

# *Sobralia abadorum* (Orchidaceae) – a new orchid species from Peru

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**Abstract:** *Sobralia* Ruiz & Pav. is one of the largest genus in Orchidaceae. It comprises about 150 species distributed from Mexico to Bolivia. In this paper, a new species of *Sobralia* from Peru, *S. abadorum*, is described and illustrated. Its taxonomic affinity is briefly discussed. An analysis of ITS sequences indicates an isolate position of this new species.

**Key words:** Orchidaceae, *Sobralia*, new species, ITS

## 1. Introduction

*Sobralia* Ruiz & Pav. is a large genus embracing about 150 species distributed from Mexico to subtropical America, particularly in Peru, Bolivia, and southern Brazil. The members of *Sobralia* are usually terrestrial herbs, sometimes growing as lithophytes or epiphytes. Most of the species have short, stiff rhizome, covered densely by long, thick roots penetrating the substrate. Stem is usually unbranched, rarely branching, glabrous or occasionally pubescent, from a few centimeters to almost 14 meters high. Leaves are always plicate, thin or stiff, plane green or reddish-brown spotted, sometimes reddish suffused on upper or lower surface, or on both, glabrous or rarely pubescent, usually acute to acuminate. Inflorescence is usually terminal and racemose. Flowers are often large or very large, showy, sometimes medium-sized or small, resupinate. Lip is the largest segment of a perianth, entire or trilobed, usually with keels or hairs in the throat, sometimes crisped and/or fimbriate along margins. Gynostemium is clavate, often narrow in basal part, anther is bent forward, pollinia form 4 or 8 bands joined together.

Most species of *Sobralia* have very peculiar pollinia, so, probably, they are pollinated by bees, especially euglossines. Presumably, large euglossine bees, such

as *Bombus* and hummingbirds, may be pollinators of *S. amabilis* (Rchb.f.) L. O. Williams (Van der Pijl & Dodson 1966). According to Pridgeon *et al.* (2005), *S. callosa* L. O. Williams is expected to be pollinated by hummingbirds too, considering its pollinaria structure, which are similar to those of *Elleanthus* Presl.

Infrageneric classification of *Sobralia* is still unclear. This genus is highly morphologically diversified, especially, in terms of its generative structures. Lindley (1854) was the first author who recognized 3 sections of *Sobralia* (A, B, and C), but he did not name them. However, in 1983, Brieger provided valid names for two of them and recognized three new sections. Now *Sobralia* comprises 5 sections: sect. *Sobralia*, sect. *Racemosae* Brieger, sect. *Abbreviatae* Brieger, sect. *Globosae* Brieger, and sect. *Intermediae* Brieger.

During the expedition to Peru dr. Erica Moron de Abad supported the senior author with plant material of *Sobralia*. It is described below.

## 2. Material and methods

**TAXONOMIC SAMPLING.** For the molecular research, 85 specimens, including 21 *Sobralia* species were taken, Tissue samples were required for particular plant analyses. Material was collected during the expedition to

Ecuador and Peru. Same samples were obtained from the Ecuadorian company *Ecuagenera*. Information concerning origin of samples, collectors of the plants and other available data are listed in the Appendix.

**MOLECULAR TECHNIQUES** (DNA isolation, amplification and sequencing). DNA was extracted from leaf tissue using the DNA Mini Plant Kit (A&A Biotechnology Poland) following the manufacturer's protocol. Amplification and sequencing of the ITS1-5.8-ITS2 region was performed using primers AB 101 and AB 102 (Douzery *et al.* 1999). PCR was performed using either Eppendorf or Biometra thermal cyclers in 25  $\mu$ L volumes with the following reaction components: 1  $\mu$ L template DNA (~10-100 ng), 19.1-19.6  $\mu$ L water, 2.5  $\mu$ L 10X buffer, 1.0  $\mu$ L dimethyl sulfoxide (DMSO), 0.5  $\mu$ L of 5mM dNTPs, 0.2  $\mu$ L each of 20  $\mu$ M primers and 2.5 units of *Taq* DNA polymerase. Amplification parameters for ITS region were: 94°C, 4 min; 26X (94°C, 45 s; 52°C, 45 s; 72°C, 50 s); 72°C, 5 min.

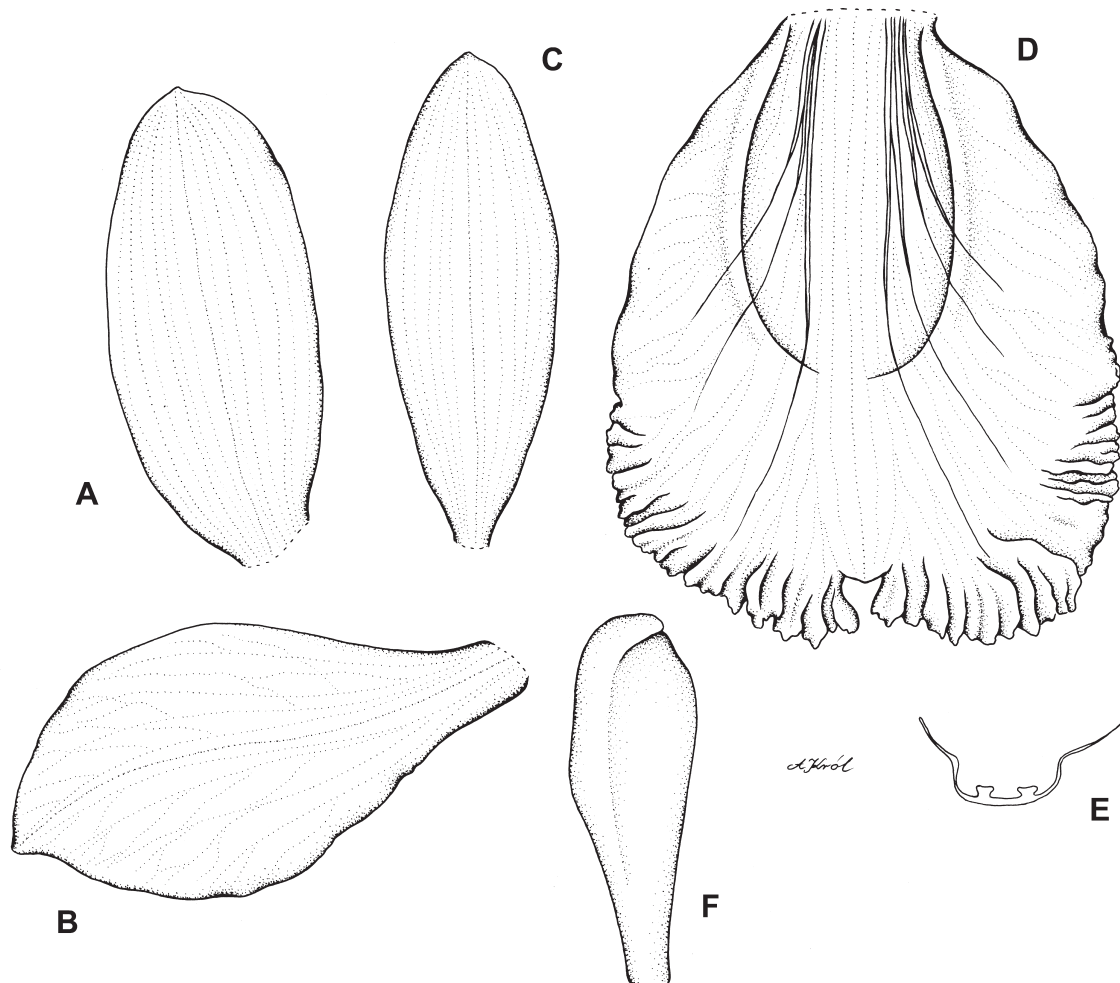
**PHYLOGENETIC ANALYSIS.** Sequence data were edited and assembled using AutoAssembler (ABI). All sequences were deposited on NCBI (Appendix) and data

matrices are available upon request. First DNA sequences were automatically aligned by 'ClustalX' (Thompson *et al.* 1997), then checked and manually corrected using 'Seaview' (Galtier *et al.* 1996). The ITS region was analyzed using heuristic search method of PAUP\* version 4.0b10 (Swofford 2000). Optimality criterion was parsimony with tree-bisection-reconnection (TBR) branch swapping and the MULTTREES option in effect, simple addition and ACCTRAN optimization. Gaps were treated as a missing value. Internal support of clades was evaluated by the bootstrap (Felsenstein 1985) with 1000 bootstrap replicates. All characters were unordered and equally weighted (Fitch 1971).

### 3. Results and discussion

*Sobralia abadorum* Szlach., Dudek & Ric. Fernández, *sp. nov.* (Figs 1-4).

**TYPE:** Peru. Junin. San Ramon, 1 km from Naranjal, *Erica Moron de Abad s.n. sub Szlachetko s.n.* (Holotype: UGDA-DLSz!)



**Fig. 1.** *Sobralia abadorum* – flower parts

Explanations: A – lateral sepal, B – petal, C – dorsal sepal, D – lip, E – cross section of the lip, F – gynostemium (drawn by A. Król from the holotype)



**Figs 2-4.** *Sobralia abadorum* – various views of a plant (photographs by Erica Moron de Abad)

*Haec species Sobralia violacea affinis est sed labello basi concavo, labelli margine crenati, undulati, sepalis et petalis brevioribus et latioribus, gynostemium brevioribus et majoribus, differt.*

**ETYMOLOGY** – Dedicated to Erica Moron de Abad and Raul Abad Echevarria, the collectors of the new entity.

**DESCRIPTION** – Stem ca 40-60 cm high, erect, rather stiff, leafy above basal third, plane green, glabrous. Leaves 5-7, to 15 cm long and 5 cm wide, elliptic to elliptic-lanceolate, long acuminate, stiff, plicate, plane green, glabrous. Flowers medium-sized as for the genus, rather widely opened, sepals and petals pink to pinkish-violet, dorsal sepal with white mid-nerve in the lower half, petals with darker mid-nerve, lip with pinkish to pink-violet margins, white throat with red or reddish spots in the entrance, gynostemium whitish-cream. Floral bracts plane green. Sepals connate, forming a basal tube 20 mm long. Dorsal sepal 60 mm long, 20 mm wide, oblong-elliptic, rounded at the apex, shortly apiculate. Petals 65 mm long, 30 mm wide, obliquely oblong-obovate, acute to obtuse at the apex, nerves branching. Lateral sepals 60 mm long, 25 mm wide, oblong-elliptic, somewhat falcate, rounded at the apex, shortly apiculate. Lip 65 mm long, 50 mm wide, obovate in general outline, notched at the apex, concave in the centre, strongly crenulate and undulate along margins in the apical half, nerves prominent, distinctly thickened

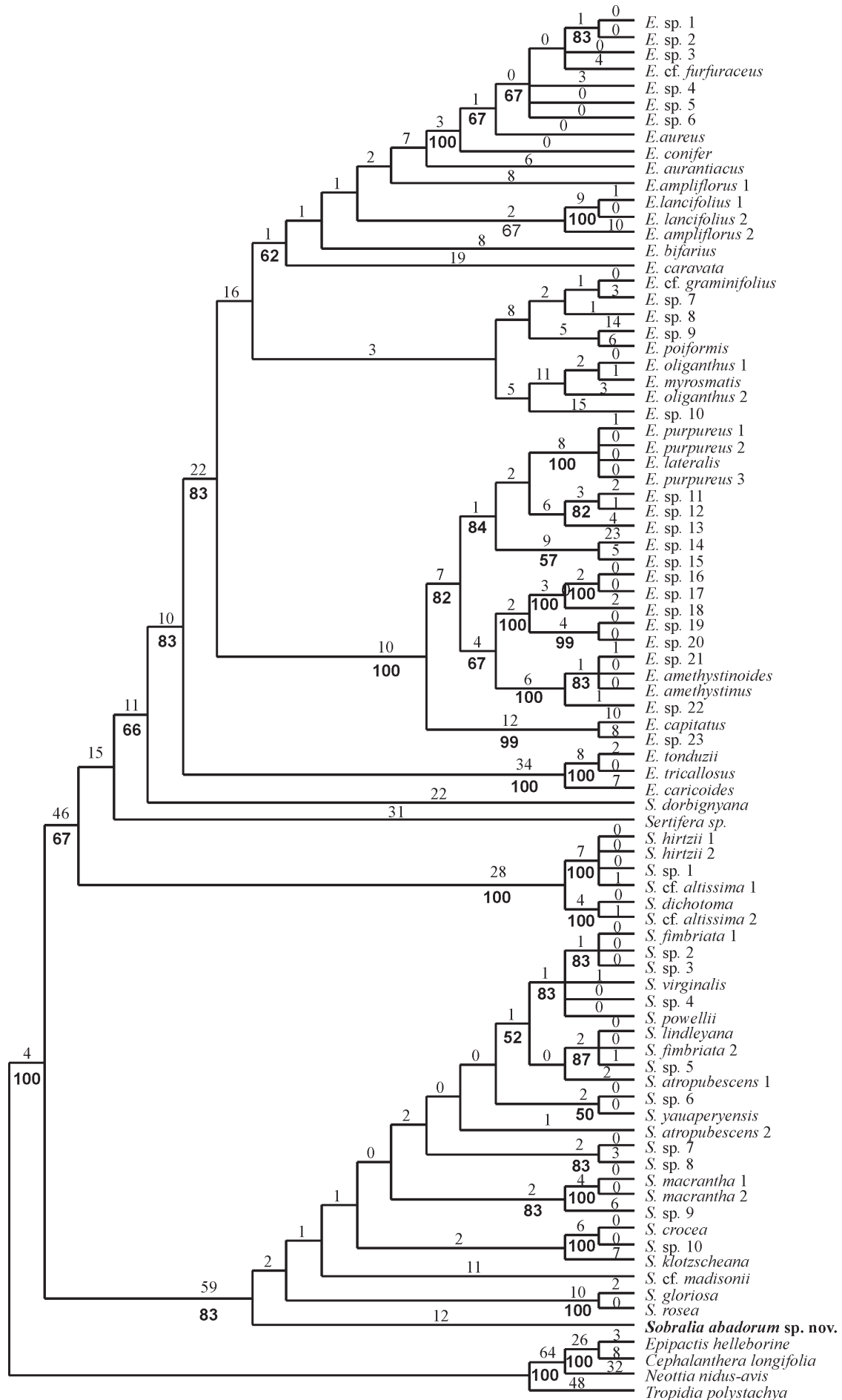
in the lower part. Gynostemium 35 mm long, clavate, massive, with prominent, falcate apical wings.

**LIFE FORM** – A terrestrial plant.

**GENERAL DISTRIBUTION** – Peru, known from the type locality only.

**TAXONOMIC NOTES** – The analysis of ITS sequences indicates an isolate position of the new species from other taxa of *Sobralia* (Fig. 5), which has been confirmed by the presence of molecular autapomorphy. The results of the molecular study show that *Sobralia abadorum* appears to be related to *S. gloriosa* Rchb.f. and *S. rosea* Poepp. & Endl. However, it differs from both in the type of inflorescence. In *S. gloriosa* and *S. rosea*, inflorescence is elongate and zig-zag, whereas in *S. abadorum* it is more compact. The lip form of *S. abadorum* reminds somewhat that of *S. violacea* Linden ex Lindl., but the lip of the latter species is concave in the basal half, its margins are undulate, crenulate, sepals and petals are shorter and wider, and gynostemium is shorter and more massive.

**Acknowledgements.** We would like to thank Erica Moron de Abad for kindly providing material that enabled a new discovery and for providing the photographs of the species. We are very grateful to Dr. Guy Chiron for translating the diagnosis of the new species. This article was prepared thanks to the grant from the Polish Ministry of Science and Higher Education (Project No N N303 361135) and from the Gdańsk University (Project No 14A0-5-0392-8).



**Fig. 5.** One of the 10,000 parsimonious trees based on the analysis of ITS. The numbers above the branches are Fitch branch lengths and below the branches are bootstrap percentages

Explanations: E – *Elleanthus*, S – *Sobralia*

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## Appendix. Species names, voucher information and GenBank accession numbers for all the taxa used in the study

Taxa	Origin	Voucher number	Genbank accession number	Code number
<i>Elleanthus</i> sp. 1	Ecuador-Vilcabamba-Yangana 2007	ex cult. Szlachetko s.n.	HM854615	8085
<i>Elleanthus</i> sp. 2	Ecuador-Vilcabamba-Yangana 2007	ex cult. Szlachetko s.n.	HM854612	8072
<i>Elleanthus</i> sp. 3	Mendoza-Molinobamba 2007	ex cult. Szlachetko s.n.	HM854616	8234
<i>Elleanthus</i> sp. 4	-	ex cult. Szlachetko s.n.	HM854619	Luis73/2006
<i>Elleanthus</i> sp. 5	Peru-Kuelap 2007	ex cult. Szlachetko s.n.	HM854601	8201
<i>Elleanthus</i> sp. 6	-	ex cult. Szlachetko s.n.	HM854604	29
<i>Elleanthus</i> sp. 7	-	ex cult. Szlachetko s.n.	HM854618	9
<i>Elleanthus</i> sp. 8	-	ex cult. Szlachetko s.n.	HM854617	8
<i>Elleanthus</i> sp. 9	Orquidario Bibero 2007	ex cult. Szlachetko s.n.	HM854602	8275
<i>Elleanthus</i> sp. 10	Ecuador 2007	ex cult. Szlachetko s.n.	HM854592	Orange
<i>Elleanthus</i> sp. 11	-	ex cult. Szlachetko s.n.	HM854594	21
<i>Elleanthus</i> sp. 12	-	ex cult. Szlachetko s.n.	HM854597	4
<i>Elleanthus</i> sp. 13	-	ex cult. Szlachetko s.n.	HM854600	22
<i>Elleanthus</i> sp. 14	-	ex cult. Szlachetko s.n.	HM854589	3
<i>Elleanthus</i> sp. 15	-	ex cult. Szlachetko s.n.	HM854588	16
<i>Elleanthus</i> sp. 16	Luis 2006	ex cult. Szlachetko s.n.	HM854596	Luis1
<i>Elleanthus</i> sp. 17	Luis 2006	ex cult. Szlachetko s.n.	HM854587	Luis75/2006
<i>Elleanthus</i> sp. 18	Ecuador 2007	ex cult. Szlachetko s.n.	HM854591	8241
<i>Elleanthus</i> sp. 19	-	ex cult. Szlachetko s.n.	HM854599	12
<i>Elleanthus</i> sp. 20	Luis 2006	ex cult. Szlachetko s.n.	HM854598	Luis53/2006
<i>Elleanthus</i> sp. 21	Ecuador-Saraguro 2005	ex cult. Szlachetko s.n.	HM854586	-
<i>Elleanthus</i> sp. 22	-	ex cult. Szlachetko s.n.	HM854609	Kopf 2004
<i>Elleanthus</i> sp. 23	Luis 2006	ex cult. Szlachetko s.n.	HM854579	Luis2
<i>Elleanthus amethystinus</i>	Ecuador	ex cult. Szlachetko s.n.	HM854584	-
<i>Elleanthus amethystinoides</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854585	-
<i>Elleanthus ampliflorus</i> 1	-	ex cult. Szlachetko s.n.	HM854610	-
<i>Elleanthus ampliflorus</i> 2	GenBank	Blanco 2949	EU490663	-
<i>Elleanthus aurantiacus</i>	GenBank	Whitten 1611	EU490664	-
<i>Elleanthus aureus</i>	-	ex cult. Szlachetko s.n.	HM854614	-
<i>Elleanthus bifarius</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854593	-
<i>Elleanthus captatus</i>	-	ex cult. Szlachetko s.n.	HM854580	-
<i>Elleanthus caravata</i>	-	ex cult. Szlachetko s.n.	HM854608	-
<i>Elleanthus caricoides</i>	GenBank	Blanco 3106	EU490665	-
<i>Elleanthus conifer</i>	GenBank	Blanco 2527	EU490666	-
<i>Elleanthus cf. furfuraceus</i>	Ecuador-Vilcabamba-Yangana 2007	ex cult. Szlachetko s.n.	HM854603	8202
<i>Elleanthus cf. graminifolius</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854605	-
<i>Elleanthus lancifolius</i> 1	Ecuador 2007	ex cult. Szlachetko s.n.	HM854613	P3
<i>Elleanthus lancifolius</i> 2	GenBank	Whitten 1575	EU490667	-
<i>Elleanthus lateralis</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854590	P9
<i>Elleanthus myrosomatis</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854578	-

<i>Elleanthus oliganthus</i> 1	-	ex cult. Szlachetko s.n.	HM854577	-
<i>Elleanthus oliganthus</i> 2	GenBank	Whitten 1502	EU490668	-
<i>Elleanthus poiformis</i>	Genbank	Blanco 3075	EU490669	-
<i>Elleanthus purpureus</i> 1	Ecuagenera 2005	ex cult. Szlachetko s.n.	HM854581	-
<i>Elleanthus purpureus</i> 2	-	ex cult. Szlachetko s.n.	HM854582	-
<i>Elleanthus purpureus</i> 3	Ecuagenera 2005	ex cult. Szlachetko s.n.	HM854583	-
<i>Elleanthus tonduzii</i>	-	ex cult. Szlachetko s.n.	HM854662	-
<i>Elleanthus tricalosus</i>	Genbank	Blanco 2961	EU490670	-
<i>Sertifera</i> sp.	-	ex cult. Szlachetko s.n.	HM854636	-
<i>Sobralia</i> sp. 1	Luis 2007	ex cult. Szlachetko s.n.	HM854661	Luis 13
<i>Sobralia</i> sp. 2	Luis 2006	ex cult. Szlachetko s.n.	HM854620	Luis 57
<i>Sobralia</i> sp. 3	-	ex cult. Szlachetko s.n.	HM854653	23
<i>Sobralia</i> sp. 4	Luis 2006	ex cult. Szlachetko s.n.	HM854633	Luis 55
<i>Sobralia</i> sp. 5	Luis 2006	ex cult. Szlachetko s.n.	HM854652	Luis 69
<i>Sobralia</i> sp. 6	Luis 2005	ex cult. Szlachetko s.n.	HM854660	-
<i>Sobralia</i> sp. 7	French Guyana	ex cult. Szlachetko s.n.	HM854626	-
<i>Sobralia</i> sp. 8	OB Viena	s.n.	HM854622	-
<i>Sobralia</i> sp. 9	Ecuador 2007	ex cult. Szlachetko s.n.	HM854638	P 11
<i>Sobralia</i> sp. 10	Ecuador 2007	ex cult. Szlachetko s.n.	HM854645	24
<i>Sobralia abadorum</i> sp. nov.	Peru	ex cult. Szlachetko s.n.	HM854663	-
<i>Sobralia</i> cf. <i>altissima</i> 1	Luis 2006	ex cult. Szlachetko s.n.	HM854648	18 Luis
<i>Sobralia</i> cf. <i>altissima</i> 2	Peru 2007	ex cult. Szlachetko s.n.	HM854642	-
<i>Sobralia atropubescens</i> 1	-	ex cult. Szlachetko s.n.	HM854628	-
<i>Sobralia atropubescens</i> 2	Ecuagenera 2006	ex cult. Szlachetko s.n.	HM854623	-
<i>Sobralia crocea</i>	-	ex cult. Szlachetko s.n.	HM854644	-
<i>Sobralia dichotoma</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854647	P7
<i>Sobralia dorbignyana</i>	Ecuador 2006	ex cult. Szlachetko s.n.	HM854637	-
<i>Sobralia fimbriata</i> 1	Ecuador 2007	ex cult. Szlachetko s.n.	HM854631	P12
<i>Sobralia fimbriata</i> 2	Ecuagenera 2006	ex cult. Szlachetko s.n.	HM854649	-
<i>Sobralia gloriosa</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854629	P15
<i>Sobralia hirtzii</i> 1	Ecuador 2007	ex cult. Szlachetko s.n.	HM854640	P17
<i>Sobralia hirtzii</i> 2	Ecuador 2007	ex cult. Szlachetko s.n.	HM854641	P18
<i>Sobralia klotzscheana</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854643	P5
<i>Sobralia lindleyana</i>	Villena 2007	ex cult. Szlachetko s.n.	HM854624	-
<i>Sobralia macrantha</i> 1	-	ex cult. Szlachetko s.n.	HM854639	-
<i>Sobralia macrantha</i> 2	OB Heidelberg	s.n.	HM854651	-
<i>Sobralia</i> cf. <i>madisonii</i>	Ecuador 2007/Lita	ex cult. Szlachetko s.n.	HM854634	-
<i>Sobralia powellii</i>	Ecuagenera 2006	ex cult. Szlachetko s.n.	HM854654	-
<i>Sobralia rosea</i>	Ecuador 2006	ex cult. Szlachetko s.n.	HM854630	-
<i>Sobralia virginalis</i>	Ecuador 2007	ex cult. Szlachetko s.n.	HM854632	P13
<i>Sobralia yauaperyensis</i>	Ecuageneia 2006	ex cult. Szlachetko s.n.	HM854621	-
<i>Cephalanthera longifolia</i>	GenBank	-	DQ182464	-
<i>Epipactis helleborine</i>	GenBank	MWC 199	AF521059	-
<i>Neottia nidus-avis</i>	GenBank	SALA 109010	AY351383	-
<i>Tropidia polystacha</i>	GenBank	Whitten 2830	EU49064	-