



Taxonomic additions to the genus *Chysis* (Orchidaceae)

Fredy Archila Morales^{1,2*} & Guy R. Chiron³

¹ Estación Experimental de orquídeas de Guatemala

² Herbario BIGU, Universidad de San Carlos de Guatemala

³ Herbiers, Université Claude Bernard Lyon I, 69622 Villeurbanne Cedex (France)

* Corresponding author archilae@gmail.com

Abstract

After a 30 years research on Guatemalan orchids, and 10 years after the last taxonomic treatment of the genus *Chysis*, the analysis of our material led us to recognize three new taxonomic entities in the genus for Guatemala. Which confirms that this country, although little collected, is not only a center of speciation for this genus but also an area of megadiversity. Two of these taxa are described at the species rank whereas the third one is described as a natural hybrid. For each of them, a morphologic description is given and the flower is illustrated. Taxonomic notes underline the differences with the known species which appear to be the most closely relatives. A key to the species is proposed.

Résumé

Après 30 années de recherche sur les orchidées guatémaltèques, et 10 ans après la publication de la dernière révision taxinomique du genre *Chysis*, l'étude du matériel à notre disposition nous a amenés à reconnaître trois nouvelles entités dans le genre, pour le Guatemala. Ce qui confirme que ce pays, même s'il reste peu collecté, est non seulement un centre de

spéciation pour ce genre mais aussi une zone de méga-diversité. Deux de ces taxons sont décrits au rang d'espèce tandis que le troisième est décrit en tant qu'hybride naturel. Pour chacun d'eux nous proposons une description morphologique détaillée et une illustration de la fleur. Les différences qu'ils présentent avec les espèces connues les plus apparentées sont soulignées dans des notes taxinomiques. Une clé des espèces est également proposée.

Resumen

Durante un periodo de 30 años de investigación y análisis después de 10 años de la última publicación monográfica del género *Chysis* se procedió a analizar material para poder llegar a la conclusión de que se tenían 3 nuevas entidades taxonómicas para Guatemala reafirmando así a Guatemala como un centro de especiación del género *Chysis*. Los estudios de orquídeas de Guatemala nos reafirman que el país es una zona megadiversa, con poca intensidad de colecta.

De estas entidades taxonómicas se presenta su descriptor, diagnosis e iconos botánicos, además de notas taxonómicas para aclarar la diferencia de estas con respecto a las ya descritas.

Keywords: Guatemala, megadiversity, new taxa, taxonomy

Mots-clés : Guatemala, méga-diversité, nouveaux taxons, taxinomie

Palabras Clave: Guatemala, megadiversidad, nuevos taxons, taxonomia

Introduction

During 30 years of studying Neotropical orchids, taxonomic problems have been faced, many of which related to the lack of workable herbarium material for reasons such as: poor quality of preservation, destruction of herbarium materials (such as the materials of Hans Von Tuerckheim destroyed in Berlin in a bombing during the Second World War), poor access to blooming material and other particular problems such as the self-digestion process in the genus *Sobralia* (Archila *et al.*, 2013). The genus *Chysis* does not escape this reality: for many years its incorrect cultivation as erect instead of pendulous plants has caused little flowering and therefore little material for conservation. That is why it was not until 2010 that a monograph could be published (Chiron & Archila, 2010), taking advantage of the materials correctly cultivated in the Archila Family Orchid Experimental Station.

Chysis offers showy flowers and is characterized by epiphytic plants; fleshy, fusiform or clavate, pendulous pseudobulbs; plicate leaves with bases sheathing the pseudobulbs; inflorescence usually solitary, produced from the axil of a lower sheath, as a short apical raceme bearing a few or several flowers; flowers rather large, conspicuous; sepals subequal, free, spreading; petals free, subequal to the sepals but usually narrower; lip fleshy, trilobed, lateral lobes rounded or falcate, in natural position upright or converging upon the column, midlobe erect or reflexed, often bilobed or emarginate, disc furnished with 3-5 fleshy longitudinal crests; gynostemium elongated, very strong, slightly arched; anther incumbent subglobose; pollinia 8, unequal in shape and size, hard, joined in two groups of 4 by large lamellar-granular caudicles, quite thick; clinandrium apical, obscure, entire; stigma rather small, transversely elliptic, deeply concave; rostellum large, ligulate.

Chysis is a small genus usually associated to Central America – although it is found in Mexico and also in South America – and rather complex on a taxonomic point of view. The ridges or keels found at the base of the lip have been used to differentiate the species. Fowlie (1971) considered that the genus should contain 6 species. Then Dressler (2000, 2003, 2006) added several species some of which now treated as synonyms (Chiron & Archila, 2010). According to Archila *et al.* (2018), the genus includes 10-15 (depending on the authors referred to) species known from Peru to Mexico, seven of them growing in Guatemala. Later a new species with salmon-coloured flowers was described from Brazil (Petini-Benellii & Pessoa, 2019). Here we recognize 14 species, included those described below. Dressler first placed *Chysis* within the subtribe Bletinae, despite its unusual habit (Dressler, 1981), then, following Schlechter (1926), in the subtribe Chysiinae (Dressler, 1993), because “[*Chysis*] seems discordant there [in Bletinae]”. However Freudenstein & Chase (2015) confirmed its placement within Bletinae, the genus being sister of the rest of the subtribe. It differs from the other genera by its epiphytic habit – *versus* terrestrial/mycoparasitic – and by its well-developed pseudobulbs – *versus* absent or short (Pridgeon, 2005). *Chysis* can be separated into two sections easily recognizable in the field, from their vegetative as well as floral parts (Table 1).

Table 1. Comparison of both sections of *Chysis*

	Section <i>Chysis</i>	Section <i>Paucicostatae</i>
Plant	hanging	decumbent
Pseudobulbs	medium, thick to very thick, stipitate	large for the genus, not too fat, not stipitate
Rhizome	long (plants scorpioid)	short (pseudobulbs joined at base)
Inflorescence	usually few-flowered but sometimes up to 10 flowers mostly clustered at the top of the rachis	few- to many-flowered flowers aggregated on the floral peduncle
Flower	white (at least towards the tepal bases) sometimes purple/pink, sometimes yellow ochre towards the tepal tips waxy most often smelling (at night)	mainly yellow-orange (one pink) not waxy not smelling
Lip margin	crisped or not (note 1)	crisped
Main crests	5, and sometimes 2 lateral ones on each side, pubescent at base, most often rather aggregated in a callus (note 3)	3, plus sometimes 1 lateral one on each side, smaller (note 2), glabrous at base
Floral bracts	globular, more or less long (note 4)	scale like, small (length 1/10 of ovary), adpressed
Column base	smooth	with an appendix

Notes: (1) margin of midlobe much crisped in *Chysis aurea* Lindley (1837: t.1937) – (2) as in *Chysis laevis* Lindley (1840: 61) – (3) but not in *C. aurea* – (4) less than ovary in *Chysis limminghei* Linden & Reichenbach f. (1858: 880).

In Guatemala, the genus *Chysis* is characteristic of the “Karstic wet arch of northern Guatemala”, even if it is not the only area where they grow: plants have been seen in the volcanic chain. Three new taxa are described below, two species and a natural hybrid. The following descriptions are mainly based on our field observations of flowering plants, with some complementary details taken down on the plants put in cultivation at the Archila Station.

Taxonomic treatment

Chysis × *confusa* Archila & Chiron, *hybrida nova*

Type: Guatemala, Alta Verapaz, Cobán, Chajcel Farm, 1,350 m asl, 02/04/1999, Oscar Archila & Fredy Archila, *FA-sn* (BIGU).

Etymology: “*confusa*” because, at first, we thought that it was the hybrid *Chysis* × *chelsonii* Reichenbach. f. (1874: 535) – see below.

Hybrida naturalis inter Chysis tricostata et Chysis bractescens. Chysis bractescens similis est sed florum colore diverso, sepalo mediano late elliptico apice truncato (versus oblongo apice concavo obtusoque) 35 × 17 mm (versus 50 × 25 mm), sepalis lateralibus triangularibus apice obtusis (versus falcatis apice truncatis) 35 × 20 mm (versus 45 × 27 mm), petalis rhombicis apice obtusis (versus longe spathulatis), differt.

Natural hybrid between *Chysis tricostata* Schlechter (1922: 123) – section *Paucicostatae* – and *Chysis bractescens* Lindley (1840: 61) – section *Chysis*. Plant small for the genus; pseudobulbs fusiform, 10-15 cm long, 2 cm wide in their widest part, briefly petiolate (petiole 4 cm long); apical leaf 1, elliptic acuminate, 12 × 3.5 cm; foliaceous bracts 1 apical and 6 lateral (3 on each side) with a sheathing base surrounding the pseudobulb, blade obliquely elliptic, acuminate, 16-19 cm long, 4-4.5 cm wide; inflorescence short, typical of the section *Chysis*, 3-flowered; flowers never closing at night, cream with yellow tepal apices and yellow spots on the petals, lip yellow except the cream outside of the lateral lobes, lip midlobe with strong yellow nerves on a slightly orange background; dorsal sepal broadly elliptic apically truncate, 3.5 cm long, 1.7 cm wide; lateral sepals triangular apically obtuse, 3.5 cm long, 2 cm wide at base; petals rhombic apically obtuse, 3.1 cm long, 1.4-1.5 cm wide; lip trilobed, 2.5 cm long, lateral lobes obliquely ovate apice obtuse, 2.2 cm long, 1 cm wide, midlobe broadly elliptic, 1.8 cm long, 1.3 cm wide, deeply emarginate with lobules apically obliquely obtuse, lip disc with a callus made of 6 keels dentate and basally densely pubescent; column 2.2 cm long, 1.2 cm wide, with 2 staminodes and an apical clinandrium, oblong and obtuse; ovary 2.4 cm long; floral bract globose, 1.7 cm long, 1.3 cm wide. Fig. 1A & B.

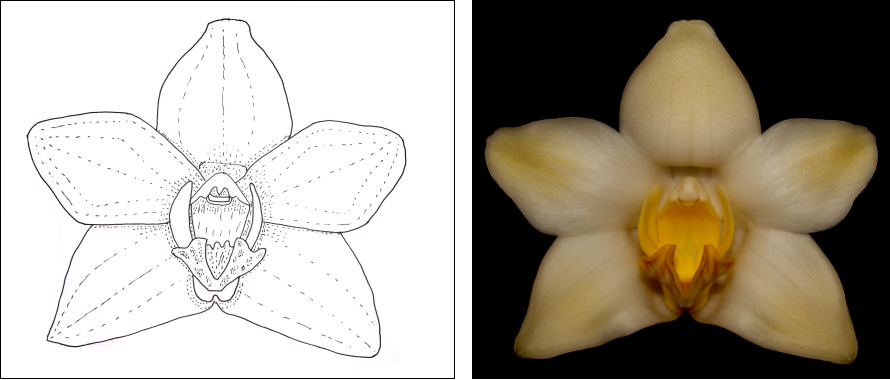


Fig. 1. Flower of *Chysis × confusa*

A (left): drawing Fredy Archila. B (right): ph. Fredy Archila

Taxonomic notes: this hybrid was first confused with *Chysis × chelsonii*, published in the *Gardeners' Chronicle*, n.s. 1: 535 (1874) as the hybrid of *C. limminghei* – section *Chysis* – and *C. laevis* – section *Paucicostatae*. However botanical illustrations and descriptions found in the literature (RHS, 1874; Reichenbach, 1874) clearly show that the shape and the colour of both taxa are quite different.

C. × confusa has flowers cream and yellow as described above whereas the flowers of *C. × chelsonii* have tepals with “a rather yellow background” marked with “large purplish-brown areas inside towards the apex”, and a “whitish lip with numerous rich violet-purplish blotches” (Reichenbach. f., 1874). The former has 6 keels on the lip disc whereas the latter has only 3 keels. Moreover, the petals of the latter are longer than the sepals whereas in the former they are subequal to shorter. *C. × confusa* is more similar to its parent *C. bractescens*. However the colour of the flowers is different: cream with yellow tepal apices and yellow spot on the petals for the hybrid, pure white in *C. bractescens*; the dorsal sepal is broadly elliptic (*versus* oblong) with truncate apex (*versus* obtuse); the lateral sepals are triangular obtuse (*versus* falcate truncate), distinctly shorter and narrower; the petals are rhombic (*versus* long spatulate). Due to the influence of *Chysis tricostata*, the flower always remains open until it dies or is pollinated, whereas, in *C. bractescens*, the flower closes at night. Other contributions of *C. tricostata* is the shape of the petals and the yellow color that appears on the sepals and petals.

The type locality is a forest where the three taxa can be found. *Chysis* × *confusa* is rather rare: only five plants have been found, whereas the parents form populations of about 400 plants each.

***Chysis tribouillieri* Archila & Chiron, species nova**

Type: Guatemala, Alta Verapaz, Valle del Polochic, 1,100 m asl, Río Matanzas, 12/12/2011, Fredy Archila, FA-sn (BIGU).

Etymology: dedicated to the well-known Guatemalan dendrologist Erick Tribouillier.

Haec herba Chysis laevis similis est sed sepalo mediano elliptice-oblongo apice leviter retuso intra apiculato bidentato (versus truncato haud apiculato), sepalis lateralibus oblique orbiculare-ellipticis apice mucronatis (versus falcatis apice acuminatis), petalis oblique oblongis apice rotundatis (versus spathulatis falcatis apice acutis), labelli lobis lateralibus oblique angusteque ovatis (versus lineare-oblongis), lobo mediano late transverseque ovato margine integro revolutoque (versus suborbiculare margine haud revoluto et crenulato), differt.

Tall plant; pseudobulbs 45-60 cm long, 5 cm wide, long-petiolate (petiole 15 cm long), apically bifoliate, furnished with 13 foliaceous bracts, 1 apical and 12 lateral (6 on each side); leaves long elliptic acuminate, 35 cm long, 9 cm wide; flowers yellow with the apex of the sepals green and the apex of petals brown; dorsal sepal elliptic-oblong apically slightly retuse inside apiculate bidentate, 4.3 cm long, 2.5 cm wide; lateral sepals obliquely orbicular-elliptic apically mucronate, 4.2 cm long, 3 cm wide; petals obliquely oblong apically rounded, 4.5 cm long, 2.3 cm wide; lip trilobed, 3.3 cm long, lateral lobes obliquely narrowly ovate, white, 2 cm long, 1 cm wide at base, apical lobe widely and transversely ovate, 2 cm long, 2 cm wide, margins revolute, with 3 white keels at base, the middle one shorter; gynostemium oblong, short, 1.8 cm long and 0.8 cm wide; ovary linear, 3 cm long; floral bract short, 1.5 cm long, 0.9 cm wide at base. Fig. 2A & B.

Taxonomic notes: this species belongs to the section *Paucicostatae*. Its most closely relative is *C. laevis*. However we can easily make the difference by looking at the dorsal sepal (elliptic-oblong *versus* linear-oblong), retuse and apiculate-bidentate inside (*versus* truncate not apiculate), at the lateral sepals (obliquely orbicular-elliptic *versus* falcate and mucronate *versus* acuminate), at the petals (obliquely oblong rounded at the apex *versus*

spatulate falcate acute) and the lip, whose lateral lobes are obliquely and narrowly ovate *versus* linear-oblong, and the midlobe ovate *versus* suborbicular. See also Table 2, which gives some morphologic and ecological characters for *Chysis addita* Dressler (2000: 194), *C. archilae* Chiron in Chiron & Archila (2010: 172), *C. chironii* Archila in Chiron & Archila (2010: 183), *C. domei*, *C. laevis*, *C. tribouilleri* and *C. tricostata*.

In the type locality we could observe two populations of *C. tribouilleri*, each composed of about 200 individuals.



Fig. 2. Flower of *Chysis tribouilleri*

A (left): drawing Fredy Archila. B (right): ph. Fredy Archila

Chysis domei* Archila & Chiron, *species nova

Type: Guatemala, Alta Verapaz, municipio de Cobán, 1,400 m asl, 07/10/2010, Fredy Archila, FA-sn (BIGU).

Etymology: dedicated to Dome Nikong, for his important botanical work.

Haec herba Chysis laevis similis est sed parte exteriori sepalorum petalorumque apice papillosa (versus glabra), sepallo mediano elliptico apice acuto (versus elliptice-oblongo truncato), petalis rhombicis acuminatis (versus spathulatis falcatis apice acutis), labelli lobis lateralibus canaliculatis oblique oblongis (versus lineare-oblongis) apice obtusis (versus rotundatis), lobo mediano trilobulato (versus integro suborbiculare), lobulis lateralibus oblique obtusis margine undulatis, lobulo mediano parvissimo orbiculare, columna oblonga obtusa brevior latioreque (15 mm longa 7 mm lata versus 17-18 mm et 5.5 mm), differt.

Medium sized plant; pseudobulbs 35 cm long 4 cm wide, petiolate, petiole 10 cm long, apically bifoliate, with 11 foliaceous bracts, 1 apical and 10 lateral (5 on each side); leaves elliptic acute, 30 cm long, 8 cm wide, foliaceous bracts elliptic, 25 cm long et 5.5 cm wide; flower yellow with the apex of the sepals and petals reddish brown; sepals and petals apically papillose on the outer side; dorsal sepal elliptic apically acute, 3.5 cm long, 2 cm wide; lateral sepals falcate, apically acuminate, 3.2 cm long, 2.2 cm wide; petals rhombic acuminate, 2.8 cm long, 1.8 cm wide; lip trilobed, 2.7 cm long, laterals lobes canaliculate, white inside, obliquely oblong, apically obtuse, 1.5 cm long, 0.9 cm wide, midlobe trilobulate, with 3 keels at base, the median one larger, lateral lobules obliquely obtuse with undulate margins, 1.4 cm long, 1 cm wide, central lobule very small, orbicular, somewhat as an appendix in the cleft apical part, 0.5 cm long and 0.4 cm wide; column oblong, obtuse, 1.5 cm long, 0.7 cm wide, column foot 0.6 cm long; ovary linear 1.3 cm long. Fig. 3A & B.

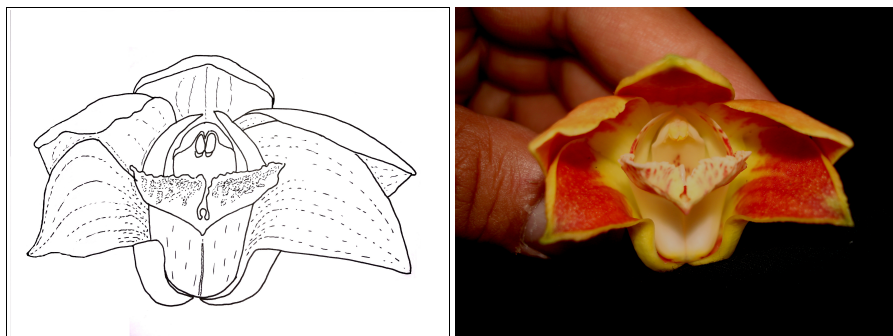


Fig. 3. Flower of *Chysis domei*

A (left): drawing Fredy Archila. B (right): ph. Fredy Archila

This species belongs to the section *Paucicostatae*. Its most closely relative is *C. laevis*. However we can easily make the difference by looking at the tepals (outside of the apex papillose *versus* glabrous), at the dorsal sepal (elliptic acute *versus* elliptic-oblong truncate), at the petals (rhombic acuminate *versus* spatulate acute), at the lip, especially the midlobe (3-lobulate *versus* entire). See also Table 2.

In the type locality only one population of about 50 plants could be observed.

Table 2. Comparative characters within the *Paucicostatae* section

	<i>Chysis addita</i>	<i>Chysis archilae</i>
Plant size	median	very large
Ecology	forests at 1250 m asl	forests at 400 m asl
Dorsal sepal	obovate, obtuse	oblong, subacute
Lateral sepals	oblong-ovate, subacute	ovate-oblong, obliquely acute
Petals	oblique, cuneate-obovate, falcate	oblique, sub-spathulate, dentate, truncate
Lip margin	ondulate	revolute
Lip lateral lobes	not superimposed, obliquely ovate, obtuse	not superposed, oblong, rounded
Lip midlobe	reniform, emarginate	deltoide, bipartite
Keels	3	7
Column foot appendix	subtriangular, concave	minute, triangular, with undulate margins
Column apex	denticulate, acuminate	1-dentate

<i>Chysis chironii</i>	<i>Chysis domei</i>	<i>Chysis laevis</i>
median	median	median
forests at 1700 m asl	forests at 1400 m asl	forests at 1400 m asl
oblong, aristate	elliptic, acute	elliptic-oblong, obtuse
obliquely lanceolate	falcate, acuminate	falcate, acute
straight, spathulate, emarginate	rhombic, acuminate	straight, spatulate, falcate, acute
ondulate	ondulate	revolute
not superposed, linear, truncate	canaliculate, obliquely oblong, obtuse	not superimposed, oblong, obtuse
suborbicular, apically cleft	trilobulate, lateral lobules oblique, obtuse, median lobule very small, orbicular	suborbicular, split at apex
3	3	3 + 2 small lateral ones
big, triangular, verrucose	just a protuberance	small, triangular
tridentate	not ornamented	with a acuminate denticle

Table 2. Continued

	<i>Chysis tribouilleri</i>	<i>Chysis tricostata</i>
Plant size	large	small
Ecology	forests at 1100 m asl	forests at 900 m asl
Dorsal sepal	obliquely orbicular-elliptic, at apex slightly retuse and apiculate-bidentate inside	ovate-oblong, obtuse
Lateral sepals	obliquely orbicular-elliptic, mucronate	triangular falcate
Petals	oblique, oblong, apically rounded	oblique, oblanceolate, obtuse
Lip margin	revolute	ondulate
Lip lateral lobes	obliquely narrowly ovate	superimposed, oblong, falcate, rounded
Lip midlobe	widely transversely ovate	reniform, emarginate at apex
Keels	3	3
Column foot appendix	subtriangular, flat	just a small protuberance
Column apex	not ornamented	1-dentate

Key to the *Chysis* species

1. Flowers waxy, lip base puberulent, lip main keels 5, subequal or the lateral ones somewhat shorter, lip base tapering to attachment point, appendix at the apex of the column foot absent.....2
- 1a. Flowers not waxy, lip base glabrous, lip main keels 3 (or 5 with the 2 lateral ones much shorter), lip base broadly rounded or subtruncate, appendix at the apex of column foot present.....8
2. Flowers basically yellow, or pink often suffused or marked with orange or brown.....3
- 2a. Flowers basically white, cream with yellow, white with rose or violet markings.....5
3. Petals and sepals pale pink with a yellowish background, labellum wider than long, with magenta stripes or dots, midlobe not passing the length of the lateral lobes, column with magenta stripes or dots abaxially*C. guimaraensis*

- 3a. Petals and sepals orange or ochre, whitish at the base, labellum longer than wide, pink or red with yellow stripes, midlobe passing the length of the lateral lobes, column abaxially yellow with red stripes or dots.....4
4. Plants robust (pseudobulbs and leaves up to 45 cm long), flowers large (up to 75 mm across), margin of the lip midlobe much crisped, keels free, parallel, not forming a massive callus, thick, fleshy, diverging distally*C. aurea*
- 4a. Plants smaller (pseudobulbs and leaves up to 35 cm long), flowers smaller (up to 50 mm across), margin of the midlobe rather smooth, keels united nearly to the apex, forming a large, raised, fleshy callus with porrect apex.....*C. bruennowiana*
5. Plants and flowers small for the genus (pseudobulbs to 20 cm long, sepals 20-25 mm long), lip midlobe elliptic-oblong.....6
- 5a. Plants and flowers bigger (pseudobulbs 20-30 cm long, sepals 30-45 mm long), midlobe subquadrate to transversally ovate.....7
6. Petals rhombic.....*C. × confusa*
- 6a. Petals different.....*C. limminghei*
7. Sepals and petals white, floral bracts to 25 mm long, conspicuous*C. bractescens*
- 7a. Sepals and petals marked with purple, floral bracts up to 17 mm long, inconspicuous.....*C. violacea*
8. Column foot with distinct wings, keels laminar, the middle one erect, the lateral ones lying.....*C. addita*
- 8a. Column foot without wing or with minute wings, keels fleshy as usual in the genus.....9
9. Keels only 3, without lateral ones, flowers not purely yellow.....10
- 9a. Secondary keels present, flowers yellow.....*C. chironii*
10. Flower either yellow with coffee areas or reddish brown.....11
- 10a. Flower coffee color.....12
11. Flower reddish brown, petals rhombic.....*C. domei*
- 11a. Flower yellow with brown and green or coffee areas, petals oblong*C. tribouillieri*
12. Lateral sepals and petals obtuse.....*C. tricostata*
- 12a. Sepals and petals acute, subacute or truncate.....13
13. Petals acute with entire margins, lip midlobe with 2 lateral crests

besides the 3 main ones, appendix of the column foot small, triangular, with entire margin.....*C. laevis*
13a. Petals truncate with serrulate margins, lip midlobe with 4 lateral crests besides the 3 main ones, appendix of the column foot big, truncate, with undulate margins.....*C. archilae*

References

- Archila, F., D. Szlachetko, P. Baranow & G. Chiron, 2013. The Genus *Sobralia* in Guatemala. *Revista Guatemalensis* 16(2): 2-47.
- Archila, F., G. Chiron, D. Szlachetko, M. Lipinska, V. Bertolini & K. Mystkowska, 2018. *Orchid Genera and Species in Guatemala*. Koeltz Botanical Books, Germany. 724 pp.
- Chiron, G. & F. Archila, 2010. Conspectus neotropicus mesoamericanus. Le genre *Chysis* Lindley (Orchidaceae). *Richardiana* 10(4): 161-192.
- Dressler, R.L., 1981. *The Orchids Natural History and Clasification*. 10.2307/1219717. 332 pp.
- Dressler, R.L., 1993. *Phylogeny and Classification of the Orchid Family*. Dioscorides Press, Portland.
- Dressler, R.L., 2000. Mesoamerican Orchid Novelties 3. *Novon* 10(3): 193-200.
- Dressler, R.L., 2003. *Chysis violacea*, una especie nueva y llamativa de Panamá oriental, con el pronóstico de otra aún no descrita. *Orquideologia*, 22: 237-243.
- Dressler, R.L., 2006. *Chysis pluricostata* Dressler, una especie nueva y distintiva de Panamá. *Orquideología*, 24:141-151.
- Fowlie, J.A., 1971. Obscure Species: Three Distinctive Species of *Chysis* from Central America. *Orchid Digest*, 35:85-87.
- Freudenstein, J.V. & M.W. Chase, 2015. Phylogenetic relationships in Epidendroideae (Orchidaceae), one of the great flowering plant radiations: progressive specialization and diversification. *Annals of Botany* 115: 665-681.
- Linden, J.J. & H.G. Reichenbach, 1858. *Chysis aurea* Lindl. und *Chysis Liminghii* Lind. et Rchb. fil. *Berliner Allgemeine Gartenzeitung* 26 : 380.
- Lindley, J., 1837. *Edwards's Botanical Register* 23: t.1937.
- Lindley, J., 1840. *Edwards's Botanical Register* 26(Misc.) : 61.

- Petini Benelli, A. & E. Pessoa, 2019. A new non-Andean South American *Chysis* (Bletiinae-Orchidaceae) with pale flowers. *Phytotaxa* 420 (1): 84-88.
- Pridgeon, A.M., 2005. Bletiinae. In Pridgeon, A.M., Cribb, P.J., Chase, M.W. & Rasmussen, F.N. (Eds.) *Genera orchidacearum*, Vol. 4. Oxford University Press, Oxford, pp. 164-165.
- Reichenbach, H.G., 1874. New Garden Plants. *The Gardeners' Chronicle* n.s. 1: 535.
- RHS, 1874. Reports of Societies. Royal Horticultural Society. Floral Committee. *The Gardeners' Chronicle* n.s. 1: 385.
- Schlechter, R., 1922. Orchidaceae novae, in caldariis Horti Dahlemensis cultae. III. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 8: 123.
- Schlechter, R., 1926. Das System der Orchidaceec. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 9: 563-591.