

OXALIS NOVEMFOLIOLATA, A NEW SPECIES OF *OXALIS* SECT. *CARNOSAE*
ENDEMIC TO THE ATACAMA DESERT OF NORTHERN CHILE

OXALIS NOVEMFOLIOLATA, UNA NUEVA ESPECIE DE *OXALIS* SECT.
CARNOSAE ENDEMICA DEL DESIERTO DE ATACAMA, CHILE

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RESUMEN

Se describe *Oxalis novemfoliolata* Heibl & Martic. del desierto de Atacama, Chile. Hasta ahora ha sido encontrada solamente en Falda Verde cerca de Chañaral. Se distingue de las demás especies halladas en el territorio chileno por sus hojas en su mayoría 9-folioladas. Tanto la morfología del cáliz, forma de vida y succulencia, así como los marcadores moleculares, la agrupan a la sección *Carnosae*.

Oxalis L. comprises about 490 species (Lourteig 2000). It reaches major diversity in southern Africa (Salter 1944) and South America (Lourteig 1994, 2000) especially in arid desert and mountain environments. Members of section *Carnosae* Reiche are typical components of the flora of the subtropical desert belt along the South American Pacific coast and their diversity is centered in the Atacama coastal desert between 24°S and 30°S with about sixteen endemic species (Lourteig 2000, Heibl 2005).

During fieldwork in the Atacama Desert in 2004 and 2005, a new species belonging to *Oxalis* sect. *Carnosae* was found. The new species is here described, illustrated and compared to other species of *Oxalis* sect. *Carnosae*.

Oxalis novemfoliolata Heibl & Martic., sp. nov.

TYPE: CHILE, Región de Atacama, Provincia de Chañaral, south-facing, steep debris-covered slopes of Falda Verde. Sparsely covered with *Heliotropium*, *Oxalis gigantea* and *Euphorbia lactiflua*, 26° 17.67' S, 70° 37.74' W, 100 m, 21.10.2005, C. Heibl 02-022 (holotype: CONC; isotypes: M, SGO) (Fig. 1, 2).

A specie affini (*Oxalis ornithopus* Phil.) differt foliis 9-foliolatis vel raro 12-foliolatis, non 3-foliolatis. Foliola ad 7-15 mm longa et 1-4 mm lata, anguste cuneata, non linearia vel peranguste elliptica.

Perennial subshrub. Elongation of internodes very much reduced and stem therefore ± short (in the range of mm to cm, depending on age of plant), about 6 mm ø, a little bit fleshy, covered by sclerified, pubescent remains of stipules and leaf bases; leaves apically crowded together. Taproot fleshy, sometimes ramified, forming one or few ovoid to conical root tuber(s) right at the stem base and sharply separated from the fibrous roots below. Leaves 9-foliolate, seldom 12-foliolate, very short-lived, therefore often less than nine leaflets present or leaves have completely vanished at the time of anthesis. Petioles up to 8 cm long, fleshy, glabrous. Leaflets 7-15 × 1-4 mm, narrowly oblanceolate to narrowly cuneate, apex rounded to retuse, base cuneate; upper leaflet surface glaucous or waxy-shining, glabrous; lower leaflet surface colliculate, sparsely pubescent at base of midvein with single, nonglandular hairs, 1-1.5 mm long. Inflorescence a dichasial cyme, each of the two partial inflorescences is a cincinnus (= non-circinate scorpioid cyme; see Buys & Hilger, 2003), internodes of cincinni well developed, laxiflorous, but sometimes internodes of cincinni contracted, giving an umbel-like appearance to inflorescence. Peduncle up to 12 cm long, fleshy, glabrous. Pedicel 5-8 mm long, glabrous. Bracts ± 3 mm long, narrowly elliptic, apex acute, margin pubescent with short, single, nonglandular hairs, 0.4-0.6 mm long. Calyx



FIGURE 1. *Oxalis novemfoliolata* Heibl & Martic., photo taken at the type locality during the 2005 field trip (Photography by C.Heibl).

FIGURA 1. *Oxalis novemfoliolata* Heibl & Martic., fotografía tomada en la localidad tipo durante la campaña de 2005 (Fotografía de C. Heibl).

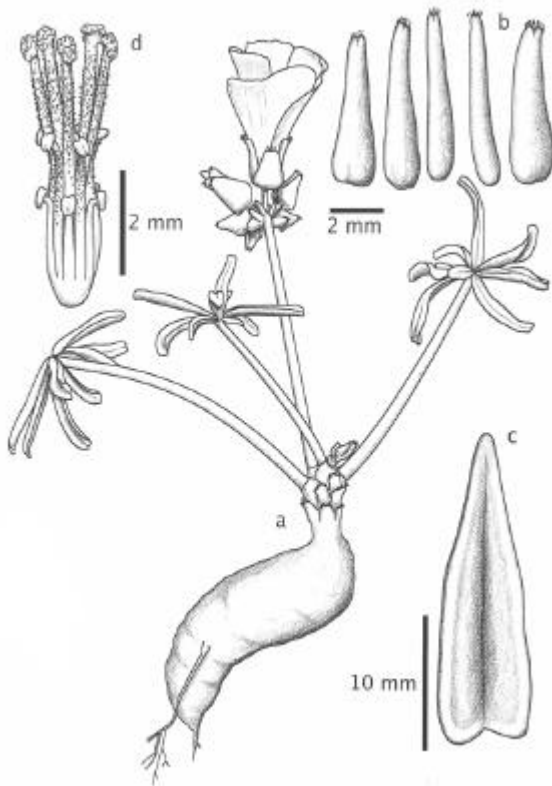


FIGURE 2. *Oxalis novemfoliolata* Heibl & Martic. (a) habit, (b) leaflet, (c) sepals, and (d) flower after removal of petals and sepals. (a) drawn after a photo taken *in situ* of an individual which showed stunted growth due to water stress. (b)-(d) drawn after a fully-developed individual (C. Heibl 01-078) from the Munich greenhouses. Note especially the differently shaped sepals in both cases. Note also that the internodes of cincinni can be much more developed than shown in (a) (see also text).

FIGURA 2. *Oxalis novemfoliolata* Heibl & Martic. (a) hábito, (b) folíolo, (c) sépalos y (d) flor después de remover el perianto. (a) dibujo según una foto tomada *in situ* de un individuo poco desarrollado debido a estrés hídrico. (b)-(d) dibujo de un individuo bien desarrollado (C. Heibl 01-078) de los invernaderos de la Universidad de Munich. Nótese la diferencias de la forma de los sépalos en ambos casos. Los entrenudos de los cincinni pueden estar mucho más desarrollados de lo que se muestra en el dibujo (a) (ver también texto).

fleshy, glaucous, with reddish sepal margins, glabrous, asymmetric: two outer sepals 6-7 × 3-4 mm broad, lanceolate to slightly hastate, apex obtuse and two inner sepals 6-7 × 1.5-2 mm broad, narrowly oblong, apex truncate to retuse, as well as a fifth sepal that is intermediate and can be described as being longitudinally split in two halves, one resembling the outer sepals and the other the inner sepals. Corolla campanulate, ± 30 mm diameter. Petals 5, connate at their base (± 4 mm), convolute, broadly spatulate, apex obtuse to subtruncate, lemon-yellow with purple outer margin on adaxial surface. Position and morphology of androecium and gynoecium vary accordingly to the tristylous condition of flowers: longs, mids, and shorts. Stamens 10, diadelphous. Filaments glanduliferous when in long and mid position, glabrous when in short position. Anthers dorsifixed, opening by longitudinal splits. Carpels 5, ovary superior, connate, forming a pistil, glabrous. Styles terminal, distinct, glanduliferous when in long or mid position, glabrous when in short position, Stigmata distinct, club-shaped, papilliferous. Capsule 6 × 2 mm, cylindrical, loculicidal dehiscence. Seeds ± 1 mm, ovoid, transversally striated, reddish brown. Chromosome number unknown.

MATERIAL STUDIED

CHILE: Region of Atacama, Prov. Chañaral, Falda Verde, i.e. slopes of Cerro Chañaral 4-5 km N of Chañaral, 100-450 m, 05.X.1997, Egli 2885 (B, CONC, SGO, ZSS); Prov. Chañaral, South-facing, stony slopes west of Falda Verde, 100-450 m, 12.XII.2004, Heibl 01-078 (M); Prov. Chañaral, South-facing, stony slopes west of Falda Verde, 100 m, 21.X.2005, Heibl 02-022 (CONC, SGO, M); Prov. Chañaral, Falda Verde, 450 m, 05.XI.2005, Schulz FV46 (ULS).

TAXONOMIC POSITION

Morphologically, *O. novemfoliolata* clearly belongs to *Oxalis* section *Carnosae* which is characterized by asymmetrical calyces with the outer sepals being deltoid, rhomboid, lanceolate or hastate, rarely ovate and the inner sepals being narrowly oblong (Lourteig 2000; Heibl *et al.* in prep.). In addition to calyx morphology, also growth form and succulence of leaves, peduncles, and sepals also suggest affiliation to section *Carnosae*. Molecular markers strongly support these findings. A non-coding cp DNA data set consisting of *psbA-trnH* spacer, *trnL* intron and *trnL-trnF* spacer confirmed the monophyly of section *Carnosae* including *O. novemfoliolata* (Heibl 2005, Heibl & Renner in prep.).

Within the section, however, *O. novemfoliolata* is unmistakably distinguished from the other species by its 9-foliolate (or seldom 12-foliolate) leaves and its narrowly cuneate leaflet shape.

DISTRIBUTION, HABITAT, AND CONSERVATION STATUS

To date *O. novemfoliolata* is only known from one locality, locally known as 'Falda Verde', e.g. the slopes between Cerro Chañaral and Cerro Falda Verde north of Chañaral (Fig. 3). At this locality it has been collected four times (Accession numbers: U. Egli 2885, C. Heibl 01-078, C. Heibl 02-022, N. Schulz FV46).



FIGURE 3. Currently known distribution of *Oxalis novemfoliolata* Heibl & Martic. It has only been collected in a small area (■ in the left panel) on the southern slopes between Cerro Chañaral and Cerro Falda Verde at an altitude between 100 and 380 m.

FIGURA 3. Distribución actualmente conocida de *Oxalis novemfoliolata* Heibl & Martic. Solamente ha sido recolectada en un área pequeña (■ a la izquierda en el mapa) sobre las laderas de exposición sur entre Cerro Chañaral y Cerro Falda Verde a una altitud ente 100 y 380 m.

The species is found from about 100 to 380 m altitude on the steep, south-facing, and debris-covered slopes of Falda Verde between coarse gravel and a sparse, xerophytic vegetation cover which is dominated by shrubby perennials such as *Eulchnia iquiquensis* K.Schum. (Britton & Rose), *Heliotropium pycnophyllum* Phil., *Oxalis gigantea* Barnéoud, and *Euphorbia lactiflua* Phil. This vegetation corresponds to the ecotone between 'Mediterranean Coastal Desert Shrub of *Gypothamnium pinifolium* Phil. and *Heliotropium pycnophyllum* Phil.' and 'Mediterranean Coastal Desert Shrub of *Euphorbia lactiflua* Phil. and *Eulchnia saint-pieana* F.Ritter (= *E. iquiquensis* (K.Schum.) Britton & Rose *sensu* Hoffmann & Walter 2004)' according to Luebert & Pliskoff (2006). The climate under which these plant communities grow is characterized by the compensatory effect of the nearby Pacific ocean and frequently occurring coastal fogs on the otherwise hyperarid desert climate with high solar radiation and erratic rainfalls.

Currently, there seems to be no direct threat to the survival of *O. novemfoliolata*. Human activities in the past such as road construction, installation of antenna towers and fog collectors have concentrated mainly on the coastal plains below and the summit region above the slopes where it grows. Nevertheless the species is inherently vulnerable due to its extremely small distributional range (as known to date) and should be explicitly considered in land managing plans concerning this area.

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