

# The genus *Sesuvium* (Aizoaceae, Sesuvioideae) in the Southern Cone

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**Key words:** Aizoaceae, lectotypification, new synonyms, revision, South America, taxonomy, *Trianthema*.

**Ključne besede:** Aizoaceae, lektotipifikacija, novi sinonimi, revizija, Južna Amerika, taksonomija, *Trianthema*.

## Abstract

*Sesuvium* is a genus of 14 to 17 species of succulent plants, both annual and perennial, widely distributed in tropical and subtropical regions. The genus *Sesuvium* has not yet been studied in detail in the Southern Cone (Argentina, Southern Brazil, Chile, Paraguay and Uruguay), which has led to a misidentification of numerous specimens as *S. portulacastrum*. As part of the ongoing floristic, taxonomic and ecologic studies in Argentina, we revise the genus *Sesuvium* for the Southern Cone. This study is based on field investigation, examination of herbarium specimens, and revision of literature. The taxonomic treatments, maps of distribution, detailed descriptions, photographs, an illustration, a dichotomous key and a comparative table to differentiate the species of the genus *Sesuvium* occurring in the Southern Cone are presented. Finally, ecological, morphological, and taxonomic aspects of the species are discussed. The new combination of *S. americanum* ( $\equiv$  *Trianthema americanum* Gillies ex Arn.; = *S. verrucosum* Raf.) is proposed. Lectotypes for three names are here designated (*S. revolutifolium* Vahl ex Willd.; *S. revolutifolium* Lam., and *S. parviflorum* DC.). Four species should be accepted for the Southern Cone: *S. americanum*, *S. humifusum*, *S. mezianum* and *S. sessile*. Furthermore, *S. portulacastrum* is excluded from the flora of the Southern Cone.

## Izveček

V rod *Sesuvium* uvrščamo od 14 do 17 vrst sukulentnih rastlin, enoletnic in trajnic s široko razširjenostjo v tropskih in subtropskih območjih. Rod *Sesuvium* v območju južnega dela Južne Amerike (Argentina, južna Brazilija, Čile, Paragvaj in Urugvaj) še ni bil podrobneje raziskan in posledica so bile številne napačne določitve osebkov kot *S. portulacastrum*. Med florističnimi, taksonomskimi in ekološkimi raziskavami v Argentini smo naredili revizijo rodu *Sesuvium* za južni del Južne Amerike. V študiji smo opravili terenske raziskave, pregledali herbarijske primerke in literaturo. Predstavili smo taksonomsko obdelavo, karte razširjenosti, podrobni opis, fotografije, ilustracije, dihonomni ključ in primerjalno tabelo za razlikovanje vrst rodu *Sesuvium*, ki se pojavljajo v južnem delu Južne Amerike. Razpravljali smo o ekoloških, morfoloških in taksonomskih vidikih teh vrst. Za *S. americanum* ( $\equiv$  *Trianthema americanum* Gillies ex Arn.; = *S. verrucosum* Raf.) smo predlagali novo kombinacijo. Predlagali smo tri lektotipe za tri imena (*S. revolutifolium* Vahl ex Willd.; *S. revolutifolium* Lam. in *S. parviflorum* DC.). Za preučevano območje so veljavne štiri vrste: *S. americanum*, *S. humifusum*, *S. mezianum* in *S. sessile*. Vrsto *S. portulacastrum* pa moramo izločiti iz flore južnega dela Južne Amerike.

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## Introduction

*Sesuvium* L. (Aizoaceae Martinov., Sesuvioideae Lindl.) is a genus of 14 species of succulent plants, both annual and perennial, widely distributed in tropical and subtropical regions and with a centre of origin in Southern Africa (Bohley et al. 2017, Hartmann 2017, Sukhorukov et al. 2018). Recent studies suggest that at least 17 species should be accepted (Sukhorukov et al. 2018).

The genus *Sesuvium* has not yet been studied in detail in the Southern Cone (Argentina, Southern Brazil, Chile, Paraguay and Uruguay), which has led to a misidentification of numerous specimens as *S. portulacastrum* (L.) L. Zuloaga et al. (2019) cited two species of *Sesuvium* for the Southern Cone area: *S. portulacastrum* and *S. humifusum* (Turpin) Bohley & G. Kadereit. However, Bohley et al. (2017) reported additionally *S. meizianum* (K. Müll.) Bohley & G. Kadereit (restricted to Paraguay) and *S. verrucosum* Raf. (a single specimen from 1983 in Argentina).

As part of the ongoing floristic and taxonomic studies of Aizoaceae (see e.g., Jocou et al. 2019a, Jocou & Minué 2020, Jocou et al. 2020a) and floristic and ecological studies in Argentina (see e.g., Jocou & Gandullo 2018, 2019, 2020, Minué & Gandullo 2019, Jocou et al. 2019b, 2020b, Jocou & Brignone 2020, Minué et al. 2021), we revised the genus *Sesuvium* for the Southern Cone.

The taxonomic treatments, maps of distribution, detailed descriptions of two species, photographs, an illustration, a dichotomous key and a comparative table to differentiate the species of the genus *Sesuvium* occurring in the Southern Cone are presented. Finally, ecological, morphological, and taxonomic aspects of the species are discussed.

## Materials and methods

Field investigations were performed in Patagonia (Argentina) for collection of specimens of *Sesuvium* in the Gran Bajo del Gualicho and Pellegrini Lake (Río Negro province) during 2018 to 2020. All the specimens collected were deposited in ARC. The morphological study of the specimens was performed under stereoscopic microscope Leica EZ4 HD, and the photographs were taken using LAS EZ 3.4.0.

High-quality digital images of *Sesuvium* specimens collected in the Southern Cone from B, BRIT, CONC, E, F, G, L, MA, NY, P, TEX, U, UCR, US, and UTC (acronyms according to Thiers 2020 [continuously updated]) were examined.

Descriptions, protologues and relevant literature were studied for the typification of names. Protologues and high-quality images of type specimens of *Cypselea humi-*

*fusa* Turpin, *C. meiziana* K. Müll., *S. parviflorum* DC., *S. revolutifolium* Vahl ex Willd., *S. revolutum* Pers., *S. revolutifolium* Lam., *S. revolutifolium* Ortega, *S. sessile* Pers., *S. verrucosum* and *Trianthema americana* Gillies ex Arn., were studied.

Specific literature about *Sesuvium* and regional floras from the Southern Cone were consulted for study of taxonomic treatments.

A comparative table of morphological features and a dichotomous key were made between the species occurring in the Southern Cone. Distribution maps of the species in the Southern Cone were made. Field and stereoscopic microscope photographs of *Sesuvium americanum* and *S. sessile* were taken to complement the descriptions.

The Articles cited throughout the text follow the *International Code of Nomenclature for algae, fungi, and plants* (ICN; Turland et al. 2018).

## Results and discussion

The identification of the perennial species of *Sesuvium* occurring in the Southern Cone has been historically erratic, due to their morphological similarity and the few comprehensive taxonomic studies. The presence of *S. portulacastrum* has been erroneously reported in the Southern Cone. We corroborate the occurrence of a North American taxon [*S. americanum* (Gillies ex Arn.) A.I. Jocou & C.R. Minué, comb. nov. = *S. verrucosum*] and a South American taxon [*S. sessile* Pers., = *S. parviflorum*]. The latter was synonymised under *S. portulacastrum* (see e.g., Bohley et al. 2017, Brignone 2020) although it presents distinctive features that justify the reinstatement to species rank, agreeing with the conclusions of Sukhorukov et al. 2018 for *S. parviflorum*.

The detachment of the aril near of the cotyledon area (Figures 4G, H & I) represents a taxonomic character (see e.g., Sukhorukov et al. 2018) that allows differentiating some of the species occurring in the Southern Cone. The length of the pedicel would allow differentiating *Sesuvium portulacastrum* (>7 mm long, *sensu* Sukhorukov et al. 2018) from other species in the Southern Cone (usually <2.5 mm). Furthermore, the presence and abundance of papillae (bladder cells) (Figures 1A & B) and warts (Figure 1C) are also useful characters for the identification of species.

The papillae are specialized structures that allow the accumulation of excess salts (Agarie et al. 2007). The density of papillae could be varying to the age of the plant, climatic conditions (Bohley et al. 2017) or even edaphic conditions, such as the concentration of salts. However, the density of papillae and warts appears to be a sufficiently stable feature to differentiate some species.

To clarify the taxonomy of *Sesuvium* in the Southern Cone, a dichotomous key, a comparative table (Table 1) and the taxonomic treatment for each species are presented.

### Taxonomic treatment

*Sesuvium americanum* (Gillies ex Arn.) A.I. Jocou & C.R. Minué, **comb. nov.** ≡ *Trianthema americanum* Gillies ex Arn., Edinburgh J. Nat. Geogr. Sci. 3: 354. 1831 – Lectotype (designated by Brignone 2020: 13): Argentina, Buenos Aires, “Pampas y Buenos Ayres near Rio del Saladillo”, “November to March, 1821”, *Gillies s.n.* (E00621957 digital image!); Isolectotype: E00621958 (digital image!). **Figures 2, 3 (C, F & I) & 4 (C, F & I).**

= *Sesuvium revolutifolium* Vahl ex Willd., Enum. Pl. [Willdenow] 1: 521. 1809, **nom. illeg. et syn. nov.** – Lectotype (designated here): Herbarium Willdenow,

“Habitat in America calidior” (B-W 09667-01 0, digital image!, available in: <https://herbarium.bgbm.org/object/BW09667010>).

= *Sesuvium verrucosum* Raf., New Fl. [Rafinesque] 4: 16. 1836, **syn. nov.** – Neotype (designated by Bohley et al. 2017: 144): United States of America, Salt River, Arkansas, *Nuttall s. n.* (P00680440 digital image!, available in: <http://coldb.mnhn.fr/catalognumber/mnhn/p/p00680440>); Isonotype: P00680439 (digital image!) – Epitype (designated by Bohley et al. 2017: 144): United States of America, California, Riverside, San Jacinto Valley, 15-X-1999, *Sanders et al. 23186* (BRIT, not seen); Isoepitypes: UCR (digital image!, available in: <https://cch2.org/portal/collections/individual/index.php?occid=1481905>), UTC00230499 (digital image!, available in: [https://intermountainbiota.org/imglib/h\\_seinet/intermt/UTC/UTC00230/UTC00230499.jpg](https://intermountainbiota.org/imglib/h_seinet/intermt/UTC/UTC00230/UTC00230499.jpg)), CAS?, DAV?, RSA?, SD?.

**Table 1:** Comparison table of the features of *Sesuvium* species in the Southern Cone.

**Tabela 1:** Primerjalna tabela lastnosti vrst rodu *Sesuvium* v južnem delu Južne Amerike.

Features	<i>S. americanum</i>	<i>S. humifusum</i>	<i>S. mezianum</i>	<i>S. sessile</i>
Life span	Perennial	Annual	Perennial	Perennial
Papillae (bladder cells)	Prominent, densely covered in stem, leaves and sepals	Small, flat	Absent	Usually absent, if present then not prominent, loosely and only in the younger parts
Leaf, size (mm)	5–30 × 4–15	4–12 × 2–8	5–7 × 2–3	5–40 × 4–15
Leaf, blade	Flat, often revolute	Flat	Flat	Flat, usually revolute
Leaf, insertion	Shortly petiolate	Petiolate	Shortly petiolate	Shortly petiolate
Leaf, shape	Linear, spatulate, obovoid, oblong or linear-oblong	Elliptic to ovate	Obovate to oblanceolate	Linear, spatulate, oblong or linear-oblong
Leaf, apex	Obtuse, often retuse	Obtuse to acute	Obtuse to rounded	Obtuse, often slightly retuse
Leaf, base	Attenuate to narrowly cuneate	Obtuse	Obtuse to attenuate	Attenuate to narrowly cuneate
Pseudostipules, margin	Entire	Fimbriate	Entire	Entire
Flower, length (mm)	5–8	3–4	3–5	5–10
Pedicel, length (mm)	0–2	3–4	1–3	0–2.5
Stamens, number	Numerous	3	3	Numerous
Carpels, number	3–5	2(–3)	3	3–5
Styles, number	3–5	2(–3)	3?	3–5
Aril and seed coat	Small detachment near the cotyledon area, with hardly noticeable pits	Covers the seed, entire, reticulated	Not seen	Very noticeable detachment near the cotyledon area
Seed, length (mm)	0.8–0.9	ca. 0.2	Not seen	0.8–0.9
Seed, shape	Rounded-reniform	Rounded reniform	Not seen	Rounded-reniform
Seed, colour	Lustrous, slightly iridescent, black	Glossy, light-brown	Not seen	Lustrous, slightly iridescent, black

**Description:** — Succulent perennial herb, sometimes suffruticose toward the base. *Stem* procumbent to erect, usually many branched and leaved, densely papillate, usually with few warts. *Leaves* fleshy, opposite, blade green to greyish-green, usually ashy brown or greyish when dry, linear, spatulate, obovoid, oblong or linear-oblong, flat, often revolute, 5–30 × 4–15 mm, slightly verrucose, densely papillate, margin entire, apex obtuse, often re-verse, base attenuate to narrowly cuneate; petioles 1–3 mm long, densely papillate, pseudostipules hyaline, without papillae, clasping the stem, margin entire. *Floral bracts* in one pair at the base of pedicels, without papillae, triangular to lanceolate, often with margin slightly toothed, 1–1.2 × 0.5–0.7 mm. *Flowers* solitary in axils, sessile to subsessile, 5–8 mm long, ovoid to slightly turbinate when closed; pedicels 0–2 mm long, densely papillate. *Sepals* 5, green outside, white, pale pink, pink, violet, purple-reddish inside, fused at the base, lobes erect, imbricate, cucullate, ovate to ovate-lanceolate, unequal, the 3 broad

ones ca. 5 × 4 mm, the 2 narrow ones ca. 5 × 2.5 mm; margins hyaline without warts or papillae, dorsal surface slightly verrucose, densely papillate; subapical dorsal mucro obvious, ca. 1 mm long. *Stamens* numerous; filaments fused at base, ca. 3 mm long; anthers pink, often white, ca. 0.7 mm long. *Ovary* globose, glabrous; carpels 3–5; styles 3–5, free, 3–4 mm long. *Capsules*, globose to ovoid, 3–6 × 2.5–3.5 mm, circumscissile in the lower fourth of the fruit, locules 3–5. *Seeds* numerous, rounded-reniform, black, lustrous, slightly iridescent, hardly noticeable pits, 0.8–0.9 × 0.6–0.7 mm; aril with small detachment near the cotyledon area.

**Illustrations:** — Ocampo Acosta (2002: 4); Fadaie et al. (2006: 89, Figure 1).

**Notes:** — *Sesuvium americanum* was mentioned for Argentina for the first time by Bohley et al. (2017, as *S. verrucosum*) referring to a single collection.

**Taxonomic notes:** — Numerous specimens of *Sesuvium americanum* from Argentina have been incorrectly identified as *S. portulacastrum*. However, *S. portulacastrum* lacks of the dense papillate indument and the detachment of the aril in the cotyledon area, and bears flowers with pedicels more than 7 mm long.

**Nomenclatural notes:** — Arnott (1831) proposed the name *Trianthema americanum* (as “americana”) based on specimens of Gillies, giving a diagnosis in Latin, the provenance of the specimens (“HAB. Near Laguna del Arbolito on the west side of Rio Saladillo, forming the western limit of the Pampas”) and the date of collection (“November to March, 1821”).

Although many authors have proposed *Trianthema americanum* as synonym (or possible) of *Sesuvium portulacastrum* (see e.g. Hauman 1925, Bohley et al. 2017, Zuloaga et al. 2019) or *S. sessile* (see e.g. Hartmann 2017) we studied the lectotype (and isolectotype) kept at E that matches the features of *S. verrucosum* (particularly ovoid and sessile-subsessile flowers, and dense papillae indumentum) (Figure 2). Consequently, as *T. americanum* has nomenclatural priority against *S. verrucosum* we propose here the new combination of *S. americanum*.

The name *Sesuvium revolutifolium*, validly published by Willdenow (1809) and ascribed to Vahl, is an illegitimate name because it is a later homonym of *S. revolutifolium* published by Ortega (1797). We have found two sheets corresponding to original materials of *S. revolutifolium* at Willdenow’s herbarium (B-W). The B-W specimens are considered as part of the original material of *S. revolutifolium*, published by Willdenow in his *Enumeratio plantarum*, partly on the basis of the statements of the “Praefatio” (Willdenow 1809: V) (see e.g., Jocou et al. 2020a). However, this is only a guide, indicating that Willdenow



**Figure 1:** Features of *Sesuvium americanum* (A, B) and *S. sessile* (C). A: close-up of flower and leaves in fresh (Minué & Jocou s.n.). B: close-up of papillae in the sepals (Minué & Jocou s.n.). C: close-up of warts in the sepals (Jocou & Minué 2381).

**Slika 1:** Lastnosti vrst *Sesuvium americanum* (A, B) in *S. sessile* (C). A: bližnji pogled cveta in listov (Minué & Jocou s.n.). B: bližnji pogled papil na časnih listih (Minué & Jocou s.n.). C: bližnji pogled bradavic na časnih listih (Jocou & Minué 2381).





**Figure 2:** Lectotype of *Trianthema americanum* (E00621957). **A:** general view of the sheet. **B:** close-up under stereoscopic microscope. Images provided by herbarium E (Royal Botanic Garden Edinburgh). Reproduced with permission.

**Slika 2:** Lektotip vrste *Trianthema americanum* (E00621957). **A:** splošni pogled herbarijske pole. **B:** bližnji pogled za stereomikroskopom. Slike je omogočil herbarij E (Kraljevi botanični vrt Edinburgh). Natis z dovoljenjem.

saw at least one specimen from his herbarium, but not necessarily any particular specimen extant in B-W. Since the sheets of the specimens shows handwriting by Willdenow, there is no reason to doubt that these specimens are original material for the name as reported by various authors (e.g., Iamónico 2020, Jocu et al. 2020a). Since Willdenow (1809) did not indicate the holotype and the existence of two sheets, these specimens are syntypes and a lectotypification is necessary (Arts. 9.3 and 9.6 of ICN). The study of these syntypes suggests that they correspond to the species treated here as *S. americanum*, mainly due to the presence of a dense papillate indument. We designate here as lectotype the sheet B-W 09667-01 0 since

its good state of preservation and quantity of material. The syntype that correspond to the sheet B-W 09667-02 0 (available in: <https://herbarium.bgbm.org/object/BW09667000>) cannot be considered as an isolectotype since it is probably not from the same gathering.

*Distribution, habitat and ecology:* — *Sesuvium americanum* is native to North America (although perhaps it could be native in South America) and behaves as a pioneer and invasive species of saline environments (Chapman 1960, Ungar 1966, 1968, Ocampo Acosta 2002, Hartmann 2017). *Sesuvium americanum* inhabits coastal wetlands and salty-gypseous soils, as well as dunes and soils with high clay content and alkaline pH (Ungar 1968, Ferren 2003, Flores-Olvera et al. 2016). This species is a weed of irrigated soils and garbage dumps in Socotra and the Arabian Peninsula (Miller 1996). *Sesuvium americanum* is naturalized on several continents: America (Cuba, Peru), Asia (Saudi Arabia, Bahrain, United Arab Emirates, Iran, Syria, Vietnam), Africa (Macaronesian region) (Abbas & El-Oqlah 1992, Fadaie et al. 2006, Al-Eisawi & Al-Ruzayza 2015, Bohley et al. 2017, Sukhorukov et al. 2018). In this sense, the presence of exotic species with these characteristics generates negative ecological consequences on the original biodiversity of saline environments (Capdevila-Argüelles et al. 2013).

The distribution of *Sesuvium americanum* in the Southern Cone according to the specimens examined is shown in Figure 5A. This species grows mainly in inland environments, in saline rivers banks, and edges of saline lagoons, lakes and bowls.

In Argentina, *Sesuvium americanum* is present in the provinces of Buenos Aires (e.g., Las Mulas Lagoon and Epecuen Lake), Córdoba, La Pampa, La Rioja, Mendoza, Río Negro (e.g., Gran Bajo del Gualicho), San Juan, and San Luis (e.g., Río Desaguadero). The Las Mulas Lagoon (Chascomús, Buenos Aires province) is a flat landscape with swampy soil surrounding it, hydromorphic with alkaline inclusions, and a silty texture (Debelis et al. 2005). The vegetation of the area according to Debelis et al. (2005) and the original label of the specimen *Zimmerman 2156* (*Typha* L. sp., *Heliotropium* L. sp., *Distichlis spicata* (L.) Greene, and *D. laxiflora* Hack.), and the physicochemical data of the lagoon water (Colautti, pers. comm.) demonstrate the salinity of the area (Ragonese & Covas 1947, Cantero et al. 1996, Fernández et al. 2018, Gandullo et al. 2019, Minué et al. 2021). The Gran Bajo del Gualicho (Río Negro province), is located in an area where the relief and climate determine halomorphic soils (Marchionni et al. 1998, Brodtkorb 1999, Alonso 2006, Panza et al. 2008) with a typical native halophilic flora [e.g., *Salicornia neei* Lag., *Heterostachys ritteriana* (Moq.) Ung.-Sternb., *Allenrolfea vaginata* (Griseb.) Kuntze,

*Atriplex undulata* (Moq.) D. Dietr., and *Pappophorum philippianum* Parodi] in silty-sandy soils (authors results, following methodology of Yolcubal et al. 2004). The Mosmota area, near the Desaguadero River (San Luis province) is characterized by soils with good drainage, sandy-loam textures, moderately saline, with calcium carbonate (Peña Zubiarte & d'Hiriart 2006).

In Chile, *Sesuvium americanum* grows at least in the Arica province (I Región) and Isla Sala y Gómez (V Región). We found specimens collected in Presidente Hayes department (Paraguay), including a record from Salada Lagoon. Further studies are necessary for establish the real distribution of the species in these two countries.

The data reveal the plasticity of *Sesuvium americanum* to inhabit habitats with varying relief, soil textures and salt concentrations; as indicated by its frequent association with saline bodies of water.

The discovery of specimens collected in Argentina, Chile and Paraguay since 1821 to the present, and the biological characteristics of the taxon, confirm that *Sesuvium americanum* is naturalized according to the criteria of Pyšek et al. (2004). Consequently, this species must be considered part of the flora of the Southern Cone.

**Common names and uses:** — Some Spanish names are “saladillo”, “verdolaga de playa”, “romerillo”, “siempre viva” and “deditos” (Ocampo Acosta 2002, González-Medina et al. 2009, Granados-Sánchez et al. 2011, Ruiz et al. 2014). In the United States of America and European countries it is called “sea purslane” (Miller et al. 2009).

*Sesuvium americanum* was introduced to other countries for landscaping and ornamental purposes as well as for erosion control on sand dunes (Schweitzer & Erell 2014). It has also been used in Mexico to desalinate soils with moderate salt content (Lastiri-Hernández et al. 2019). In Bahrain, it is used for medicinal purposes, specifically for ear ailments (Taha & Alsayed 2000). In California, both its leaves and seeds are used for human consumption (Fauvelle et al. 2017).

**Material examined:** — ARGENTINA. Buenos Aires: Adolfo Alsina, lago Epecuen, 12-XI-1943, *Cabrera 8048* (F). Chascomús, Chascomús, 17-XII-1983, *Zimmerman 2156* (TEX). Monte Hermoso, Monte Hermoso, 1916, *Carette s.n.* (NY04242090). Villarino, Salinas Chicas, 20-XI-1981, *Villamil & Nicora 2195* (NY). S.d., “Pampas y Buenos Ayres, near Río del Saladillo”, “November to March, 1821”, *Gillies s.n.* (E00621957, E00621958). Córdoba: San Justo, alrededores de Miramar, 9-II-1964, *Hunziker et al. 16911* (NY). La Pampa: Catrilo, Uruburu, 23-XII-1944, *Fortuna 46* (F). Utracán, camino a Gral. Acha sobre médano, 28-XI-1959, *Troncoso s.n.* (US03611527). La Rioja: Chamental (ex Gobernador Gordillo), Llanos de

La Rioja, Salina La Antigua, El Infiernillo, 21-V-1959, *Hunziker et al. 14355* (NY). Mendoza: La Paz, margen derecha del Desaguadero entre 33°10' y 33°27' lat. S, 5-III-1944, *Semper s.n.* (NY04242089). Lavalle, 15-III-1940, *Dawson 960* (NY). S.d., *Gillies s.n.* (E00621959). Río Negro: San Antonio, Gran Bajo del Gualicho, cerca de RP N°2, 08-II-2020, *Minué & Jocou s.n.* (ARC). San Juan: San Martín, cerca de laguna, 17-I-1987, *Kiesling & Meglioli 6460* (NY). San Luis: Juan Martín de Pueyrredón, Desaguadero/ Mosmota, III-1911, *Gerth s.n.* (L1693491). CHILE. Arica y Parinacota (I Región): Arica, 2 km from the Panamericana towards Caleta Vitor, 20?-III-1997, *Egglí et al. 2796* (CONC 138590). Valparaíso (V Región): Isla de Pascua, Isla Sala y Gómez, 6-IX-1995, *Retamal s.n.* (CONC 131390). PARAGUAY. Presidente Hayes: Río Verde, cerca de Pozo Colorado, 25-X-1980, *Fernández Casas & Molero 4501* (G, NY); laguna Salada y alrededores, 27-III-1996, *Mereles & Degen 6254* (G); km 300 s/ruta Trans-Chaco, 3-III-1979, *Mereles 1167* (G).

***Sesuvium humifusum*** (Turpin) Bohley & G. Kade-reit, Syst. Bot. 42(1): 134. 2017. ≡ *Cypselea humifusa* Turpin, Ann. Mus. Natl. Hist. Nat. 7: 219. 1806 – Lectotype (designated by Bohley et al. 2017: 134): Dominican Republic, XII-1806, *P. A. Poiteau s.n.* (P01900032 digital image!, available in: <http://coldb.mnhn.fr/catalognumber/mnhn/p/p01900032>); Isolectotype B 10 1071825 (digital image!).

**Description:** — For a detailed description see Bohley et al. (2017).

**Illustrations:** — Bohley et al. (2017: 135, Figure 7); Brignone (2020: 13).

**Notes:** — *Sesuvium humifusum* was recorder at the first time for Argentina by Eskuche (1989) and included by Brignone (2020) in the taxonomic treatment of *Sesuvium* for Flora of Argentina. We were unable to examine the specimens (see material of reference) and more studies are necessary.

**Taxonomic notes:** — This species is very easy to distinguish of other species of *Sesuvium* present in the Southern Cone for the life span (annual) and the margins of pseudoestipules (fimbriates).

**Distribution, habitat and ecology:** — Species native of the Caribbean and introduced in North America (Bohley et al. 2017). Common in alluvial freshwater areas and vernal pools, but not in saline soils (Bohley et al. 2017).

In Argentina occurs in the Corrientes province (Figure 5A), on banks of the Paraná river (Eskuche 1989).

**Common names and uses:** — “Panal” (Bohley et al. 2017).

**Material of reference:** — ARGENTINA. Corrientes: Corrientes Capital, Molina Punta, 17-IX-1970, *Skuche* 675 (SI); 14-VI-1970, *Skuche* 1723 (CTES).

*Sesuvium mezianum* (K. Müll.) Bohley & G. Kadereit, Syst. Bot. 42(1): 138. 2017. ≡ *Cypselea meziana* K. Müll., Bot. Jahrb. Syst. 42 (2–3, Beibl. 97): 72. 1908 – Lectotype (designated by Jocou & Minué 2020: 69): Paraguay, Asunción, “Plaines bordant le Rio Paraguay, couvertes D’efflorescences saleés, á l’Assomption”, X-1875, *Balansa* 2263 (P04583791 digital image!, available in: <http://coldb.mnhn.fr/catalognumber/mnhn/p/p04583791>); Isolectotypes: G00102877 (digital image!), F-V0360256F (digital image!).

**Description:** — For a description see Müller (1908) and Bohley et al. (2017).

**Notes:** — *Sesuvium mezianum* was described for Paraguay by Müller (1908) (see also Bohley et al. 2017). We have only been able to examine images of the type specimens (see Jocou & Minué 2020). *Sesuvium mezianum* is a poorly studied species and apparently restricted to Paraguay (Figure 5A). However, there are more distant records that need to be confirmed (Sukhorukov, pers. comm.).

**Taxonomic notes:** — This species can be distinguished from the other perennial species present in the Southern Cone by the number of stamens (3 *vs.* numerous) and length of the flowers (3–5 mm *vs.* more than 5 mm).

We consider that *Sesuvium mezianum* may be conspecific (or at least very closely related) with *S. microphyllum* Willd. since the morphological similarity (mainly in the habit), although *S. microphyllum* has around 30 stamens. Further studies are necessary to delimit and describe detailly both species.

**Material examined:** — PARAGUAY. Asunción: Plains bordant le Rio Paraguay, couvertes D’efflorescences saleés, á l’Assomption, X-1875, *Balansa* 2263 (G, P, F).

*Sesuvium sessile* Pers., Syn. Pl. [Persoon] 2(1): 39. 1807 – Lectotype (designated by Bohley et al. 2017: 139): Illustration in De Candolle (1799), plate 9 (available in: <https://www.biodiversitylibrary.org/page/280684>) – Epitype (designated by Bohley et al. 2017: 139): Uruguay, Montevideo, Jussieu Collection, *Commerson* 138 (P00680445 digital image!, available in: <http://coldb.mnhn.fr/catalognumber/mnhn/p/p00680445>); Isoepitype: P01900029 (digital image!). **Figures 3 (A, B, D, E, G & H), 4 (A, B, D, E, G & H) & 6.**

= *Sesuvium revolutum* Pers., Syn. Pl. [Persoon] 2(1): 39. 1807, **syn. nov.** – Lectotype (designated by Hartmann 2001: 300): Illustration in De Candolle (1837?, ined?), fig. 179, not seen.

= *Sesuvium revolutifolium* Lam., Tabl. Encycl. 2: 545. 1819, **nom. illeg. et syn. nov.** – Lectotype (designated here): Illustration in Lamarck (1794), pp. 217, pl. 434, fig. 2 (available in: <https://www.biodiversitylibrary.org/page/43516109>).

= *Sesuvium parviflorum* DC., Prodr. [A. P. de Candolle] 3: 453. 1828, **syn. nov.** – Lectotype (designated here): Uruguay, Montevideo, “Au pied du Morne de Mont Video. le long de la plage”, *Commerson* 138 (P01900029 digital image!, available in: <http://coldb.mnhn.fr/catalognumber/mnhn/p/p01900029>); Isolectotype: P00680445 (digital image!).

**Description:** — Succulent perennial herb, suffruticose toward the base. *Stem* procumbent to erect, many branched and leaved, with many warts, glabrous, papillate only in the younger parts. *Leaves* fleshy, opposite, blade green to pale green, usually green or dark brown when dry, linear, spatulate, oblong or linear-oblong, flat, usually revolute, 5–40 × 4–15 mm, usually with many warts, without papillae, if presents then loosely and in young ones, margin entire, apex obtuse, often slightly retuse, base attenuate to narrowly cuneate; petioles 2–5 mm long, verrucose, pseudostipules hyaline, without papillae, clasping the stem, margin entire. *Floral bracts* in one pair at the base of pedicels, without papillae, triangular to lanceolate, often with margin slightly toothed, 1–1.2 × 0.5–0.7 mm. *Flowers* solitary in axils, the terminals sessile to subsessile, the basal often pedicellate, 5–10 mm long, ovoid to slightly turbinate when closed; pedicels 0–2.5 mm long, verrucose, usually glabrous. *Sepals* 5, green outside, white, pale pink, pink, rarely reddish or yellowish inside, fused at the base, lobes erect, imbricate, cucullate, ovate to ovate-lanceolate, unequal, the 3 broad ones ca. 5 × 4 mm, the 2 narrow ones ca. 5 × 2.5 mm; margins hyaline without warts or papillae, dorsal surface with many warts, glabrous to loosely papillate; subapical dorsal mucro obvious, ca. 1 mm long. *Stamens* numerous; filaments fused at base, ca. 3 mm long; anthers pink, often white, ca. 0.7 mm long. *Ovary* globose, glabrous; carpels 3–5; styles 3–5, free, 3–4 mm long. *Capsules* globose to ovoid, 3–6 × 2.5–3.5 mm, circumscissile in the lower fourth of the fruit, locules 3–5. *Seeds* numerous, rounded-reniform, black, lustrous, slightly iridescent, 0.8–0.9 × 0.6–0.7 mm; aril with very noticeable detachment near the cotyledon area.

**Notes:** — *Sesuvium portulacastrum* was reported for Chile by Taylor (1992), for Paraguay by Degen & Merelles (1996) and for Argentina by various regional floras (see e.g. Cabrera 1953, Fabris 1967, Pérez-Moreau 1984, Troncoso 1987, Novara 2012, Brignone 2020). However, the study of specimens from the Southern Cone identi-





**Figure 3:** Morphological features of *Sesuvium sessile* (A, B, D, E, G, H) and *S. americanum* (C, F, I). A–C: habitus. D–F: close-up of flowers and leaves. G–I: herbarium specimens. A, D, G: from Jocou & Minué 2192; B, E, H: from Jocou & Minué 2381; C, F, I: from Minué & Jocou s.n. (ARC).

**Slika 3:** Morfološke lastnosti vrst *Sesuvium sessile* (A, B, D, E, G, H) in *S. americanum* (C, F, I). A–C: habitus. D–F: bližnji pogled cvetov in listov. G–I: herbarijski primerki. A, D, G: iz Jocou & Minué 2192; B, E, H: iz Jocou & Minué 2381; C, F, I: iz Minué & Jocou s.n. (ARC).



fied as *S. portulacastrum*, confirmed that these actually correspond to *S. sessile* (and a few to *S. americanum*). Consequently, we suggest excluding *S. portulacastrum* from the flora of the Southern Cone. *Sesuvium portulacastrum* seems widely distributed in Brazil, but we were unable to examine specimens from Southern Brazil (part of Southern Cone: states of Paraná, Rio Grande do Sul and Santa Catarina) reported by Reitz (1984) for the state of Santa Catarina.

**Taxonomic notes:** — *Sesuvium sessile* differs from *S. portulacastrum* mainly in the remarkable detachment of the aril (Figures 4G, H & 6F), the usually revolute leaves and the sessile to subsessile flowers (*vs.* pedicels more than 7 mm in *S. portulacastrum*, Sukhorukov et al. 2018). *Sesuvium sessile* differs from *S. americanum* mainly in the aril (very noticeable detachment *vs.* small detachment, Figures 4G–I) and the indument (glabrous to loosely papillate *vs.* densely papillate, Figures 4A–F).



**Figure 4:** Morphological features of *Sesuvium sessile* (A, B, D, E, G, H) and *S. americanum* (C, F, I) under stereoscopic microscope. A–C: density of warts and papillae. D–F: density of papillae. G–I: detachment of the aril. A, D, G: from Jocou & Minué 2192; B, E, H: from Jocou & Minué 2381; C, F, I: from Minué & Jocou s.n. (ARC).

**Slika 4:** Morfološke lastnosti vrst *Sesuvium sessile* (A, B, D, E, G, H) in *S. americanum* (C, F, I) prikazane s stereomikroskopom. A–C: gostota bradavic in papilae. D–F: gostota papilae. G–I: del arila (ovoja semena). A, D, G: iz Jocou & Minué 2192; B, E, H: iz Jocou & Minué 2381; C, F, I: iz Minué & Jocou s.n. (ARC).

*Nomenclatural notes:* — While Bohley et al. (2017) indicated the date of publication of the type of *Sesuvium sessile* as “1807”; actually corresponds to the year 1799 (see Stafleu & Cowan 1976).

Although Stafleu & Cowan (1979) stated that the page of *Tableau Encyclopédique* [...] where the name *Sesuvium revolutifolium* is included was written by Poiret (Tome 2, Volume 5, Part 2), there is no internal evidence in the publication that ascribe the authorship to Poiret, and Lamarck must be indicated as the correct author of the name (Art. 46.8 of ICN). Regarding the date of effective publication, Stafleu & Cowan (1979) stated that vol. 5 (2) was published in the year 1819 and should be indicated as the correct year (Art. 31.1 of ICN). Although the name *S. revolutifolium* Lam. was validly published in 1819, it is an illegitimate name as it is a later homonym of the name published by Ortega (1797) and the protologues of both names have exactly the same diagnosis in Latin. Although Lamarck (1819) provided only a brief diagnosis, an illustration was included (in Lamarck 1794, pl. 434, fig. 2) which is the only available original material and is designated here as lectotype. This illustration completely matches with the Southern Cone taxon treated here as *S. sessile*.

Ortega (1797) validly published the name *Sesuvium revolutifolium* with a detailed description and a diagnosis in Latin. Although this name was described from Cuba, we consider that it could correspond to the species treated here as *S. sessile* since we did not find sufficient evidence to apply this name to *S. americanum*. Ortega (1797) only indicated the presence of tiny papillae on both sides of the leaves, but in *S. americanum* the papillae also cover abundantly the sepals and stems. Furthermore, no original material could be traced for study. Regarding the statements of Sukhorukov et al. (2018) that the habit described by Ortega (1797) completely matches with *S. americanum* (= *S. verrucosum*), we have observed that *S. sessile* can range from erect to notably prostrate habit (Figures 3A & B). Consequently, further studies are necessary to establish the correct application of the name *S. revolutifolium* Ortega, which is why it was not included in the current taxonomic treatment.

We have found two sheets corresponding to original materials of *Sesuvium parviflorum* at P. According to the Art. 9.3 and 9.6 of ICN, the two specimens are syntypes and a lectotypification is necessary. Due the good preservation, we here designate the specimen P01900029 as lectotype.

The type specimens of both *Sesuvium sessile* and *S. parviflorum* undoubtedly correspond to the taxon historically treated as *S. portulacastrum* in the Southern Cone.

*Distribution, habitat and ecology:* — *Sesuvium sessile* is native of South America and the most widely distributed in the Southern Cone (Figure 5B). This species grows in both coast and inland environments with saline and clayey to sandy soils.

In Argentina, *Sesuvium sessile* is very widely distributed, and occurs in the provinces of Buenos Aires, Chubut, Corrientes, Formosa, Jujuy, Río Negro, Salta, San Juan, Santiago del Estero, and Tucumán; but probably also distributed in Chaco, Córdoba, Entre Ríos, La Rioja, La Pampa, Mendoza, San Luis, and Santa Fe. This species grows in coastal areas, edges of saline lagoons and lakes, and wet saline bowls.

We only examine two specimens from Chile (Arica province) (one of these cited by Taylor 1992, *Villagrán et al. 1019* - CONC), consequently furthermore studies are necessary for establish the actually distribution of the species in this country.

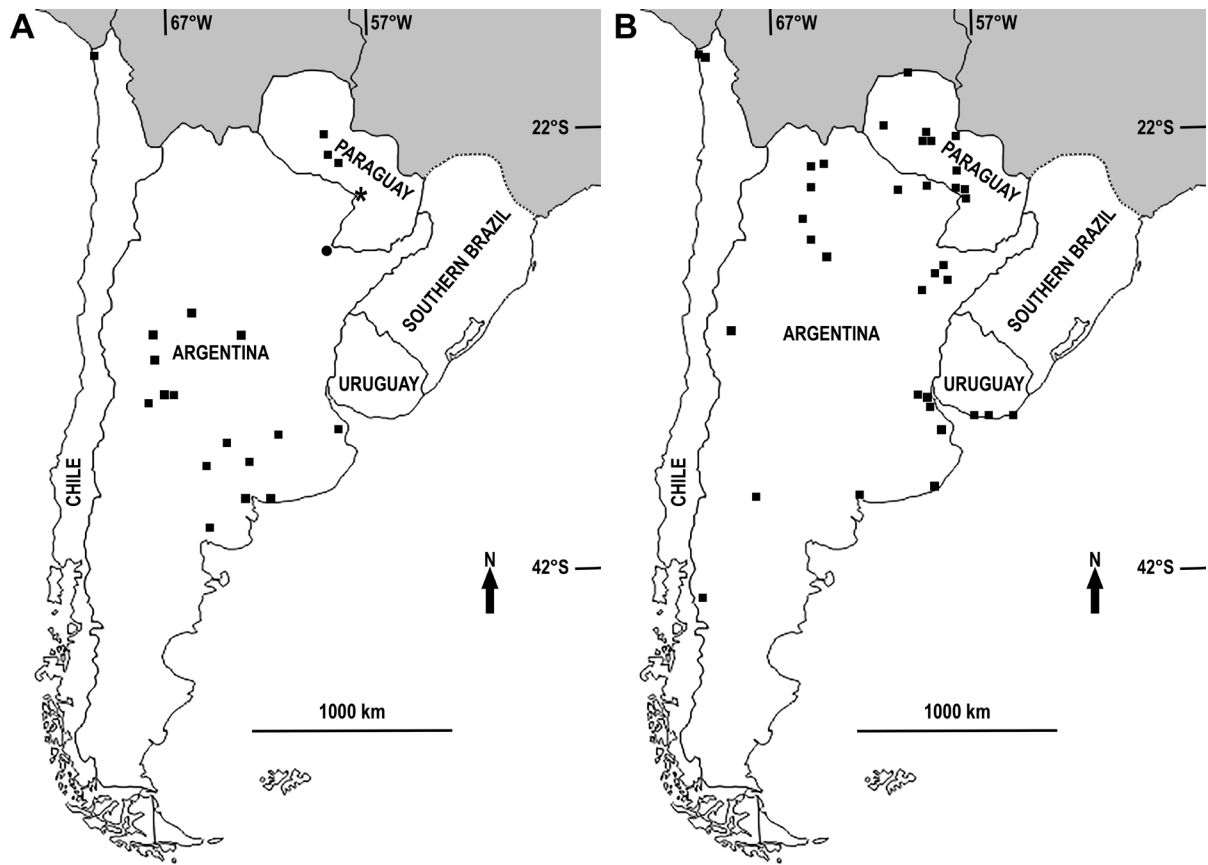
In Uruguay, the species occurs in the departments of Canelones, Montevideo, and Rocha; mainly in coastal areas.

In Paraguay, the species grows in Asunción district and departments of Boquerón, Central, Chaco, and Presidente Hayes; mainly in riparian areas and lagoon edges.

*Common names and uses:* — In Argentina “verdolaga de campo” (Novara 2012). This species is a good indicator of saline soils (Novara 2012).

**Material examined:** — ARGENTINA. Buenos Aires: Bahía Blanca, Bahía Blanca, *Gillies s.n.* (E00621960). Baradero, 22-XI-1937, *Burkart 8466* (F, NY). Campana. Otamendi, 3-I-1940, *Hunziker 34364* (NY). Chascomús, laguna La Adela, 6-IV-1939, *Dawson 665* (NY). General Alvarado, playa de Miramar, II-1929, *Scala 6* (NY). Tigre, Benavidez, 2-XII-1982, *Mulgura & Cialdella 278* (US). Chubut: Futaleufú, Corcovado, s.d. (F V0314754F). Corrientes: Lavalle, Santa Lucía, Salinas Grandes, 9-XI-1978, *Schinini & Ahumada 15932* (F). Mburucuyá, Estancia Santa Teresa, 28-XII-1954, *Pedersen 3078* (US). Mercedes, Macrosistema Iberá, nacimiento del río Corriente, 3-XII-1998, *Schinini et al. 8252* (MA). Saladas, Paso Naranjito, 25-IV-1979, *Pedersen 12464* (L, NY). Formosa: Patiño, Las Lomitas, 11-XII-1984, *Schinini & Pire 24193* (F, G); Nuevo Porteño, VI-1971, *Schulz 15391* (G). S.d., *Jørgensen 2373* (US). Jujuy: Ledesma, Ruta Nac. 34, Chalicán, 9-XI-1974, *Krapovickas et al. 26682* (G). Santa Bárbara, Laguna de la Brea, 22-VI-1901, *Fries 227* (US). Río Negro: General Roca, Cinco Saltos, lago Pellegrini, cerca de orillas del lago, 15-XII-2019, *Jocou & Minué 2381* (ARC); 17-I-2019, *Jocou & Minué 2192* (ARC). S.d., 1838-1842, Wilkes Explor.



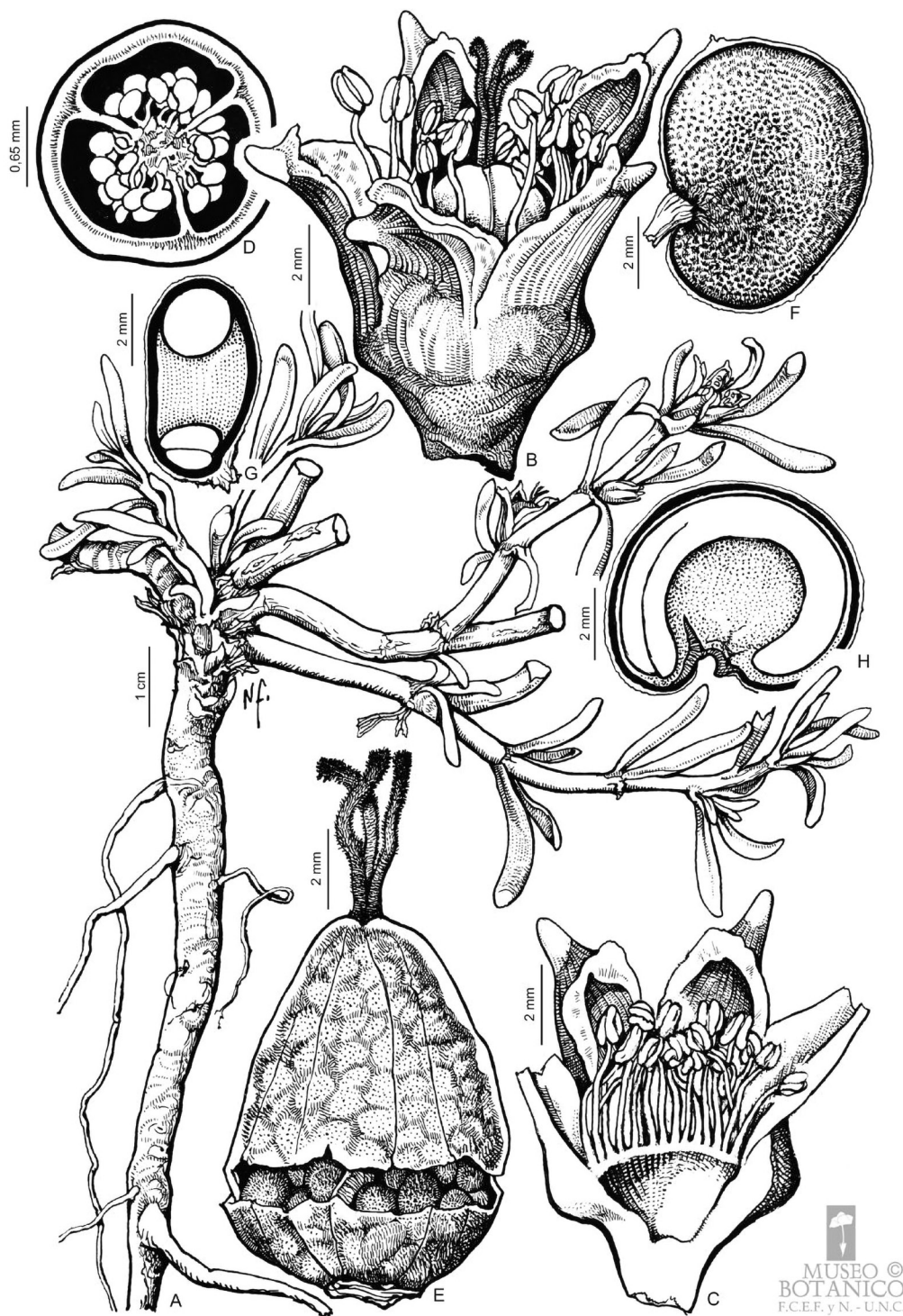


**Figure 5:** Distribution of *Sesuvium* in the Southern Cone. **A:** *S. americanum* (squares), *S. humifusum* (circle) and *S. mezianum* (asterisk). **B:** *S. sessile* (squares).

**Slika 5:** Razširjenost vrst rodu *Sesuvium* v južnem delu Južne Amerike. **A:** *S. americanum* (kvadratki), *S. humifusum* (krožci) in *S. mezianum* (zvezdice). **B:** *S. sessile* (kvadratki).

Exped., s.d. (US00830094). Salta: General Güemes, Ojo de Agua, Ruta 10, 6-9 km al NE de Gral. Güemes, 12-V-1990, *Novara & Bruno* 9875 (G). San Juan: Río de los Patos, Los Hornillos, 9-I-1953, *Castellano s.n.* (NY04242095). Santiago del Estero: Capital, Capital, 3-IV-1947, *Meyer* 12027 (NY). Tucumán: Leales, Chañar Pozo, 17-X-1919, *Venturi* 545 (US). Trancas, Tapia a Vipos, s.d., *Schreiter* 7371 (U, US). CHILE. Arica y Parinacota (I Región): Arica, Arica, río San José, quebrada junto a la playa, 14-V-1979, *Villagrán et al.* 1019 (CONC); Arica, 20-V-1917, *Skottsberg* 1361 (NY). PARAGUAY. Alto Paraguay: Palmar de las Islas, 11-III-1989, *Mereles & Ramella* 2852 (G); Laguna Palmar de las Islas, 28-IV-1995, *Ramella & Mereles* 2658 (G). Asunción: Asunción, 2-X-1889, *Morong* 789 (NY). Boquerón: Col. Fernheim, 10 km E de Campo Grande, 15-IX-1990, *Vanni et al.* 2149 (G); Col. Menno, Río Verde, Colonia Lolita, 10-IX-1990, *Vanni et al.* 1867 (G). Central: 1888-1890, *Morong* 489 (BRY); Lambaré, V-1875, *Balansa* 2262 (G).

Presidente Hayes: Campo León, Riacho Yacaré Sur, 21-III-1996, *Mereles & Degen* 6250 (G); Laguna Capitán, 17-X-2004, *De Egea et al.* 560 (G); Laguna Ganso, 14-XII-2010, *Vogt* 980 (G); Riacho Mosquito, 4-I-2012, *Vogt* 1315 (G); s.d., Río Pilcomayo, 3-V-1890, *Morong* 1042 (G, MICH, NY); Río Pilcomayo, “In regione curus inferioris fluminis Pilcomayo”, V-1906, *Rojas* 49 (G); Santa Elisa, III-1903, *Hassler & Rojas* 2821 (G). URUGUAY. Canelones: cerca de la ruta Interbalnearia, ar. Solís chico al E, 23-III-1967, *Rosengurtt* 10876 (F). Montevideo: Montevideo, Au pied du Morne de Mont Video, le long de la plage, Herbar d'Antoine Laurent de Jussieu, *Commerson* 138 (P01900029; P00680445); Carrasco, en arenas marítimas, 1934, *Legrand* 48 (F). Rocha: Paloma, Isla de la Tuna, 6-II-1948, *Castellanos s.n.* (L1693364).



**Figure 6:** Illustration of *Sesuvium sessile*. **A:** habit. **B:** flower. **C:** longitudinal section of flower. **D:** transversal section of ovary. **E:** capsule. **F–H:** seed, lateral view, cross and longitudinal section respectively; note the detachment of the aril in F. Illustrated by Nidia Flury from *Cocuci 14* (CORD) and *A.T. Hunziker 21177* (CORD). Provided by and reproduced with permission of Museo Botánico de Córdoba.

**Slika 6:** Risba vrste *Sesuvium sessile*. **A:** habitus. **B:** cvet. **C:** vzdolžni prerez cveta. **D:** prečni prerez plodnice. **E:** kapsula. **F–H:** seme, stranski pogled, prečni in stranski preseki; pozor na del arila (ovoja semena) na sliki F. Avtorica risbe Nidia Flury iz *Cocuci 14* (CORD) in *A.T. Hunziker 21177* (CORD). Objavljeno z dovoljenjem Museo Botánico de Córdoba.



## Excluded taxa from the flora of Southern Cone

*Sesuvium portulacastrum* (L.) L., Syst. Nat., ed. 10(2): 1058. 1759. *Portulaca portulacastrum* L., Sp. Pl. 1: 446. 1753 – Lectotype (designated by Wijnands 1983: 175): Kingdom of the Netherlands, Curaçao, Hermann, Paradisus Batavus seu description rariorum plantarum: 212, icon. 1698!.

This name is excluded from the flora of Southern Cone, because it has been misapplied to specimens of either *Sesuvium sessile* or *S. americanum*. This species seems to be native of Central America and widely distributed in Brazil, but not in the Southern Cone.

### Key for the identification of *Sesuvium* species occurring in the Southern Cone

1. Annual plants; pseudostipules with fimbriated margins ..... *S. humifusum*
- 1'. Perennial plants; pseudostipules with entire margins ..2
2. Stamens 3, flowers 3–5 mm long (Paraguay).....*S. mezianum*
- 2'. Stamens numerous, flowers more than 5 mm long. (widespread) ..... 3
3. Papillae usually absent, if present then not prominent, never densely covered and only in young parts; dry material green or dark green, never greyish; aril with very noticeable detachment near the cotyledon area ..
- ..... *S. sessile*
- 3'. Papillae present, prominent, densely covered in leaves, sepals and terminal parts of stems; dry material usually greyish or brown greyish; aril with small detachments near the cotyledon area.....*S. americanum*

## Conclusions

The morphological study, bibliographic revision and examined specimens, suggest that at least four species (two native and two exotic) should be accepted for the flora of the Southern Cone: *Sesuvium americanum*, *S. humifusum*, *S. mezianum*, and *S. sessile*. Furthermore, *S. portulacastrum* is excluded from the flora of the Southern Cone.

The morphological study suggest that features of the aril could be useful to distinguish *Sesuvium americanum* and *S. sessile*.


Several names of *Sesuvium* still until without resolve and should be studied for correct application.

Furthermore, studies are necessary to clarify the current distribution of taxa in the Southern Cone.

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