

New combinations and notes on *Oxybasis* (Amaranthaceae) from southern South America

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Abstract

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The new combinations *Oxybasis frigida* (Phil.) Uotila, *O. halophila* (Phil.) Uotila and *O. macrosperma* subsp. *salsa* (Phil.) Uotila are proposed according to the recent splitting of the heterogeneous genus *Chenopodium* L. *Chenopodium glaucum* var. *divaricatum* Hook. f. is considered to be a synonym of *Oxybasis ambigua* (R. Br.) de Lange & Mosyakin. Lectotypes are designated here for the names *Chenopodium halophilum* Phil. and *C. macrospermum* f. *nanum* Aellen. Nomenclatural notes are also provided for *Oxybasis macrosperma* (Hook. f.) S. Fuentes et al. and *O. ambigua*. Finally, *O. parodii* (Aellen) Mosyakin & de Lange is newly recorded from Tierra del Fuego Province in Argentina.

Keywords

AMARANTHACEAE – CHENOPODIACEAE – *Chenopodium* – *Oxybasis* – Argentina – Chile – Cono Sur

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Introduction

The genus *Chenopodium* L. (*Chenopodiaceae*) was recently divided into seven genera (FUENTES-BAZAN et al., 2012). The splitting was based largely on phylogenetic molecular studies, but it also had a firm morphological basis. The separated new genera were earlier recognized as morphological groups and generally accepted as subgenera, sections or subsections. At present, they belong to three different tribes. The splitting affects also the treatment of the genus in the floras of South America. MÚLGURA & MARTICORENA (2008) listed 43 species for the Southern Cone: 23 of them remain in *Chenopodium* s.str., 12 now belong to *Dysphania* R. Br., six to *Oxybasis* Kar. & Kir., one to *Blitum* L. and another one to *Chenopodiastrum* S. Fuentes et al. In addition, the genus *Monolepis* Schrad. (one species in the Southern Cone) was merged with *Blitum*. With regard to South America, the new generic treatment was recently adopted in the catalogue of Bolivian plants (MÚLGURA & GALARZA, 2014), Flora Argentina (BRIGNONE, 2020) and accepted by the recent contribution by BRIGNONE & DENHAM (2021).

The genus *Oxybasis* is revealed to be more diverse in South America than commonly understood and new combinations needed for the new generic treatment of *Chenopodium* s.l. in South America are made in the present study. Moreover, some typifications and old specimens are discussed, especially those referring to Paul Aellen's herbarium at G. This work is also aimed at drawing attention to the importance of Aellen's herbarium for understanding *Chenopodium* s.l. in South America, particularly in the Southern Cone.

Paul Aellen (1896–1973) was the leading specialist in *Chenopodiaceae* (now part of *Amaranthaceae*; MORALES-BRIONES et al., 2020) from the 1920s to the 1970s and he established a large and important private herbarium, which is now at G (BURDET, 1977; UOTILA & LOMONOSOVA, 2016). His herbarium includes many specimens from South America, especially from Argentina, Chile and Uruguay, mostly collected by W. Herter, L.R. Parodi and A. Ruiz-Leal. Furthermore, the herbarium contains numerous fragments of important specimens, including type material, e.g., from B, G, K, P, S, W and especially US. Aellen maintained close correspondence with Paul C. Standley (Smithsonian Institution, Washington D.C.; Field Museum of Natural History, Chicago). According to Standley's missives (filed in G), Aellen exchanged copious material with US and personal private herbaria and, in 1927, received on loan most of the *Chenopodium* s.l. specimens of US (c. 1326 sheets) for his revision of the genus in the Americas (AELLEN, 1929).

Material and methods

This contribution is mainly based on the revision of the specimens kept at G, especially those belonging to Aellen's herbarium. Additionally, material from BM, H, K, LE, P and

S was studied, as well as digital images of specimens from RNG. Aellen's correspondence was thoroughly examined in the archives of the library of the Conservatoire et Jardin botaniques de Genève.

New combinations

Oxybasis frigida (Phil.) Uotila, **comb. nov.**

≡ *Chenopodium frigidum* Phil., Fl. Atacam.: 47. 1860.

Holotypus: CHILE. **Reg. Antofagasta:** Riofrio in deserto Atacamensi, II.1854, R.A. Philippi s.n. (SGO [SGO000001632] image!; iso-: G [G00412681 fragm.]). Fig. 1.

Distribution and ecology. – *Oxybasis frigida* grows at high elevations (2500–4200 m) of the Andes of Chile (regions of Tarapacá, Antofagasta, Atacama, Coquimbo, Metropolitan) and Argentina (provinces of Catamarca, La Rioja, San Juan, Mendoza, Neuquén) (MÚLGURA & MARTICORENA, 2008; BRIGNONE, 2020).

Notes. – Differences between terminal and lateral flowers and their seed position are important diagnostic characters for distinguishing *Oxybasis* from the other genera of the former *Chenopodium* s.l. and such features support the transfer of *C. frigidum* Phil. to *Oxybasis*. Its growth habit and the leaf shape and thickness also correspond well to *Oxybasis*. A dense indumentum composed of vesicular hairs on the lower leaf surface is typical for several *Oxybasis* species, e.g., *O. glauca* (L.) S. Fuentes et al. and *O. macrosperma* subsp. *salsa* (Phil.) Uotila [new combination below], but a dense cover of vesicular hairs on both leaf surfaces is unknown for the other species of *Oxybasis*, which broadens the original description of the genus. Dense indumentum and presence of small bracts may be adaptations to a harsh, cold environment.

An isotype of *Chenopodium frigidum* was kept at W, but it was destroyed during the Second World War. However, Aellen took a fragment from it before the War as recorded by himself: “*Chenopodium frigidum* Phil. (Original exempl.), Chili; Desert. Atacama, Riofrio (l.cl.), leg. Philippi”. The fragment is small but shows the essential characters concerning the leaves, flowers and seeds (Fig. 1).

The original material of *Chenopodium hypsophilum* Hauman has not been studied. However, and according to AELLEN (1929), it is most probably a later heterotypic synonym of *C. frigidum*.

Additional specimens examined. – CHILE. **Reg. Atacama:** Wüste Atacama, in Vega Ancha, 20 km E vom Salar de Pedernales, 3600 m, 16.I.1966, Zöllner 1103 (G). **Reg. Coquimbo:** Illapel, Cerro La Yerba Loca, 3450 m, 21.XII.1938, Morrison 16981 (K). **Reg. Tarapacá:** Parinacota 42.7 km E of Pica, 20°21'58"S 69°24'00"W, 3741 m, 17.V.2005, Acosta et al. INLA.BB 382 (K).

ARGENTINA. **Prov. Mendoza:** Las Heras (Estancia San Isidro), Agua de los Pajaritos, 2600 m, 14.I.1964, *Ruiz Leal 23126* (G); San Carlos, Quebrada del Paso de la Cruz de Piedra, 16.I.1949, *Ruiz Leal 11771* (G). **Prov. San Juan:** Calingasta, Reserva Natural Estricta El Leoncito, Quebrada Vaquita Muerta, 25.I.1995, *Apochian et al. 227* (K); Arroyo Tambillos, along trail from Paso de Valeriano, Pueblo Tambillo, 29°10'S 69°51'W, c. 4000 m, 10.I.1926, *Johnston 6100* (K).

Oxybasis halophila (Phil.) Uotila, **comb. nov.**

= *Chenopodium halophilum* Phil. in *Anales Univ. Chile* 18: 67. 1861. = *Chenopodium macrospermum* subsp. *halophilum* (Phil.) Aellen in *Repert. Spec. Nov. Regni Veg.* 26: 42. 1929.

Lectotypus (designated here): CHILE. **Reg. Los Lagos:** Llanquihue, Coihuin, prope Puerto-Montt, s.d., *Fonk s.n.* (SGO [SGO000001634] image!; isolecto-: [SGO000001635] image!).

Distribution and ecology. – *Oxybasis halophila* is known from a very limited area in the Llanquihue Province of Chile. In addition to five specimens from Coihuin, TRONCOSO (1974) cited a specimen from Palena; all specimens seem to come from brackish water shores.

Notes. – REICHE (1911) treated *Chenopodium halophilum* Phil. as an accepted species and included *Blitum salsum* Phil. in its synonymy. AELLEN (1929) related *Chenopodium halophilum* to *C. macrospermum* Hook. f. and proposed the combination *C. macrospermum* subsp. *halophilum* (Phil.) Aellen. In this regard, TRONCOSO (1974) pointed out that these authors had not studied the type material of these species and were not aware of the essential differences in their flower and seed characters. Aellen, in his last letter to Troncoso dated 2 August 1972, agreed that the morphological differences justified the separation of *C. halophilum* and *Blitum salsum* at specific level. However, once again, they have recently been considered conspecific and included in the synonymy of *Oxybasis macrosperma* (Hook. f.) S. Fuentes et al. (e.g. MÚLGURA & GALARZA, 2014; BRIGNONE, 2020).

Oxybasis halophila is here treated as an accepted species distinct to *O. macrosperma* mainly on the basis of the seed position (practically all horizontal in *O. halophila* vs. practically all vertical in *O. macrosperma*). Indeed, they belong to two different sections, *O. halophila* having greater affinity with *O. ambigua* (R. Br.) de Lange & Mosyakin. Furthermore, the broadly rhombic-ovate, slightly 3-lobed middle leaves with almost entire margins and roundish apex distinguish this species from the other *Oxybasis* taxa (Table 1).

The specimens SGO000001634 and SGO000001635 were cited as syntypes of *Chenopodium halophilum* by MUÑOZ PIZARRO (1960) and TRONCOSO (1974). Although the label information of the two specimens does not perfectly match one another, they most probably correspond to the same

collection as indicated by the same phenology, size, habit, and preservation conditions. The specimen SGO000001634 is designated here as the lectotype because it bears the original label.

Additional specimen examined. – CHILE. **Reg. Los Lagos:** Llanquihue, Coihuin, prope Puerto-Montt, II.1868, *Anon. s.n.* (BM, K).

Oxybasis macrosperma subsp. *salsa* (Phil.) Uotila, **comb. nov.**

= *Blitum salsum* Phil. in *Anales Univ. Chile* 91: 423. 1895.
= *Chenopodium macrospermum* subsp. *salsum* (Phil.) A. Tronc. in *Not. Mens. Mus. Nac. Hist. Nat.* 18(211): 6. 1974.

Lectotypus (designated by TRONCOSO, 1974: 7): CHILE. **Reg. O'Higgins:** Cardenal Caro, Bucalemu, I.1878, *Sanfurgo s.n.* (SGO [SGO000001626] image!; isolecto-: G [G00398323 fragm.], SGO [SGO000001625] image!, US).

= *Chenopodium macrospermum* f. *nanum* Aellen in *Repert. Spec. Nov. Regni Veget.* 26: 44. 1929. **Lectotypus** (designated here): BOLIVIA. **Dept. La Paz:** Guaqui, Ufer des Titicaca Sees, 3820 m, III.1910, *Buchtien 2828* (US [US00169597] image!; isolecto-: G [G00426956 fragm.], US [US007229802] image!).

Distribution and ecology. – This subspecies is widely distributed in the Cono Sur: Argentina (provinces of Buenos Aires, Catamarca, Chubut, Río Negro, Mendoza, Santa Cruz, Santa Fe, San Juan), Chile (regions of Antofagasta, O'Higgins, Maule, Metropolitan), Uruguay (departments of Canelones, Montevideo, San José), and Paraguay (department of Presidente Hayes). It also occurs in the Bolivian departments of Cochabamba and La Paz. It grows in many types of open habitats, often in marshy lakeshores, showing preference for sand and saline soils (NAVAS BUSTAMANTE, 1976).

Oxybasis macrosperma subsp. *salsa* has been recorded as introduced in USA, Mexico, Europe (AELLEN, 1960) and Australia (WILSON, 1984) under the names *Chenopodium macrospermum* or *C. macrospermum* subsp. *halophilum*. European plants have remained casual, many of them non-flowering or at least non-fruiting, which may indicate their origin from shorter-day conditions.

Notes. – *Oxybasis macrosperma* is morphologically variable regarding the habit, leaf size and shape, inflorescence, density of vesicular trichomes (especially on the lower leaf surface) and seed size. AELLEN (1929) recognized *Chenopodium macrospermum* subsp. *macrospermum* (under the name *C. subsp. crassicaule* (Moq.) Aellen), which is limited to the Falkland Islands and southernmost part of the continent, and the more widespread *C. macrospermum* subsp. *halophilum* (currently *Oxybasis macrosperma* subsp. *salsa*; see above under *Oxybasis halophila*). This division was generally accepted in South America until 2012.

Table 1. – Morphological comparison between *Oxybasis macrosperma* (Hook. f.) S. Fuentes et al. subsp. *macrosperma*, *O. macrosperma* subsp. *salsa* (Phil.) Uotila, *O. halophila* (Phil.) Uotila, and *O. ambigua* (R. Br.) de Lange & Mosyakin.

	<i>O. macrosperma</i> subsp. <i>macrosperma</i>	<i>O. macrosperma</i> subsp. <i>salsa</i>	<i>O. halophila</i>	<i>O. ambigua</i>
Stem [cm]	7–20, procumbent to erect	(5–)10–60(–100), erect	15–25, erect to ascending	10–50, prostrate to ascending
Leaf blade of middle leaves [mm]	± glabrous, 10–30 × 7–25, rhombic-ovate, margins ± entire	glabrous or farinose below, (20–)40–60(–120) × (15–)30–50(–100), triangular to rhombic, margins coarsely dentate to sinuate	farinose below, 20–45 × 15–35, broadly rhombic-ovate, slightly 3-lobed, margins almost entire	farinose below, 3–20(–50) × 2–18(–60), rhombic-ovate to triangular-ovate, usually ± 3-lobed, margins entire to sinuate-dentate
Inflorescences	compact, glomerules obscure, loose	loose glomerules, terminal and axillary	compact glomerules, axillary	compact glomerules, axillary
Flowers	± sessile	short-stipitate	sessile	sessile
Perianth segments	(4–)5, partite at most ½ of the length	in terminal flowers 4 or 5, deeply partite; in lateral flowers 3, shallowly partite	3 or 4, deeply partite	in terminal flowers 3–4(–5), deeply partite; in lateral flowers 3, shallowly partite
Seeds [mm]	(1.1–)1.2–1.5(–2), vertical	0.75–1.2, vertical (a few horizontal)	1.5–c. 2, almost all horizontal	1–1.3(–1.6), mostly horizontal

In the recent treatments of the genus no subspecies are accepted (FUENTES-BAZAN et al., 2012; MÚLGURA & GALARZA, 2014; BRIGNONE, 2020). However, differences in leaf and inflorescence characters and seed size (Table 1), besides the more or less allopatric areas justify recognition of the two subspecies. Small plants of subsp. *salsa* may have a habit resembling that of subsp. *macrosperma*, but they differ at least in having smaller seeds (1 mm). The description of *Oxybasis macrosperma* given by BRIGNONE (2020) fits well with the subsp. *salsa* but practically excludes subsp. *macrosperma*.

The isolectotype of *Blitum salsum* at B was destroyed during the Second World War except for a small fragment taken by Aellen for his herbarium. The specimen of US was cited as “Orig. von *Blitum salsum* Phil. (Herb. Wash.)” by AELLEN (1929), however, it has not been located.

Chenopodium macrospermum f. *nanum* Aellen was described on the basis of the collection *Buchtien 2828* (US), which consists of two specimens. Because US00169597 is more complete, it is designated here as the lectotype. There is also a fragment in G originating from Aellen herbarium. The plants are less than 5 cm tall, have small (1 cm long), entire, succulent leaves and fairly compact inflorescences; however, their seeds do not exceed 1 mm in diameter.

Additional specimens examined. – ARGENTINA. **Prov. Chubut:** Rawson, 0.5 km N of Trelew, 30 m, 23.XII.1938, *Eyerdam et al. 23756* (G, K). **Prov. Mendoza:** San Rafael, IV.192?, *Parodi 8543* (G). **Prov. Río Negro:** Vicinity of General Roca, 250–360 m, IX.1914–II.1915, *Fischer s.n.* (BM). **Prov. Santa Cruz:** Lago San Martín, Península Maipu, 3.III.1903, *Hogberg 33* (BM).

BOLIVIA. Dept. La Paz: Murillo, Mecapaca, c. 20 km al SE de La Paz (La Florida), 16°38'S 68°03'W, 2950 m, 14.II.1987, *Solomon & Nee 16083* (G).

CHILE. Reg. Metropolitana: Santiago, Lake Aculeo, c. 500 m, V.1971, *Troncoso s.n.* (G).

PARAGUAY. Dept. Presidente Hayes: Estancia Tinfunque, a 5 km al oeste de Tinfunqué, 100–150 m, 23.IX.1987, *Spichiger et al. RS2143* (G); Pilcomayo River, 1888–1890, *Morong 918* (BM, G, K).

URUGUAY. Dept. San José: Barra Sta. Lucía, 11.III.1921, *Osten 22183* (S). **Dept. Montevideo:** 15.VI.1932, *Fruchard s.n.* (P).

Nomenclatural and chorological notes on *Oxybasis*

Oxybasis macrosperma (Hook. f.) S. Fuentes, Uotila & Borsch in *Willdenowia* 42: 15. 2012.

= *Chenopodium macrospermum* Hook. f., *Bot. Antarct. Voy.* (Fl. Antarct.) 2: 341. 1846.

Lectotypus (designated by MOORE, 1968: 61): **Falkland Islands:** East Falkland, Berkeley Sound, III.1833, *Darwin s.n.* (CGE).

= *Blitum rubrum* var. *crassicaule* Moq. in A. DC., *Prodr.* 13(2): 84. 1849. = *Chenopodium macrospermum* subsp. *crassicaule* (Moq.) Aellen in *Repert. Spec. Nov. Regni Veg.* 26: 42. 1929. **Holotypus:** **Falkland Islands:** “No. 30, Falkland”, 1834, *Darwin s.n.* (K [K000368312, individual at the bottom!]; iso-: G [G00414383 fragm.!]).

Notes. – Three syntypes were cited in the protologue of *Chenopodium macrospermum*: two Darwin’s collections from Berkeley Sound and St. Salvador Bay, collected in 1833 and 1834 respectively, and one Hooker’s own collection without locality and date information. MOORE (1968) indicated Darwin’s specimen from 1833 at CGE as the “type”, which is here corrected to lectotype (TURLAND et al., 2018: Art. 9.10). Later

lectotypifications, based on Darwin's specimen from 1834 at K (PORTER, 1986) and Hooker's specimen at K (FUENTES-BAZAN et al., 2012) are superfluous.

MOQUIN-TANDON (1849) described *Blitum rubrum* var. *crassicaule* Moq. from the Falkland Islands on the basis of the specimen "Henslow! 30", which refers to the individual mounted at the bottom of the specimen K000368312 bearing the annotation "No. 30 Falkland". The specimen was actually collected by Darwin and sent to J.S. Henslow, who numbered the specimen and self-attributed it (PORTER, 1982, 1986).

Oxybasis ambigua (R. Br.) de Lange & Mosyakin in Phytotaxa 350: 266. 2018.

- = *Chenopodium ambiguum* R. Br., Prodr. Novae Holl. 1: 407. 1810. = *Chenopodium glaucum* subsp. *ambiguum* (R. Br.) Murr & Thell. in Mém. Soc. Sci. Nat. Math. Cherbourg 38: 196. 1912.

Lectotypus (designated by WILSON, 1983: 141): AUSTRALIA. **Tasmania:** Port Dalrymple, I.1801, *Brown s.n.* (BM [BM001015839]!; isolecto-: K [K000898449]!).

- = *Chenopodium glaucum* var. *divaricatum* Hook. f., Bot. Antarct. Voy. (Fl. Antarct.) 2: 341. 1846. **Lectotypus** (designated by PORTER, 1986: 92): CHILE. **Reg. Aysén:** Chonos Archipelago Patagonia, XII.1834, *Darwin s.n.* (CGE; isolecto-: G [G00414382 fragm.], K!), **syn. nov.**
- = *Chenopodium glaucum* f. *paschale* Fuentes in Bol. Mus. Nac. Chile 5: 332. 1913. **Holotypus:** CHILE. **Reg. Valparaíso:** Pascua ["Isla de Pasqua"], IV.1911, *Fuentes s.n.* (SGO [SGO000001633] image!; iso-: G [G00412682 fragm.]).

Notes. – *Oxybasis ambigua* is a species from Australia and New Zealand that is related to the northern hemisphere species *O. glauca*. Its identity and status have been much discussed and Wilson (1983, 1984) did not formally accept the splitting of *Chenopodium glaucum* L. into two taxa but considered it to be a polymorphic species. Although both *O. ambigua* and *O. glauca* certainly show considerable morphological variation, the differences regarding the leaf shape and seed size support their separation (MOSYAKIN & DE LANGE, 2018), as the cytological information also suggests ($2n = 36$ for *O. ambigua* vs. $2n = 18$ for *O. glauca*). AELLEN & JUST (1943) mentioned *Chenopodium glaucum* subsp. *ambiguum* (R. Br.) Murr & Thellung from Easter Island and the Chonos Archipelago, but the latter was forgotten and the taxon has not been generally accepted for the South American continent. Later, Aellen himself only mentioned the taxon for Easter Island (AELLEN, 1960).

A specimen originating from the Ventenat herbarium with two fragmentary duplicates, one in G-DC [G00687110] and a second originating from Aellen herbarium in G [G00398325],

is deposited in G [G00398324]. This specimen was cited by MOQUIN-TANDON (1849: 67). It was most likely collected by Louis Ventenat, brother of Étienne-Pierre during the Entrecasteaux Expedition (1791–1794); see CALLMANDER et al. (2017). This collection is therefore not a duplicate of the original material of *Oxybasis ambigua*.

Chenopodium glaucum var. *divaricatum* Hook. f. is treated in Candolle's *Prodromus* (MOQUIN-TANDON, 1849: 72) but the respective protologues of var. *divaricatum* and var. *microphyllum* Moq. are inverted. This mistake was not amended in "Corrections and additions" in the subsequent volumes of the *Prodromus*. In G-DC, var. *microphyllum* is present, as expected, while var. *divaricatum* is absent. The var. *divaricatum* was correctly reported by MACLOSIE (1905: 359), but the mistake in the *Prodromus* misled subsequent botanists dealing with this taxon, e.g., by HAUMAN & IRIGOYEN (1923), AELLEN (1929) and MÚLGURA & MARTICORENA (2008). In 1931, Aellen studied Darwin's specimen at K and determined it as *C. glaucum* subsp. *ambiguum* (R. Br.) Murr & Thell. and included the chorological information in AELLEN & JUST (1943), but he did not comment on the var. *divaricatum*. The latter variety has generally been neglected and therefore not synonymized with *Oxybasis ambigua*. The synonymy is formally proposed here.

PORTER (1986: 92) designated Darwin's specimen from Chonos Archipelago at CGE as the holotype of *Chenopodium glaucum* var. *divaricatum*. The term holotype is corrected to lectotype (Art. 9.10) since a duplicate has been located at K, where Joseph D. Hooker most probably studied the specimen. His father, William J. Hooker, obtained Darwin's specimens from John S. Henslow for determination and these were later included in K as a part of Hooker's herbarium (PORTER, 1984).

The fragments of type material in G of the names *Chenopodium glaucum* var. *divaricatum* and *C. glaucum* f. *paschale* Fuentes originate from the Aellen herbarium.

Oxybasis parodii (Aellen) Mosyakin & de Lange in Phytotaxa 350: 266. 2018.

Notes. – BRIGNONE (2020) recorded this species from the Argentinian provinces of Mendoza, Neuquén, Río Negro, Chubut and Santa Cruz. MOORE (1983) cited *Chenopodium glaucum* from Tierra del Fuego, based on *Goodall 520*, but this specimen corresponds to *Oxybasis parodii* (Aellen) Mosyakin & de Lange. Therefore, the latter species is here recorded for the first time from Tierra del Fuego Province.

Specimens examined. – ARGENTINA. **Prov. Tierra del Fuego:** Río Grande, Tennessee Oil Company, 0–45 m, 11.I.1967, *Goodall 520* (RNG); Estancia Viamonte, Barrientos Stream, 10.I.1971, *Goodall 3312a* (RNG); Estancia Los Flamencos, 46 km W of Río Grande, 53°42'S 68°09'W, 4.I.1972, *Moore & Goodall 288* (RNG).

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