Dec 2000), (COL!); *J. Cuatrecasas and Echeverry 27657*—Colombia, Tolima, Cordillera Central, La Linea, cerro El Campanario, subpáramo y páramo, elev. 3,600–3,700 m (4 Mar 1969), (COL!).

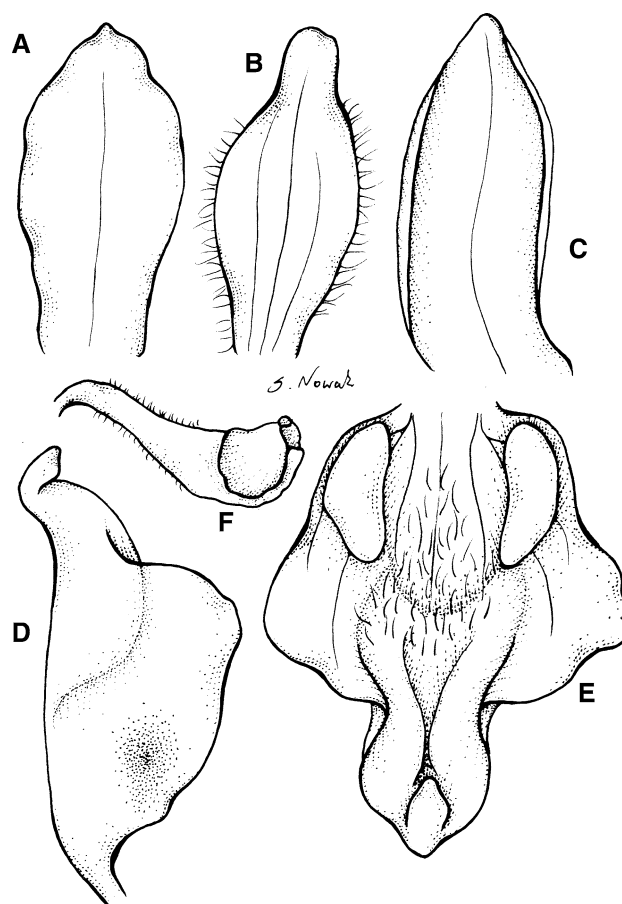
Notes: *Gomphichis carlos-parrae* is related to *G. valida*, lip of both species is very similar, but the former species possesses much longer leaves up to 40 cm (vs. 9 cm in *G. valida*). The petals of *G. carlos-parrae* are as long as dorsal sepal (up to 8.5 mm), in contrast to *G. valida* where petals (up to 6.7 mm) are shorter than dorsal sepal (up to 7 mm). In the new species gynostemium is shorter and massive, also densely ciliate below stigma (vs. pubescent below stigma in *G. valida*).

***Gomphichis magnicallosa* S. Nowak and Szlach., sp. nov.** (Fig. 6)

Plants relatively small, delicate, somewhat similar to *Gomphichis traceyae* Rolfe, but with petals pubescent along margins and very large, prominent oblong basal thickenings being 1/3 of the whole lip length.

Type: *J. L. Fernandez Alonso, M. R. Garzón et al. 7745*—Colombia, Cundinamarca, DC de Bogota, Páramo Sumapaz, después de la laguna de Chisacá, bosque andino y pajonales cerca del río Taquecito, elev. 3,500–3,700 m (9–13 Nov 1987), (COL! holotype).

Plants 35–40 cm tall, delicate, erect. Leaves 5–6, basal, shortly petiolate; petiole 1–2 cm long; blade to 5 cm long, 1.7 cm wide, oblong–lanceolate to oblong–elliptic, acute. Scape several sheathed, glabrous in the lower part, glandular above. Flowers small, densely pubescent externally. Floral bracts up to 8 mm long, lanceolate, acute, sparsely glandular. Ovary 4–5 mm long, cylindrical, pubescent.



**Fig. 6** *Gomphichis magnicallosa* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [J. L. Fernandez Alonso, M. R. Garzón et al. 7745 (COL); drawn by S. Nowak]

Dorsal sepal up to 4 mm long and 1.8 mm wide, obovate–oblong, obtuse, 1-nerved. Petals up to 4 mm long and 1.5 mm wide, from a cuneate base obliquely oblong–obovate or obovate, attenuate towards base, elongate towards truncate apex, pubescent along margins, except apex, obscurely 3-nerved. Lateral sepals up to 4 mm long and 1.8 mm wide, obliquely elliptic–oblong, obtuse, 1-nerved. Lip up to 4.2 mm long and 3 mm wide, with very large, massive, prominent oblong basal thickenings being 1/3 of the whole lip length, hypochile 3 mm long, trapezoid in outline, pubescent in the centre; epichile 1 mm long and wide, ligulate–ovate, subobtusate, sulcate. Gynostemium 3.8 mm long, minutely ciliate all over below stigma.

Ecology: Terrestrial mainly in grassy páramo dominated by *Espeletia*, *Calamagrostis*, *Hypericum*, *Lupinus*, *Monnina*, *Cavendishia*, and *Castilleja*, also shrubby páramo, mountain forest with *Prumnopitys* and *Podocarpus*. Flowering time: April–May, July–December.

Distribution: Colombia (Boyacá, Cauca, Cesar, Cundinamarca, Magdalena). Elev. 2,600–3,800 m (Fig. 7).

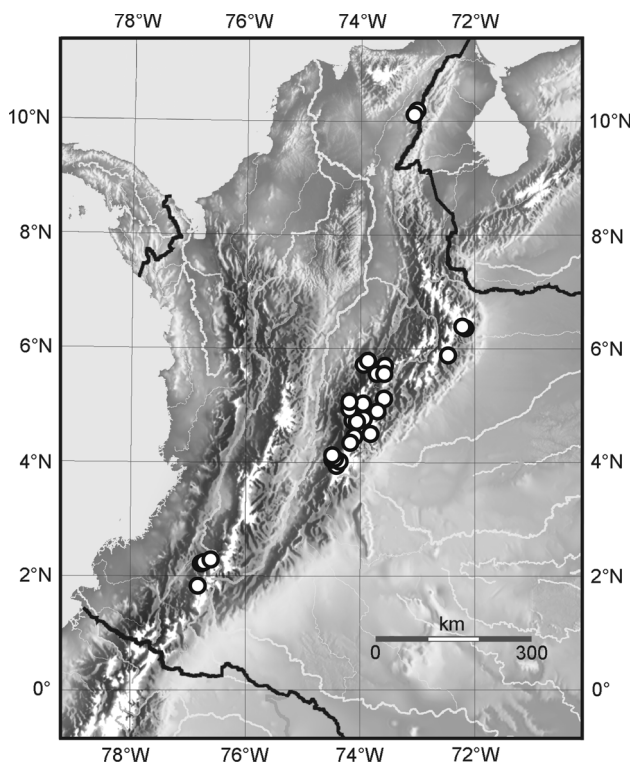


**Etymology:** In reference to the presence of large basal lip calli.

**Conservation status:** According to the IUCN Red List (IUCN 2011), the species can be assigned as NT. The species is known from several locations and occurs at the highest elevations at which the representatives of *Gomphichis* have been reported ever.

**Representative specimens:** *N. Diaz* 32—Colombia, Boyaca, Mpio. de Villa de Leyva, Santuario de Flora y Fauna de Iguaque, camino a la laguna, elev. 3,800 m (14 Nov 1988), (COL!); *H. Dueñas, F. Cortés and N. Aranguren* 3129—Colombia, Boyaca, Mpio. de Arcabuco, Santuario de Flora y Fauna de Iguaque, camino a la laguna, paramo dominado por *Espeletia*, *Calamagrostis*, *Hypericum*, *Lupinus*, *Monnina*, *Cavendishia*, *Castilleja*, elev. 3,600 m (24 Sep 2002), (COL!); *M.P. Córdoba, C. Lopez and L. Bernal* 3038—Colombia, Boyaca, Mpio. de Tibasosa, Cerro Guaquita, 5°42'33.2"N, 73°02'16.3"W, elev. 3,120 m (11 Dec 2003), (COL!); *J. Farfan s.n.*—Colombia, Boyaca, Mpio. de Tunja, Rio Teatinos, Embalse de Teatinos, bosque, elev. 2,800 m (10 Oct 2001), (COL!); *L.A. Camargo G.* 8048—Colombia, Boyaca, Mpio. de Socotá, Cordillera Oriental, en matorrales, a la orilla de la carretera que conduce al Páramo de Pisba, elev. 2,950 m (30 Sep 1981), (COL!); *D. Stancik* 1304—Colombia, Boyaca, Mpio. de Samacá, Vereda Ruch cal—

parte alta, shrubby matorral on the margin of road from Vereda to Desaguadero, elev. 2,900 m (1 Nov 1998), (COL!); *P. J. Grubb, B. A. B. Curry and A. Fernández Pérez* 609—Colombia, Boyaca, Sierra Nevada del Cocuy, on ground in hill sabana (?forest cleared) between Laguna Seca and Bachira by path, elev. 2,750 m (19 Aug 1957), (COL!); *P.J. Grubb, B.A.B. Curry and A. Fernández Pérez* 773—Colombia, Boyaca, Sierra Nevada del Cocuy, on ground near river in shrub paramo zone near El Playón, elev. 3,800 m (10 Sep 1957), (COL!); *F.A. Barclay and R.E. Schultes* 144—Colombia, Cauca, Mpio. de Puracé, N slope of the Volcán de Puracé, elev. 2,700–2,800 m (23 Jul 1956), (COL!); *H. Barclay and P. Juajibioy* 5910—Colombia, Cauca, Macizo Colombiano, Valle de Las Papas, ver wet portion of extensive *Espeletia*-grass cienaga near Hacienda Los Andes, Sta 4.2–2.5 km from casa Los Andes, elev. 3,150 m (4 Oct 1958), (COL!); *E.P. Arbelaez and J. Cuatrecasas* 5941—Colombia, Cauca, Del Páramo a Puracé, Matorrales en Chiquin, elev. 2,700–3,100 m (11 Jul 1939), (COL!); *G. Lozano C.* 3509—Colombia, Cauca, Mpio. de Coconuco, páramo del valle de Paletara, elev. 2,950 m (30 Jul 1980), (COL!); *O. Rangel, P. Franco, A. Rudas, J.R. Olmos, M. Pardo and M. Clavijo* 11047b—Colombia, Cesar, Mpio de Manaure, Serrania del Perijá, Casa de Vidrio, 32 km SE de Manaure, Arriba de la Laguna, en bosque de *Prumnopytis* y *Podocarpus*, 72°53'W, 10°25'N, elev. 2,950 m (5 Nov 1993), (COL!); *C. Hahn and K. E. Koch s.n.*—Colombia, Cundinamarca, Mpio. de Bogotá, entre Bogotá y Choachí, Páramo de Cruz Verde, cerca del camino al cerro de antenna de television, cerca al barranca del camino (24 Apr. 1996), (COL!); *J.L. Fernández Alonso, M.R. Garzón et al.* 7745—Colombia, Cundinamarca, DC de Bogotá, Páramo Sumapaz, después de la laguna de Chisacá, bosque andino y pajonales cerca del rio Taquecito, elev. 3,500–3,700 m (9–13 Nov 1987), (COL!); *P. Pedro, P. Franco, D. Stancik and A. Neira* 216—Colombia, Cundinamarca, DC, localidad 20, Parque Nacional Natural Sumapaz. Vereda Santa Rosa, Ladera de la Quebrada Bijuacales (7 Aug 1998), (COL!); *M.R. Garzón* 178—Colombia, Cundinamarca, Bogota, Páramo de Monserrate, Vereda El Verjón, Hacienda Santa Barbara, El Granizo, elev. 3,000–3,200 m (15–23 Nov 1986), (COL!); *M.R. Garzón* 337—Colombia, Cundinamarca, Bogota, Páramo de Monserrate, Vereda El Verjón, Hacienda Santa Barbara, El Granizo, elev. 3,000–3,200 m (3 Oct 1987), (COL!); *M. Schneider* 245/1—Colombia, Cundinamarca, Bogota, Cerro de Monserrate, elev. 3,100 m (17 Sep 1944), (COL!); *M. Schneider* 245/2—Colombia, Cundinamarca, Bogota, Cerro de Monserrate, elev. 3,100 m (17 Sep 1944), (COL!); *M. Schneider* 288/1—Colombia, Cundinamarca, Bogota, Cerro de Monserrate, elev. 3,100 m (17 Sep 1944), (COL!); *M.*



**Fig. 7** Distribution map of *Gomphichis magnicallosa* S. Nowak and Szlach. in Andean Colombia

*Schneider 288/3*—Colombia, Cundinamarca, Bogota, Cerro de Monserrate, elev. 3,250 m (2 Jul 1950), (COL!); *J. Cuatrecasas 20*—Colombia, Cundinamarca, Bogota, Cerro de Monserrate, Cumbre, matorroles, elev. 3,210 m (20 Aug 1938), (COL!); *M.A. Bello 86*—Colombia, Cundinamarca, Mpio. La Calera, Páramo Chingaza, Monteredondo, camino a La Quebrada Babilonia, 4°38'2"N, 73°43'8"W, elev. 3,000 m (27 Dec 1999), (COL!); *S. P. Cortés Sánchez 555*—Colombia, Cundinamarca, Mpio. de Chia, Cerca de la casa del cabildo indijena, elev. 2,690 m (17 May 1996), (COL!); *M. Schneider 245/3*—Colombia, Cundinamarca, Usme, elev. 2,600–2,700 m (26 Sep 1951), (COL!); *G. Morales L. 37*—Colombia, Cundinamarca, Usme, embalse de Chisacá, elev. 3,100 m (27 Oct 1977), (COL!); *M. Schneider 288/4*—Colombia, Cundinamarca, Usaquén, elev. 3,000 m (12 Oct 1951), (COL!); *L. Uribe U. 5998*—Colombia, Cundinamarca, Tocancipá, montes altos al oriente, elev. 2,800 m (5 Nov 1967), (COL!); *Haught 6492*—Colombia, Cundinamarca, Guadalupe near Bogotá, Open páramo, elev. 3,300 m (17 Jul 1949), (COL!); *G. Huertas and L. A. Camargo G. 6573*—Colombia, Cundinamarca, Mpio. de Fómeque, Páramo de Chingaza, Cerros vecinos a La Laguna, elev. 3,400 m (3 Nov 1966), (COL!); *G. Morales L. and Flenley 31*—Colombia, Cundinamarca, Páramo Cruz Verde, elev. 3,200 m (6 Sep 1977), (COL!); *M. T. Murillo 400*—Colombia, Cundinamarca, Zipaquirá, El Carrizal, elev. 3,200–3,400 m (14 Oct 1961), (COL!); *Barclay 5343*—Colombia, Cundinamarca, Páramo de Guerrero, between Zipaquirá and Pacho, elev. 3,200 m (9 Jul 1957), (COL!); *B. van Wesenbeeck and J. van Mourik 6*—Colombia, Cundinamarca, Tominé de Indios, bosque altoandino y subparamo, elev. 3,000–3,100 m (3 Aug 1999), (COL!); *J.L. Fernandez Alonso, O. Rangel, S. Cortés, A. Garzón and M. Hernandez 15556*—Colombia, Cundinamarca, Villapinzón, de Villapinzón a Umbita, limite municipal, elev. 3,200 m (21 May 1998), (COL!); *J. Cuatrecasas and R. Romero Castañeda 25060*—Colombia, Magdalena, Sierra de Perijá, E of Manaure, Sabana Rubia, páramo, elev. 3,000–3,100 m (6–8 Nov 1959), (COL!).

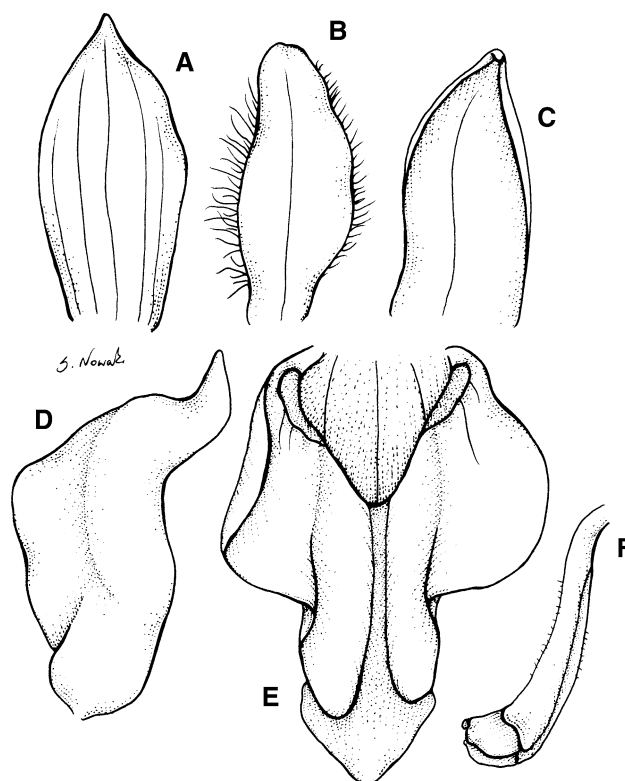
Notes: *Gomphichis magnicallosa* is related to *G. traceyae*, but its smaller plant. The new species is 34–40 cm tall (vs. up to 60 cm tall in *G. traceyae*), leaves are petiolate, 6–7 cm long, 1.7 cm wide (vs. leaves sessile, up to 10 cm long, 2.5 cm wide), lip up to 4.2 mm long and 3 mm wide (vs. up to 4.5 mm long and 5 mm wide). Additionally lip of *G. magnicallosa* with very large, massive, prominent oblong basal thickenings being 1/3 of the whole lip length, what is unusual in the genus. Gynostemium of *G. magnicallosa* is minutely ciliate all over below stigma, in contrast to *G. traceyae* where is almost glabrous or glabrous.

***Gomphichis fernandezii* S. Nowak and Szlach., *sp. nov.* (Fig. 8)**

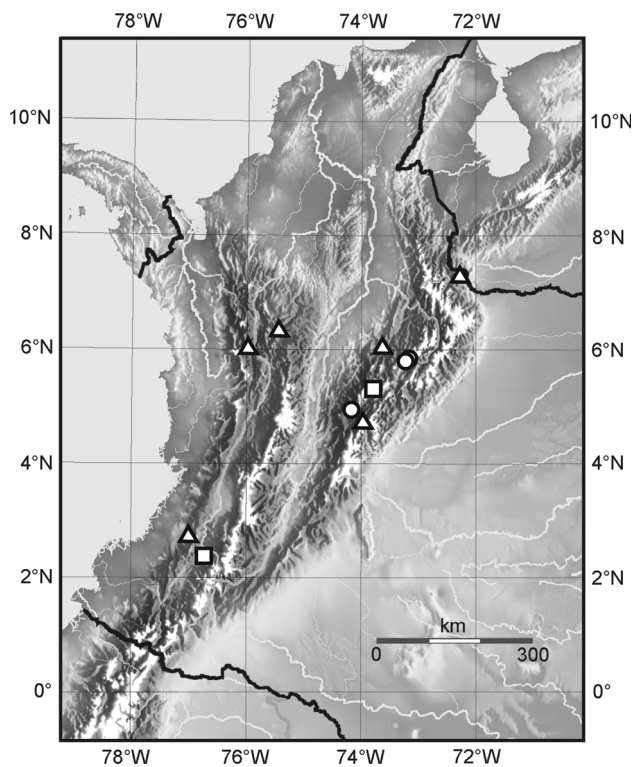
The species allied to *Gomphichis traceyae*, but with 1-nerved petals and lip with furrow along the midnerve and thin apical part of epichile.

Type: *J. L. Fernandez Alonso et al. 11921*—Colombia, Boyaca, Mpio. de Duitama, Trayecto Vereda El Carmen (3,100 m) a el Páramo de La Rusia (3,550 m), (19 Nov 1994), (COL! holotype).

Plants up to 45 cm tall. Leaves 2–3 basal and 1–2 cauline, petiolate; petiole up to 6 cm long; blade up to 5 cm long and 1.5 cm wide, oblanceolate to oblong-lanceolate, acute. Scape slender, erect, glabrous in the lower part, glandular towards the apex, with seven cauline sheaths. Flowers small. Floral bracts up to 9 mm long, ovate-lanceolate, acute, sparsely pubescent. Ovary up to 7 mm long, sessile, ovoid, glandular. Dorsal sepal up to 4 mm long and 1.8 mm wide, oblong-obovate, deeply concave, subacute to subobtuse, glandular pubescent outside. Petals up to 3.8 mm long and 1.2 mm wide, obliquely ovate-oblong or ovate-elliptic, obtuse, long-pubescent along inner margin and ciliate along outer margins, 1-nerved. Lateral sepals up to 4 mm long and 2 mm wide,



**Fig. 8** *Gomphichis fernandezii* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [J. L. Fernandez Alonso et al. 11921 (COL); drawn by S. Nowak]



**Fig. 9** Distribution map of *Gomphichis fernandezii* S. Nowak and Szlach. (circle), *G. monstruosa* S. Nowak and Szlach. (square) and *G. lozanoi* S. Nowak and Szlach. (triangle) in Andean Colombia

obliquely oblong–ovate, concave, subobtuse, glandular pubescent outside. Lip up to 3.6 mm long in total, sessile, fleshy, concave, difficult to spread, when spread divided into hypochile and epichile; hypochile 2 mm long, 2.5 mm wide, trapezoid–elliptic in outline; epichile 1.2 mm long, 0.8 mm wide, ligulate, with a pair of cushion-like calli, separated by a furrow, apex of epichile thin. Gynostemium 2.5 mm long, minutely ciliate below stigma.

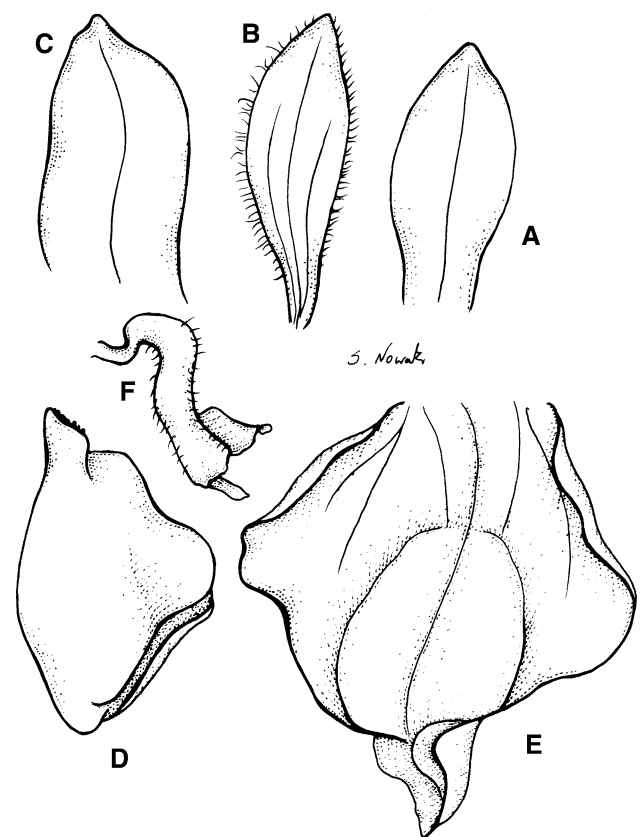
Ecology: Terrestrial in páramo with *Polylepis*, *Espeletia*, Melastomataceae, Ericaceae and Asteraceae. Flowering time: February, November.

Distribution: Colombia (Boyacá, Cundinamarca). Elev. 3,400–3,600 m (Fig. 9).

Etymology: Dedicated to J. L. Fernandez Alonso, who collected the specimens of this species.

Conservation status: According to the IUCN Red List (IUCN 2011), the species can be assigned as endangered (EN B1ab(i,iii)). The species is known only from three localities. The known extent of occurrence of this species is about 1000 km<sup>2</sup> and the known localities are all restricted to very narrow elevation range in high Andean paramo.

Representative specimens: *J. Betancur et al.* 5632—Colombia, Boyaca, Mpio. de Duitama, Corregimiento El Carmen, via a Virolin, Páramo de La Rusia, páramo muy perturbado dominado por *Polylepis*, *Espeletia*, compuestas,



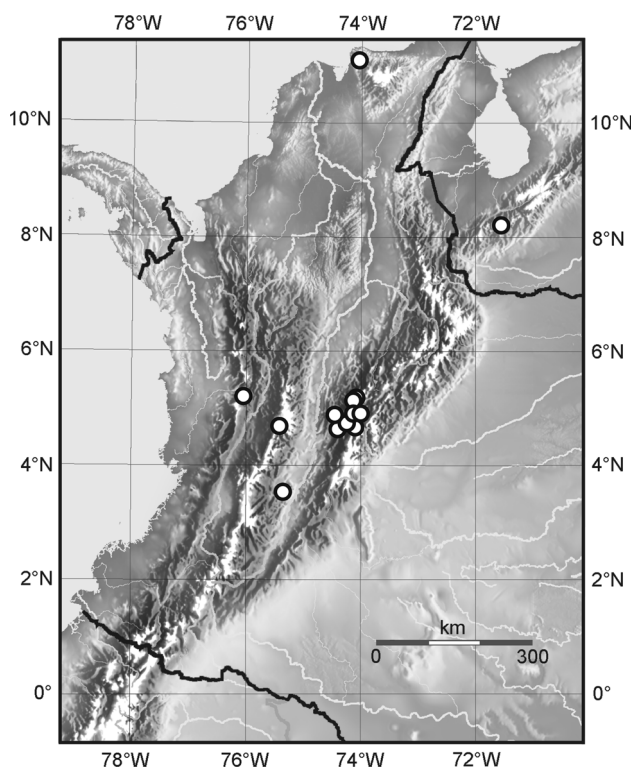
**Fig. 10** *Gomphichis jaramilloi* S. Nowak and Szlach.: a dorsal sepal, b petal, c lateral sepal, d lip-side view, e lip, f gynostemium [J. Cuatrecasas and R. Jaramillo 12035 (COL); drawn by S. Nowak]

Melastomataceae y Ericaceae, elev. 3,400–3,500 m (19 Nov 1994), (COL!); *M. Schneider* 288/5—Colombia, Cundinamarca, Páramo de Siberia, elev. 3,600 m (24 Feb 1952), (COL!).

Notes. The species appears to be related to *Gomphichis traceyae*, from which it is easily separable by the petals and lip form. The petals of *G. fernandezii* are long-pubescent along inner margin and ciliate along outer margins, in contrast to *G. traceyae* where petals are sparsely ciliate along margin in middle as well as on the back and obscurely erose-denticulate at rounded apex. Additionally lip of *G. fernandezii* with a pair of cushion-like calli, separated by a furrow (vs. absent in *G. traceyae*) and thin apex of epichile (vs. a pair of cushion-like, approximate calli which are papillose). Gynostemium of *G. fernandezii* is minutely ciliate below stigma, in contrast to *G. traceyae* where is almost glabrous or glabrous.

***Gomphichis jaramilloi*** S. Nowak and Szlach., *sp. nov.* (Fig. 10)

This species is characteristic by its sessile rhombic lip, very wide hypochile, subcordate epichile, ciliate petals and



**Fig. 11** Distribution map of *Gomphichis jaramilloi* S. Nowak and Szlach. in Andean Colombia

geniculate gynostemium, which is densely ciliate on the dorsal surface and sparsely ciliate on the ventral one.

Type: *J. Cuatrecasas* and *R. Jaramillo 12035*—Colombia, Cundinamarca, Cordillera Oriental, extremo SE de la Sabana de Bogotá, en San Miguel, bosque, elev. 2,800–3,000 m (10 Sep 1941), (COL! holotype).

Plants ca. 75 cm tall. Leaves 1, basal, withering at flowering. Scape with 7, glabrous sheaths, glabrous below, glandular above. Spike 11.5 cm long, cylindrical, densely many flowered. Flowers small. Floral bracts 7 mm, linear-lanceolate, somewhat oblique. Ovary 10 mm long, densely glandular. Dorsal sepal up to 4.5 mm long and 1.8 mm wide, oblong–obovate, concave, subacute, densely pubescent outside, obscurely 1-nerved. Petals up to 4.5 mm long and 1.7 mm wide, obliquely oblong–oblanceolate, attenuate towards subacute apex and towards the base, ciliate on both margins near the middle, obscurely 3-nerved. Lateral sepals up to 4.5 mm long and 2.5 mm wide, obliquely oblong–elliptic, concave, subobtuse, densely pubescent outside, 1-nerved. Lip up to 5 mm long in total and 5.5 mm wide, sessile, with no basal thickenings; hypochile rhombic when spread, very thick and papillate at the apex, sulcate; epichile 1 mm long and wide, subcordate, subacute, thick at the base. Gynostemium 4 mm long, geniculate above the base, very ciliate on dorsal surface, sparsely ciliate on the ventral one.

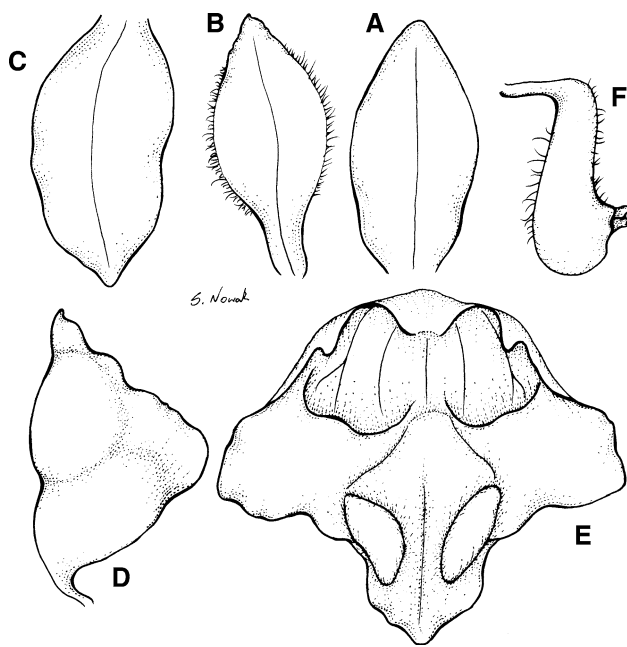
Ecology: Terrestrial in páramo, subpáramo, also Andean forest with *Weinmannia*, *Brunellia*, *Clusia* and *Miconia*. Flowering time: February–May, July–September, November.

Distribution: Colombia (Cundinamarca, Huila, Magdalena, Risaralda, Tolima), Venezuela (Mérida). Elev. 2,500–3,700 m (Fig. 11).

Etymology: Dedicated to Roberto Jaramillo Mejía, who intensively collected and was an expert in Colombian plants.

Conservation status: According to the IUCN Red List (IUCN 2011), the species can be assigned as NT. The species is known from several fragmented localities, most of them are concentrated in Cundinamarca. All localities are limited to heavily impacted high Andean páramo (Davis et al. 1997), so there are not much potential habitat and in our opinion continuing decline in extent and area of occurrence, as well as a quality of habitat are expected.

Representative specimens: *H. Dueñas* and *G. Peñalosa 3066*—Colombia, Cundinamarca, Mpio. de Suesca-Nemocón, Vereda Susatá, Hacienda Susatá (4 May 2001), (COL!); *J.L. Fernandez Alonso, J. Groenendijk, D. Cortés and G. Peñalosa 19054*—Colombia, Cundinamarca, Mpio. de Suesca-Nemocón, Hacienda Susatá, zona seca con restos de bosque andino y subpáramo, elev. 2,850–2,950 m (23 Aug 2000), (COL!—sterile); *H. Dueñas s.n.*—Colombia, Cundinamarca, Mpio. de Bogotá, Jardín Botánico Bogota “José Celestino Mutis”, elev. 2,650 m (20 Nov 2001), (COL!); *M. Schneider 9/1*—Colombia, Cundinamarca, alrededores de Bogotá, El Chicó, elev. 2,750 m (8 Apr 1944), (COL!); *G. Lozano C., R. Castillo and E. Vega 728*—Colombia, Cundinamarca, Carretera Bogotá-Choachí, vertiente hacia Choachí, adelante de Divorcium Acuarum (10 Mar 1967), (COL!); *S. P. Cortés Sánchez 816*—Colombia, Cundinamarca, Mpio. de Chia, Cima del cerro Manjuy, elev. 2,910 m (Aug 1996), (COL!—sterile); *M. Schneider 9/2*—Colombia, Cundinamarca, Bojacá, elev. 2,800–2,900 m (28 Jun 1953), (COL!—sterile); *G. Morales L. 193*—Colombia, Cundinamarca, Páramo de Guasca, km 48 via Sueva, elev. 3,100 m (25 Aug 1979), (COL!—in bud); *J.L. Fernandez Alonso, E. Linares, P. Balcazar, R. Yasquez, J. Velez and G. Salazar 14884*—Colombia, Huila, Mpio. de Gigante, subida desde Vereda Ventanas al Páramo de Miraflores, bosque andino de *Weinmannia*, *Brunellia*, *Clusia*, *Miconia*, elev. 2,970 m (12–16 Aug 1997), (COL!); *R. Romero Castañeda 7751*—Colombia, Magdalena, Mpio. de Santa Marta, entre Cerro Quemado y Cerro San Lorenzo, elev. 2,600–2,800 m (16 Apr 1959), (COL!); *J.H. Torres, O. Rangel, P. Franco, A.M. Cleef and S. Salamanca 2286*—Colombia, Risaralda, Mpio. de Santuario, Vereda Las Colonias, margen derecha del rio San Rafael, elev. 2,500 m (25 Feb 1983), (COL!); *R. Echeverry 1990*—Colombia, Tolima, camino de Nevada del Tolima, Arriba del Rancho (Termales), elev. 3,700 m (17 Jul 1969),



**Fig. 12** *Gomphichis monstruosa* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip-side view, **e** lip, **f** gynostemium [G. Lozano C. 3429 (COL); drawn by S. Nowak]

(COL!); *H. Barclay* and *P. Juajibioy* 9935—Venezuela, Merida, alrededores de La Laguna Coromoto, Forestry Station and Laguna Coromoto (2 Dec 1959), (COL!).

Notes: *Gomphichis jaramilloi* is easily separable from its closest relative *G. traceyae* by the lip and gynostemium. Lip of the new species as the same as *G. traceyae* is wider than long, however differs with no basal thickenings (vs. with small, oblong basal thickenings in *G. traceyae*). Gynostemium of *G. jaramilloi* is very ciliate on dorsal surface, sparsely ciliate on the ventral, in contrast to *G. traceyae* where is almost glabrous or glabrous.

***Gomphichis monstruosa*** S. Nowak and Szlach., *sp. nov.* (Fig. 12)

*Gomphichis monstruosa* is related to *G. longifolia* (Rolfe) Schltr. in having lip wider than long, but lip lateral lobes are obliquely triangular, epichile with two thickenings near the base and narrower, clawed petals.

Type: *G. Lozano* C. 3429—Colombia, Huila, Mpio. San José de Isnos, Vereda El Marmol, Parque Nacional Naturel de Puracé, elev. 2,800 m (24 Jul 1980), (COL! holotype).

Plants ca. 75 cm tall. Leaves 4, basal, sessile, to 16 cm long and 1.7 cm wide, linear-oblongate, acuminate. Scape with 5, sheaths, glabrous below, glandular above. Spike 13 cm long, cylindrical, densely many flowered. Flowers small. Floral bracts 12 mm long, linear-lanceolate, somewhat oblique, pubescent. Ovary 7 mm long, densely pubescent. Dorsal sepal up to 6 mm long and 3 mm wide,

oblong-ovate, concave, subobtusate, densely pubescent outside, 1-nerved. Petals up to 6 mm long and 3 mm wide, elliptic-ovate above cuneate base, attenuate towards acute apex, somewhat oblique, ciliate on both margins near the middle, otherwise glabrous, 1-nerved. Lateral sepals up to 5.7 mm long and 3.5 mm wide, obliquely oblong-elliptic, concave, subobtusate, densely pubescent outside, 1-nerved. Lip up to 6 mm long in total and 6.8 mm wide, clawed, with two, basal thickenings; hypochile broadly rhombic when spread, lateral lobes obliquely triangular, concave in the lower half, thick and papillate at the apex, somewhat sulcate; epichile 1 mm long and wide, pentagonal, subacute, with large cushion-like thickenings at the base distinctly separated one from another. Gynostemium 4 mm long, geniculate above the base, pubescent on dorsal surface, ciliate on the ventral one.

Ecology: In forest. Flowering time: July, October.

Distribution: Colombia (Cundinamarca, Huila). Elev. 2,800 m (Fig. 9).

Etymology: An allusion to the lip which reminds, when spread, a head of a monster.

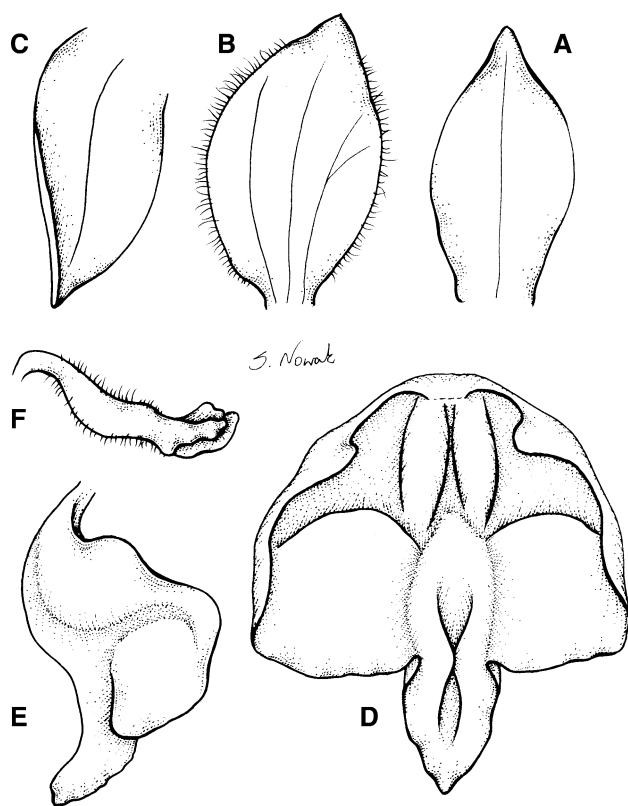
Conservation status: According to the IUCN Red List (IUCN 2011), the species can be assigned as vulnerable (VU B1ab(iii)). The species is known only from two fragmented localities and occurs at very high elevations, in Andean forest, so this may be a reason for its rare occurrence. However, the distribution range of the species is similar to the distribution range of *Gomphichis lozanoi*, so in our opinion vulnerable category is appropriate.

Representative specimens: *R. Echeverry* 1990—Colombia, Cundinamarca, bosque sobre Represa del Sisga, tépalos verdesos, labello blanco amarillo (27 Oct 1984), (COL!).

Notes: *Gomphichis monstruosa* is easily separable from its closest relative *G. longifolia* by the lip and petals form. The petals of *G. monstruosa* are elliptic-ovate above cuneate base and longer (up to 6 mm) than lateral sepals (up to 5.7 mm), in contrast to *G. longifolia* where petals are obliquely obovate to broadly obovate and shorter (up to 5.5 mm) than lateral sepals (up to 6 mm). Additionally, petals of *G. monstruosa* are ciliate on both margins near the middle, otherwise glabrous (vs. ciliate all over margins in *G. longifolia*). Lip of the new species as the same as *G. longifolia* is wider than long, however epichile of *G. monstruosa* with large cushion-like thickenings at the base distinctly separated one from another differ from fleshy callus in the central part of lip in *G. longifolia*.

***Gomphichis lozanoi*** S. Nowak and Szlach., *sp. nov.* (Fig. 13)

Species related to *Gomphichis costaricensis* (Schltr.) Ames, F.T.Hubb. & C.Schweinf., but petals prominently



**Fig. 13** *Gomphichis lozanoi* S. Nowak and Szlach.: **a** dorsal sepal, **b** petal, **c** lateral sepal, **d** lip, **e** lip-side view, **f** gynostemium [G. Lozano C. 3648 (COL); drawn by S. Nowak]

clawed, lip papillate in the centre and gynostemium bent at right angle versus stigma. In *G. costaricensis* petals are sessile, lip pubescent in the centre and gynostemium geniculate above the base.

Type: *G. Lozano C. 3648*—Colombia, Cauca, Mpio. de Tambo, La Romelia, Parque Nacional Natural Munchique, elev. 2,600–2,800 m (5 Aug 1980), (COL! holotype).

Plants up to 120 cm tall. Leaves 2–5 basal and occasionally 1 cauline, petiolate; petiole up to 10 cm long, wide; blade to 22 cm long and 4 cm wide, linear-oblongate to oblanceolate, acute. Scape with 4–7, sheaths, slender, erect, delicate, glabrous below, glandular above. Spike 20–30 cm long, cylindrical, laxly many flowered. Flowers relatively small. Floral bracts 8–10 mm long, linear-lanceolate, somewhat oblique, pubescent on margins. Ovary 4–8 mm long, densely or sparsely pubescent. Dorsal sepal up to 5.5 mm long and 2.8 mm wide, oblong-ovate, concave, subacute, pubescent outside, 1-nerved. Petals up to 5.2 mm long and 3.1 mm wide, elliptic-ovate to elliptic-suborbicular above cuneate base, attenuate towards subacute apex, oblique, ciliate on both margins near the middle, otherwise glabrous, 3-nerved. Lateral sepals up to 5.5 mm long and 3 mm wide, obliquely oblong-elliptic,

concave, subobtusate, pubescent outside, 1-nerved. Lip up to 5.7 mm long in total and 4.6 mm wide, clawed, with two, basal thickenings; hypochile rhombic when spread, lateral lobes obliquely triangular, concave in the lower half, with two cushion-like, papillate thickenings, divided by prominent furrow; epichile 1 mm long and wide, ligulate-ovate, subobtusate. Gynostemium up to 4.5 mm long, bent at right angle above the base, ciliate below stigma.

Ecology: Terrestrial in oak forest, also in páramo. Flowering time: August, October–January.

Distribution: Colombia (Antioquia, Cauca, Chocó, Cundinamarca, Norte de Santander). Elev. 2,300–2,900 m (Fig. 9).

Etymology: Dedicated to G. Lozano C., who collected type specimen of this species.

Conservation status: According to the IUCN Red List (IUCN 2011), the species can be assigned as vulnerable (VU B1ab(i,iii)). The species is known only from six fragmented localities. An extent of occurrence is about 100,000 km<sup>2</sup>, but an occurrence of this species is restricted mainly to oak forest, which is rare formation in Andes, especially at high elevations, additionally the oak forests are one of the less protected ecosystems (Armenteras et al. 2003). All of these factors caused that real EOO (suitable habitat for species) is probably much narrower.

Representative specimens: *G. Galeano et al. 304*—Colombia, Antioquia, Mpio. de Medellín, Vereda Santa Elena, 12 km al E de Medellín, elev. 2,400 m (18 Dec 1980), (COL!); *D. Stancik 1174*—Colombia, Boyaca, Mpio. de Gachantivá, Vereda Savedras de Roncancio, *Quercus-Clusia* forest, terrestrial, 5°43'33"N, 73°32'01"W, elev. 2,600 m (2 Nov 1998), (COL!); *A. Gentry and E. Renteria A. 24184*—Colombia, Choco, Emisoria La Sirena, 3 km W of La Mansa at top of Cordillera Occidental, disturbed oak forest, flowers white, elev. 2,300–2,400 m (16 Jan 1979), (COL!); *P.G. Huertas and P.L. Camargo 6679*—Colombia, Cundinamarca, Junín, Vereda La Cumbre, a orillas de la carretera, bosques, elev. 2,700 m (18 Jan 1967), (COL!); *J. Cuatrecasas, R.E. Schultes and E. Smith 12754*—Colombia, Norte de Santander, Páramo de Tamá, Vertiente de Samaria, elev. 2,600–2,900 m (29 Oct 1941), (COL!).

Notes: The species appears to be related to *Gomphichis costaricensis*, from which it is easily separable by the petals and lip form. The petals of *G. lozanoi* are cuneate at the base (vs. sessile, with broad base in *G. costaricensis*). The lip of the new species is concave in the lower half, with two cushion-like, papillate thickenings, divided by prominent furrow, in contrast to *G. costaricensis* which is pubescent in the centre, with very large callus, sulcate in front.

## Discussion

Spirantheid orchids comprise a wide spectrum of species somehow complex for taxonomists to identify. With few exceptions, all of them are most difficult for proper identification at the species level. Most of them are indistinguishable using solely vegetative characters. In most cases they do not contain unique or peculiar information sufficient to ensure proper identification of the plant. This can be seen in a previous section: neither of the vegetative features can be used to discriminate at the species level in *Gomphichis*. Even with the flowers it is impossible to arrive at an appropriate name without dissecting the usually tubular flowers. Our experiences in working with spirantheid species permit us to call the attention of future students to some items important in the taxonomy of *Gomphichis*.

The shape of the lip and alternately its lobation as well as the presence of thickenings, outgrowth(s) and surface cover seem to be constant at the species level. Equally important are the form, length–width ratio and margin cover of petals, as well as the deflection and cover of the gynostemium. The reproductive structure of *Gomphichis* was described in detail by Szlachetko and Rutkowski (2000). Some of the characters aforementioned, however, are observable under lenses only. Combinations of these features are the most prognostic and useful in determination of the species of *Gomphichis*.

Occurrence of species described in this paper is characterized by many disjunctions, which could result from their relationships with paramo. Another fact is that the very light seeds of *Gomphichis* can have a long-distance wind transport and may arrive at distant localities. Their area of occurrence could be larger during the last glacial period, when the subparamo zone extended from ca. 2,000 m, with the result that distribution of the new species could be more continuous. The present-day subparamo belt extends from 3,200–3,300 to ca. 3,600 m, directly above the upper forest line (Hooghiemstra et al. 2006).

Paramos are a megadiverse biome with many endemic species. As a proper biome paramos exist since 2–4 millions of years. They have experienced immigrations from lower altitudes (savanna, upper montane rain forests) and from southern (puna, Austral–Antarctic region) and northern latitudes via Central America (Hooghiemstra et al. 2006). All this has resulted in the world's most megadiverse equatorial tropicalpine biome. Since the recent past of the Pliocene, about 40 glacial periods alternating with warmer interstadials have been strongly operational in speciation processes of the paramo flora (Hoorn et al. 2010; Van der Hammen and Cleef 1986; Torres et al. 2013; Smith and Cleef 1988; Cleef 1979). The paramo reflects a sort of island archipelago, isolated

and fragmented, which promotes high speciation and a high endemism at the species and genus level (Murillo 1951; Luteyn 1999; Sklenář and Ramsay 2001). Most endemic species are the result of the repeated island-like distribution in the Pleistocene and connectivity again during glacial times (Van der Hammen and Cleef 1986). Hughes and Eastwood (2006) suggested that rates of diversification found for high Andean plants driven by ecological opportunity in island-like model may indeed outpace the mainland type. Referring to the novelties in *Gomphichis* presented in this paper, there is a close relationship with insularity and altitudinal sequence of montane forest and paramos.

According to the IUCN Red List (IUCN 2011) for all species described in this paper, the conservation status is proposed. Categories were determined based on geographical range of species showing that four species are in threatened categories and four are in a 'NT' category. In our opinion, keeping in mind the many factors which determine the survival of terrestrial orchid group of plants, which is one of the largest in species number threatened by extinction (Swarts and Dixon 2009), the designated conservation statuses are justified. The main factors having an impact upon terrestrial orchid population (or species) are the presence of mycorrhiza, support of pollinators, ecological stability and climate change (Arditti et al. 1990; Arditti and Ghani 2000; Swarts and Dixon 2009). Ecological stability and climate change belong to long-term impacting factors. The effects of the latter can be observed after 20–50 years (Swarts and Dixon 2009; Cleef 2013). However, it is possible to draw conclusions by observation of the plant formations where orchids occur, which are part of ecological stability. Newly described species occur mainly in the subparamo and grass paramo in Colombia. The upper forest line is in general close, and the first evidence of displacement of subparamo vegetation by climatic warming up already has been observed (Cleef 2013). At present, paramos suffer from multiple human influences and even destruction of entire habitats by mining, burning and grazing by cattle and large-scale potato agriculture. Even the water resources, the most important paramo ecosystem service, is also strongly affected (in quality and quantity).

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