Two new species of *Aa* (Orchidaceae, Spiranthoideae) from Colombia

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Abstract Two new species of the Andean genus *Aa* (Orchidaceae, Spiranthoideae) are described: *Aa lozanoi* Szlach. and S. Nowak, and *Aa figueroi* Szlach. and S. Nowak. They are restricted in distribution mainly to Cordillera Oriental in the department of Cundinamarca, however, *A. lozanoi* was also collected in Cordillera Central and *A. figueroi* in Sierra Nevada de Santa Marta, in northern part of Colombia. Each species is described and illustrated, detailed habitat and distribution data are provided. A distribution map of the new species is presented. A dichotomous key for determination of the Colombian species of *Aa* is provided. Brief discussion about the most important threats for plants in Andes is presented.

Keywords *Aa* · Colombia · Orchidaceae · New species · Taxonomy

Introduction

The orchid genus *Aa* Rchb.f. contains approximately 25 species occurring in Andean regions in South America and disjunctive population in Costa Rican mountains (Wood 2003). Ortiz (1995) reported seven species of *Aa* in Colombia. Our studies on Colombian orchids extend this number to ten, including two new species described in this paper. New species were discovered during researches conducted by the first author in Colombian National

Herbarium in Bogota, COL [herbarium acronym followed Holmgren and Holmgren (1998)].

Aa, likes closely related genus *Myrosmodes* Rchb.f., is often found in the highest elevation of the Andes, i.e. above 3,100 m.a.s.l. (Wood 2003; Álvarez-Molina and Cameron 2009; Trujillo and Vargas 2011). In result, they are commonly seen in vegetations, like open scrubs and woodlands, damp mountain meadows and paramo, dry puna, also in lower lomas formations from the desert coast of Peru (Wood 2003; Trujillo and Vargas 2011). Populations of some species in Argentina and Peru have been noted at lower elevations (Cocucci 1964; Trujillo and Rodriguez 2011).

Both *Aa* and *Myrosmodes* were distinguished from *Altensteinia* Kunth by Reichenbach (1854). However, in the later work, he classified all these genera under the name of *Altensteinia* (Reichenbach 1878). *Aa* was revalidated by Schlechter (1912, 1920a, b), but later taxonomists still treated this genus as congeneric with *Altensteinia*. This situation reminded unchanged till Garay's (1978) treatment on Ecuadorian orchid flora. Since then *Aa* is widely accepted as distinct taxon. We recapitulate differences between genera in question in the Table 1. The genus is classify within Prescottinae (Dressler 1990, 1993; Szlachetko 1995), which in our opinion belongs to Spirantheae, what was suggested by Szlachetko (1995).

Representatives of *Aa* are terrestrial plants with inflorescence with many small, inconspicuous, greenish-white and non-resupinate flowers. Elongate peduncle is enclothed by hyaline, semi-transparent, imbricating sheaths. Dorsal sepal and petals are free from the gynostemium. Lip is globose and truncate, papillate or glabrous in the center, rounded or cordate at base, basally with a pair of globose calli. Lip margins are minutely denate to lacerate-fimbriate. Gynostemium is short, erect, rather massive. Anther is

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Table 1 Comparison of the genera *Aa*, *Altensteinia* and *Myrosmodes*

Character/ genus	<i>Aa</i>	<i>Altensteinia</i>	<i>Myrosmodes</i>
Inflorescence	Lateral	Terminal	Lateral
Leaves	Hysteranthous	Synanthous	Hysteranthous
Sepals	Free or occasionally connate	Free	Connate
Lip	Calceolate with involute and lacerate margins, disc with a pair of subglobose basal calli	Concave, flaring to galeate, never calceolate	Cucullate, tubular or flared with fimbriate margins with moniliform hairs, disc with obscure basal calli
Column part	Glabrous, very short	Pubescent, elongate	Glabrous, elongate
Staminodes	Poorly developed, usually joined with stigma and filament margins forming a dorsal clinandrium	Forming a distinct dorsal clinandrium	Very large, in basal part fused with filament and stigma margins, apically free
Stigma	Horizontal	Horizontal	Ventral

sessile or shortly stalked, erect motile with two parallel or basally slightly divergent chambers. Pollinia are two, but bipartite, powdery and oblong to ellipsoid-ovoid in shape. Staminodes are poorly developed, usually joined with the stigma and filament margins forming a dorsal, delicate clinandrium. Stigma is relatively large and flat. Rostellum is formed from apical part of the middle stigma lobe, and is restricted to the oval viscidium only, which is single, apical, detachable, cellular and multilayered (Fig. 1; Szlachetko and Rutkowski 2000).

Flowers of all *Aa* species are small or even tiny, and diagnostic features hidden inside the flower cannot be traced without lenses. The proper identification of species requires careful examination of the lip and gynostemium morphology. It is necessary to pay special attention to the following characters; lip thickening and surface of its margins, form and presence of basal lip calli, as well as position of the anther (sessile vs stalked), form of the receptive surface and developing of the clinandrium. The most important discriminative characters well observed in cursory study concerns flower/floral bract ratio and position of the floral bracts in inflorescence.

The new species described here are restricted in distribution to the western part of Andes, mainly Cordillera Oriental in the department of Cundinamarca. Additionally,

one specimen of *Aa lozanoi* was collected in Cordillera Central, department of Caldas (Fig. 2). Three specimens of *A. figueroi* were found on the isolated, pyramid-like prolongation of the Andes in North of Colombia, which are situated in protected area, Sierra Nevada de Santa Marta National Park. However, indigenous people's actions, like cattle grazing or agricultural development have severely altered the landscape (Davis et al. 1997; Luteyn 1999; Mittermeier et al. 2004). Cordillera Oriental in the department of Cundinamarca is an area where the most representatives of new species were collected.

In the following paper, we adopted key to determination of the species published by Garay (1978), but some discriminative features require to be commented. In his key, Garay (1978) stated that petals of *Aa hartwegii* Garay are crenulate, but in the original description he indicated the petals margins to be erose. Based on examination of 19 herbarium specimens from Colombia (e.g. Cleef 2265a, COL; Barclay 5282, COL; Pedraza 848, COL) and three from Ecuador (Korning and Thomsen 47294, AAU; Barclay and Juajibioy 9205, COL) including holotype (*Hartweg s.n.*, K-L), we think that petals of *A. hartwegii* are crenulate.

According to Garay (1978), *Aa nigrescens* Schltr. is conspecific with *A. leucantha* (Rchb.f.) Schltr., but in our opinion they are separate species. *Aa nigrescens* is known only from the type specimen collected in Colombia (*Madero s.n.*, B†, AMES—lectotype) and *A. leucantha* from Ecuadorian (*Lehmann 247*, W—lectotype) and Colombian materials (*Grubb, Curry and Fernandez Perez 752*, COL; *Cordoba, Lopez and Bernal 3210*, COL; *Diaz, Cleef, Rangel and Salamanca 2904*, COL; *Barclay and Juajibioy 6563*, COL; *Barkley and Araque 185159*, COL). Based on studied materials, it seems that *A. nigrescens* is distinctive from *A. leucantha* by smaller leaves. In the former, they are 3 cm long and 1 cm wide, when in the latter 14 cm long and 2 cm wide. Tepals of *A. nigrescens* are almost linear to ligulate, versus mostly lanceolate in *A. leucantha*. Dorsal sepal of *A. nigrescens* is 3.5 mm long, 0.6–0.7 mm wide, petals 3.7 mm long, 0.3–0.4 mm wide and lateral sepals 4 mm long, 0.8 mm wide, when dorsal sepal of *A. leucantha* is 3 mm long, to 2 mm wide, petals to 3 mm long, 1 mm wide and lateral sepals to 4 mm long, 2.1 mm wide. Characteristic feature of *A. nigrescens* is glandular-pilose ovary, which is glabrous in *A. leucantha*. Additionally, black colour of flowers is well-seen on herbarium specimens of *A. nigrescens*, they are brownish in *A. leucantha*.

Key to the species of *Aa* in Colombia [adopted from Garay (1978), changed].

1. Floral bracts lanceolate, acute, acuminate to long-attenuate, much exceeding the flowers, usually reflexed above base when mature 2

Fig. 1 Gynostemium structure of *Aa* Rchb.f.: **a** gynostemium—bottom view, **b** rostellum remnant, **c** gynostemium—back view; **d** gynostemium—side view, **e** anther, **f** gynostemium—bottom view, **g** gynostemium—side view (Szlachetko and Rutkowski 2000)

- 1.* Floral bracts ovate, deltoid to rhombic, acute to obtuse, equaling or slightly longer than flower, usually straight but sometimes reflexed when mature 6
2. Rostellum transversely elliptic or reniform, adnate to the ascending wall of clinandrium, anther sessile 3
- 2* Rostellum trapezoid, prominently protruding and free from clinandrium, anther stalked 4
3. Plants rather slender. Floral bracts entire and undulate on margins *A. leucantha*
- 3* Plants robust. Floral bracts irregularly denticulate or lacerate on margins *A. maderoi*
4. Petals obscurely crenulate *A. hartwegii*
- 4* Petals erose 5
5. Flowers black in dried specimens, ovary glandular-pilose *A. nigrescens*
- 5* Flowers brownish when dried out, ovary glabrous. *A. paleacea*
6. Margins of lip more or less denticulate 7
- 6* Margins of lip lacerate or fimbriate 8

7. Leaves absent at flowering *A. lozanoi*
- 7* Leaves present at flowering *A. denticulata*
8. Petals elliptic, more or less similar to dorsal sepal, twice as long as wide *A. argyrolepis*
- 8* Petals narrowly oblong, dissimilar to dorsal sepal, three times as long as wide 9
9. Lip strongly thickened below margins, anther stalked and subquadrate *A. figueroi*
- 9* Lip thickened in the center only, anther sessile, reniform-cordate *A. colombiana*

Taxonomic treatment

Aa lozanoi Szlach. and S. Nowak *sp. nov.* (Fig. 3).

This species is similar to *Aa argyrolepis* Rchb.f., but margins of floral bracts, sepals and petals are entire, lip is very thick and fleshy, especially in the centre, lip margins are very minutely denticulate in the upper part, entire

Fig. 2 Map of distribution of the new species in Andean Colombia (square—*Aa lozanoi*, triangle—*A. figueroi*)

below, stigma is transversely pandurate, clinandrium very obscure and anther shortly stalked.

Type: *C. Saravia T. and G. Lozano C. 2987*—Colombia, Caldas (Cundinamarca), Mpio, Suesca, Vereda de Hato Grande, 7.3 km al SE del caserio, En pastizales subseriales de *Festuca*, por encima de las areas erosionadas, alt. 3,300 m (18 Dec 1968), (COL! holotype).

Plants to 43 cm tall, erect, slender. Leaves absent at flowering. Scape slender, loosely 12–18 sheathed, terminated by 4–8 cm long, cylindrical many-flowered, dense, glabrous spike. Floral bracts to 13 mm long, somewhat surpassing the flowers, broadly ovate to ovate-lanceolate, acute, semi-transparent, margins entire. Sessile ovary to 4 mm long, glabrous or sparsely

glandular. Margins of sepals and petals entire. Dorsal sepal up to 2.7 mm long and 1.5 mm wide, triangular-ovate to elliptic-ovate, obtuse to rounded at apex, 1-nerved. Petals up to 3 mm long and 1.2 mm wide, obliquely ligulate to oblong lanceolate, obtuse, 1-nerved. Lateral sepals to 3.5 mm long and 1.7 mm wide, obliquely oblong elliptic to ligulate, obtuse to rounded, 1-nerved. Lip to 3.2 mm long and 3 mm wide in natural position, globose, truncate at base, very thick and fleshy, especially in the centre, margins very minutely denticulate in the upper part, entire below, incurved, with a pair of globose calli. Gynostemium 1.2 mm long, erect, delicate, much swollen above the narrow base. Stigma transversely pandurate, very conspicuous. Clinandrium

Fig. 3 *Aa lozanoi* Szlach. and S. Nowak: **a** bract, **b** dorsal sepal, **c** petal, **d** lateral sepal, **e** lip in natural position, **f** lip-side view, **g** gynostemium—bottom view, **h** gynostemium—back view [C. Saravia T. and G. Lozano C. 2987 (COL); drawn by S. Nowak]

obscure, spread between stigma margins and filament. Anther shortly stalked, transversely elliptic.

Ecology: terrestrial in paramo.

Distribution: Colombia (Caldas, Cundinamarca). Alt. 2,800–4,300 m.

Etymology: dedicated to G Lozano, who co-collected the type specimen.

Additional specimens examined: *Cleef and 't Hart* 2524—Colombia, Caldas, Nevado del Ruiz, Superparamo Arenales del finca NW, 3 km al NW del Refugio, alt. 4,300 m (19 Mar 1972), (COL!); *G. Morales L.* 36—Colombia, Cundinamarca, Usme, embalse de Chisaca, Crece bajo pinar joven entre gramineas, alt. 3,100 m (27 Oct 1977), (COL!); *J. L. Fernandez Alonso, Groenedijk, D. Cortes and G. Penaloza* 19040—Colombia, Cundinamarca, Mpio. de Suesca-Nemocon, Hacienda Susata, Zona seca con restos de bosque andino y subparamo, alt. 2,850–2,950 m. (23 Aug 2000), (COL!); *Schneider* 173—Colombia, Cundinamarca, Sibate, alt. 2,800–2,900 m (22 Mar 1948), (COL!).

Notes: *Aa lozanoi* is easily separable from *A. argyrolepis* (Fig. 4) by its lip, petals and floral bracts. Despite *A. argyrolepis*, the floral bracts and petals

margins are entire in the new species. The lip is very thick in the centre with margins being minutely denticulate in the upper part. According to Garay (1978), the lip of *A. argyrolepis* is “fleshier than other segments”, but we found no differences in the thickness of the floral parts. The lip margin is lacerate-fimbriate in this species. The gynostemium morphology supplies additional characters distinguishing *A. lozanoi* from its closest congener. In the new species, gynostemium is much swollen towards the apex, hence obovoid, stigma is very large, transversely pandurate, clinandrium very obscure and anther shortly stalked. In contrast, the gynostemium of *Aa argyrolepis* is cylindrical, stigma is oblong-elliptic, the clinandrium is prominent, more or less erose on margins and the anther sessile.

Aa figueroi Szlach. and S. Nowak *sp. nov.* (Fig. 5).

This species appears to be related to *Aa colombiana* Schltr., but the lip is almost orbicular when spread, very thick in the center and fimbriate along margins just above its base, clinandrium is shorter and spread between style and filament and anther is prominently stalked.

Type: *Y. Figueroa* C. 647—Colombia, Cundinamarca, Bogota, Localidad 5—Usme, sector del Embalse de

Fig. 4 *Aa argyrolepis* Rchb.f.: **a** bract, **b** dorsal sepal, **c** petal, **d** lateral sepal, **e** lip, **f** gynostemium [Cuadros and Gentry 2749 (MO); drawn by S. Nowak]

Chisaca, Vereda las margaritas, 4° 20'N, 74° 15'W, alt. 3,000–3,200 m (5 Aug 2005), (COL! holotype).

Plants to 50 cm tall, erect, slender. Leaves 3–6, at the base of the stem, petiolate; petiole to 1.5 cm long; blade to 11 cm long and 2.5 cm wide, lanceolate. Scape loosely 13–18 sheathed, terminated by cylindrical, densely many-flowered spike. Spike up to 8 cm long, densely many-flowered. Floral bracts to 8.5 mm long, elliptic to elliptic-ovate, acute, with entire margins. Ovary 3 mm long, glabrous. Margins of sepals and petals entire. Dorsal sepal up to 3.2 mm long and 1.2 mm wide, elliptic-ovate, elliptic to oblong elliptic, obtuse, 1-nerved. Petals up to 3 mm long and 1 mm wide, ligulate, straight, 1-nerved. Lateral sepals to 4 mm long and 1.2 mm wide, oblong ligulate-ovate, subfalcate, 1-nerved. Lip up to 3.5 mm long in natural position, globose, subcordate at base, very thick in the center, margins fimbriate just above the base, with a pair of ovoid calli at base. Gynostemium 1.5 mm long, erect, delicate, slightly swollen above the base. Stigma reniform.

Clinandrium prominent, spread between margins of style and filament, with free apices. Anther stalked, subquadrate.

Ecology: terrestrial in paramo. Alt. 2,600–4,150 m.

Distribution: known from Colombia (Cundinamarca, Magdalena) only.

Etymology: dedicated to Y. Figueroa, who collected type specimen of this new entity.

Additional specimens examined: *J.L. Fernandez Alonso, Groenendijk, D. Cortes and G. Penaloza 19046*—Colombia, Cundinamarca, Mpio. de Suesca-Nemocon, Hacienda Susata, Zona seca con restos de bosque andino y subparamo, alt. 2,850–2,950 m (23 Aug 2000), (COL!); *van der Hammen 7155*—Colombia, Cundinamarca, Mpio. de Nemocon, Quebrada Checua, alt. 2,600 m (1996), (COL!); *Schneider 219*—Colombia, Cundinamarca Bogota, Cerro de Monserrate, alt. 2,800 m, (COL!); *Schneider 173*—Colombia, Cundinamarca, Facatativa, La Tribuna, alt. 2,800 m (13 Jun 1952), (COL!); *J.L. Fernandez Alonso and R. Castillo 12658*—Colombia, Cundinamarca, Antre

Fig. 5 *Aa figueroi* Szlach. and S. Nowak: **a** bract, **b** dorsal sepal, **c** petal, **d** lateral sepal, **e** lip in natural position, **f** lip, **g** gynostemium, **h** rostellum remnant, **i** anther [Y. Figueroa C. 647 (COL); drawn by S. Nowak]

Lago Sisga y Alto del Sisga en la via Choconta-Bogota (16 Jul 1995), (COL!); *J. Mora, Y. Figueroa C. and T. Vivas 1143*—Colombia, Cundinamarca, Bogota, Localidad 5—Usme, sector del Embalse de Chisaca, Alrededores del rio Tunjuelo, vereda las margaritas, 4°20'N, 74°15'W, alt. 3,000–3,200 m (5 Aug 2005), (COL!); *van der Hammen 1190*—Colombia, Magdalena, Sierra Nevada de Santa Marta, Valle del rio Donachuy, camino Corisa-Naboba Lake, alt. 4,150 m (15 Oct 1958), (COL!); *Cuatrecasas and Romero Castaneda 24472*—Colombia, Magdalena, Sierra Nevada de Santa Marta, SE slopes, Hoya del Rio Donachuy, Meollaca (or Meuyaca), paramo bushy prairies and thickets, alt. 3,320–3,260 m (28 Sep 1959), (COL!); *Cuatrecasas and Romero Castaneda 24525*—Colombia, Magdalena, Sierra Nevada de Santa Marta, SE slopes, Hoya del Rio Donachuy, Laguna de Calocribe (E of Meollaca), paramo, alt. 3,600–3,700 m (30 Sep 1959), (COL!).

Notes: *Aa figueroi* differs from *A. colombiana* (Fig. 6) in series of features concerning the lip and gynostemium morphology. Both species share similar lip form, but differ clearly in its margins. The lip of *A. figueroi* is fimbriate along margins, in contrast to *A. colombiana* where margins are lacerate-fimbriate. Garay (1978) stated that lip of *A. colombiana* is fleshier than other segments, but in *A. figueroi* it is exceptionally thick just below margins, having maximum in the centre. Gynostemium of the new species is 1.5 mm long (vs 1 mm in *A. colombiana*). Its clinandrium is prominent, spread between margins of style and filament reaching barely base of receptive surface, whereas in *A. colombiana* is spread between stigma and filament much exceeding half length of stigma. Both species are easily separable based on anther—it is stalked and subquadrate in *A. figueroi*, and sessile, reniform-cordate in

Fig. 6 *Aa colombiana* Schltr.:
a bract, **b** dorsal sepal, **c** petal,
d lateral sepal, **e** lip,
f gynostemium [Luer 10174
 (MO); drawn by S. Nowak]

A. colombiana. Additionally, stigma of new entity is reniform (vs broadly reniform in *A. argyrolepis*) and viscidium is rounded (vs transversely elliptic).

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