



Oxalis yalinensis, a new species of *O.* sect. *Rhombifoliae* (Oxalidaceae) from Oaxaca, Mexico

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Summary. The description of a new species of *Oxalis* sect. *Rhombifoliae* (R.Knuth) Lourteig from the state of Oaxaca, in Mexico is presented. To date, this section includes six species, of which four are American and two are from the Marquesas Islands, in French Polynesia. The new species belongs to a group of three, morphologically similar, species inhabiting areas ranging from northern Mexico to Guatemala: *Oxalis clematodes* Donn.Sm., *O. madrensis* S.Watson and *O. yalinensis* sp. nov., the latter of which is described here. These three species are compared morphologically and their geographic distributions are illustrated. The new species differs from the other two mostly by the obcordate leaflets and the inflorescences with shorter peduncles and bracts. This manuscript also includes a preliminary conservation assessment of *O. yalinensis* based on IUCN guidelines.

Key Words. Conservation, endemism, IUCN, North America, taxonomy.

Resumen. En este manuscrito presentamos la descripción de una especie nueva de *Oxalis* sect. *Rhombifoliae* (R.Knuth) Lourteig del estado de Oaxaca, México. Hasta el momento, esta sección incluía seis especies, de las cuales cuatro son americanas y dos de las Islas Marquesas, en la Polinesia Francesa. La nueva especie pertenece a un grupo de tres especies morfológicamente similares que habitan en áreas que abarcan desde el norte de México hasta Guatemala: *Oxalis clematodes* Donn.Sm., *O. madrensis* S.Watson, y *O. yalinensis* sp. nov., esta última descrita en el presente trabajo. Estas tres especies son comparadas morfológicamente y se ilustran sus distribuciones geográficas. La especie nueva se distingue de las otras dos principalmente por presentar folíolos obcordados y por las inflorescencias con pedúnculos y brácteas más cortos. Este manuscrito también incluye una evaluación preliminar del estado de conservación de *O. yalinensis* con base en los lineamientos de la UICN.

Introduction

Oxalis L. is the largest genus in the Oxalidaceae, with 500–550 described species (Mabberley 2017; Frey 2022) with two main centres of diversity: the tropical and subtropical Americas and southern Africa. The genus has been the subject of several regional taxonomic studies (e.g., Progel 1877; Knuth 1930; Salter 1944; Lourteig 1994, 2000; Lopez 2017) and recent updates of species circumscriptions (e.g., Nuernberg-Silva & Fiaschi 2021; Vasques *et al.* 2025; Fiaschi *et al.* 2025), but due to its large size it remains in need of further updates, offering opportunities for global cooperation (Moonlight *et al.* 2024).

There are approximately 30 species of *Oxalis* in Mexico, and the country is home to species from three of the four currently recognised subgenera *sensu* Lourteig (1994, 2000), *O.* subg. *Monoxalis*, *O.* subg. *Oxalis* and *O.* subg. *Thamnoxys*. The subgenus with the greatest species richness in Mexico is *O.* subg. *Oxalis*, with representatives from three sections: *O.* sect. *Corniculatae* (c. 2 spp.), *O.* sect. *Ionoxalis* (20 spp. *sensu* Denton 1973), and *O.* sect. *Rhombifoliae* (4 spp.).

While reviewing the *Oxalis* specimens at MEXU, we came across a few specimens of *O.* sect. *Rhombifoliae* that differ from the morphologically similar *O. clematodes* Donn.Sm. and *O. madrensis* S.Watson by several vegetative and reproductive traits (Watson 1890; Donnell-Smith 1893). These specimens were collected as part of a floristic inventory conducted at the request of the local community of Yalina, Oaxaca and are here described as a new species. *Oxalis yalinensis* is described, illustrated, and compared with these two morphologically similar species. A provisional conservation assessment is also provided for the new species, as well as a geographic distribution map showing the disjunction among the three species.

Materials & Methods

All analysed specimens are deposited at MEXU and were studied using an Olympus SZ60 stereoscopic microscope. Morphological terminology follows Radford *et al.* (1976) for plane and solid shapes, Eiten (1963) for

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indument abundance and Beentje (2016) for all other structures. The geographic distribution map was created using QGIS version 3.24 (<http://www.qgis.org>), and the preliminary conservation assessment was based on IUCN categories and criteria (IUCN 2024). For the calculation of the extent of occurrence (EOO) and area of occupancy (AOO) we used GeoCAT (Bachman *et al.* 2011) based on the geographic coordinates of available specimens. Herbarium labels and field observations were used to compile ecological and phenological data.

Taxonomic Treatment

***Oxalis yalinensis* Fiaschi sp. nov.** Type: México. Oaxaca, Santa María Yalina, Villa Alta, Paraje "Piedra boluda", a 1.2 km al NE de la cabaña de la empresa forestal, 17°17'17.1"N 96°17'08.7"W, 20 Feb. 2020, K. Velasco-Gutiérrez *et al.* 7352 (holotype MEXU [1586847]; isotype: FLOR). Fig. 1, Map 1.

<http://www.ipni.org//urn:lsid:ipni.org:names:77371734-1>

Erect to procumbent *shrubs* or *subshrubs* 50 – 100 cm long, with an elongate, monopodial axis, and lateral branches acropetally decreasing in length; old stem with sparse to moderate, antrorse, appressed hairs; young branches with abundant, antrorse, appressed hairs. *Leaves* digitate, trifoliolate; petioles 1 – 3 cm long, adaxially canaliculate, with sparse to moderate, appressed to ascending hairs to c. 0.5 mm long, the bases only slightly enlarged, leaving a thickened remnant after leaf abscission; petiolules up to c. 0.5 mm long, the terminal one slightly larger than the lateral ones. Leaf blades obcordate, the terminal one 6 – 18 × 6 – 18 mm, symmetric to slightly asymmetric, the apex incised c. 1/10 of the blade length, the lateral ones 5.5 – 14 × 5 – 12 mm, asymmetric, the proximal half clearly smaller than the distal half, the apex incised c. 1/10 of the blade length; adaxial surface glabrous, abaxial surface glabrescent, with moderate to abundant, appressed hairs c. 0.5 mm long restricted to the midrib, margin sparsely to moderately ciliate. *Inflorescence* a depauperate, 1 – 2-flowered cyme; peduncle 14 – 22 mm long, with moderate to abundant, appressed to ascending hairs; bracts 0.5 – 0.8 mm long, linear, alternate or subopposite, the first one or two sometimes sterile or each with a branch 4.5 – 5.5 mm long; pedicel above the branch articulation 1.5 – 3 mm long, indumentum as on the peduncle, but with more abundant and appressed hairs. *Flowers* with unequal sepals; the outer two slightly smaller, c. 3 – 3.5 × 1 mm, with occasional, single hairs, apices acute to rounded, pilose; inner ones c. 3.8 – 4 × 1.5 mm, glabrous, apices pilose; corolla c. 12 mm long, yellow, with faint, reddish lines above the throat; androgynophore c. 0.5 mm long; flower brevi-styled; filaments connate for c. 1.2 mm; shorter filaments c. 3.5 mm long, non-ligulate,

with moderate, setose hairs; longer filaments c. 4.5 mm long, non-ligulate, with abundant, setose hairs; anthers c. 0.4 × 0.4 mm; ovary c. 1 mm long, styles c. 1.2 mm long, stigma bilobed; mid-styled and long-styled flowers unknown. *Capsules* c. 5 × 2.5 mm (excluding the styles), elliptic, longer than the persistent calyx lobes, with very abundant, antrorse, appressed hairs.

RECOGNITION. *Oxalis yalinensis* is placed among the American species of *O.* sect. *Rhombifoliae*, which share a shrubby, erect to procumbent habit, leaves with digitate, 3-foliolate leaflets with an acute to shallowly incised apex, erect fruits, non-ligulate stamens and complanate, costate, transversely striate seeds with acute protuberances (Lourteig 2000). The most similar species are *O. clematodes*, from Guatemala and southern Mexico (Chiapas State) and *O. madreensis*, which is endemic to northeastern Mexico (Nuevo León and Tamaulipas States). Table 1 presents a morphological comparison between these three species and Map 1 illustrates their disjunct geographic distributions.

DISTRIBUTION AND HABITAT. *Oxalis yalinensis* is only known from the Sierra Norte region, in the state of Oaxaca (Map 1), ranging from 1500 to 2650 m elev. This area is located in the Sierra Madre de Oaxaca physiographic sub-province, within the upper Papaloapam River basin. The substrate is composed of extrusive igneous rocks from the Cenozoic era, the predominant soil type is dystric cambisol, defined by being highly acidic, nutrient-poor, and susceptible to erosion, with a medium texture (INEGI 2014).

Oxalis yalinensis occurs in a few areas of *Pinus-Quercus* and *Quercus-Pinus* forest with some elements of mesophyllous montane forest. The forest is characterised by *Pinus patula* Schiede ex Schltdl. & Cham. and *Pinus pseudostrobus* Lindl., whose individuals reach 30 m tall. A second tree layer, between 12 and 20 m, is dominated by *Quercus laurina* Bonpl., *Q. ocoiteifolia* Liebm., *Q. scytophylla* Liebm., *Clethra galeottiana* Briq., *C. mexicana* DC., *Persea americana* Mill., *Bejaria aestuans* Mutis, *Styrax ramirezii* Greenm., and *Ahnus acuminata* Kunth. Above 5 m tall, young trees of the dominant species are combined with *Litsea glaucescens* Kunth, *Oreopanax xalapensis* (Kunth) Decne. & Planch., *Viburnum disjunctum* C.V.Morton, and *Ternstroemia* sp. The understory features *Cestrum fasciculatum* (Schltdl.) Miers, *Persea palle-scens* (Mez) Lorea-Hern., and *Fuchsia paniculata* Lindl. Sheltered ravines house species such as *Tilia americana* var. *mexicana* (Schltdl.) Hardin, *Prunus serotina* Ehrh., *Ocotea betazensis* (Mez) van der Werff, *Cyathea myosuroides* Domin, *Saurauia pringlei* Rose, *Cleome magnifica* Briq., *Begonia oaxacana* A.DC., *Deppea* aff. *obtusifolia* (Benth.) Benth., *Asclepias pellucida* E.Fourn., *Crusea coccinea* DC., *Asplenium sessilifolium* Desv. and *Polystichum hartwegii* (Klotzsch) Hieron, among other herbaceous plants, all of which share the habitat with *Oxalis yalinensis*.



Fig. 1. *Oxalis yalinensis*. **A** habit; **B – C** flowering branch, details; **D** comparison between the leaf of *O. yalinensis* (left, based on Velasco-Gutiérrez et al. 7352, MEXU) and the terminal leaflets (tl) of *O. clematodes* (middle, based on Breedlove & Almeda 58220, MEXU) and *O. madrensis* (right, based on Martínez 5326, MEXU). **A – C** photos from the field.



Map 1. Distribution map of *Oxalis yalinensis* and two morphologically similar species, *O. clematodes* and *O. madrensis*.

ADDITIONAL SPECIMENS EXAMINED. MÉXICO. Oaxaca: Santa María Yalina, Villa Alta, Paraje Ya ghuazheé, a 1.4 km en LR al SE de la cabaña forestal, 17°17'07.3"N 96°16'23.4"W, 2129 m elev., 14 April 2021, *K. Velasco-Gutiérrez et al.* 7748 (MEXU); Teotitlán del Camino, Dto. Teotitlán, 24 km al oeste de Huautla, carr. Huautla-Teotitlán, 19 July 1992, *L. C. Arriaga* 44 (MEXU).

CONSERVATION STATUS. *Oxalis yalinensis* is known from only three collections, but two of these (*Velasco-Gutiérrez et al.* 7352 and 7748) were collected in nearby sites, corresponding to the same location sensu IUCN (2024). Due to this, we could not estimate its EOO and AOO using GeoCAT, these parameters were automatically set as zero, and the species was categorised as Critically Endangered [CR]. However, we prefer to treat this species provisionally as Data Deficient [DD] until new samples are collected, and proper estimations of both EOO and AOO can be made.

The sites where *Oxalis yalinensis* is found are part of the general forestry area used by the community of Santa María Yalina. The species used there for timber are *Pinus patula* and *P. pseudostrobus*; *Quercus* species are occasionally used for fuel. The remoteness of these

sites from populated areas and main roads, their location within stands of low commercial interest and the fact that the community has Forest Stewardship Council (FSC, <https://uk.fsc.org>) certification promoting sustainable practices in forest resource management, could be considered factors that reduce immediate threats to *O. yalinensis*, as long as this community is made aware of it, through good forest management practices.

ETYMOLOGY. The chosen epithet honours the community of Santa María Yalina, where the type material of *Oxalis yalinensis* was collected.

NOTES. This new species belongs to *Oxalis* sect. *Rhombifoliae* sensu Lourteig (2000), which now includes five Central and North American species from Mexico and Guatemala south to northern South America (*O. rhombifolia* Jacq.), and two species from the Marquesas Islands in French Polynesia (Fosberg & Sachet 1981; Lorence & Wagner 2011). The placement of *O. gagneorum* Fosberg & Sachet, one of these Polynesian species, among an otherwise American section by Lourteig (2000) was likely based on the shrubby habit, the inconspicuous stipules, and the sclerified leaf bases after leaves fall off, but these

Table 1. Morphological comparison of *Oxalis yalinensis* and two similar species from *O.* sect. *Rhombifoliae* (sensu Lourteig 2000).

Character/species	<i>O. clematodes</i>	<i>O. madrensis</i>	<i>O. yalinensis</i>
Terminal leaflet, shape	obovate to widely obovate	widely obovate to very widely obovate	obcordate
Terminal leaflet, size (mm)	10 – 16 × 8 – 11	15 – 23 × 11.5 – 22	6 – 18 × 6 – 18
Terminal leaflet, apex	not incised or very shallowly incised (to c. 1/25)	incised 1/10 to 1/20	incised c. 1/10
Terminal leaflet, indumentum (adaxially)	moderate to abundant, appressed hairs	glabrous or with moderate, appressed hairs	glabrous
Terminal leaflet, indumentum (abaxially)	moderate to abundant, appressed hairs	glabrescent, with appressed hairs restricted to the midrib or with moderate, appressed hairs	glabrescent, with appressed hairs restricted to the midrib
Peduncle length (mm)	20 – 50	46 – 73	14 – 22
Bracts arrangement	opposite	opposite	alternate or subopposite
Bracts length (mm)	2 – 2.5	1.5 – 3	0.5 – 0.8
Pedicle length (in flower, mm)	2.5 – 3	8 – 13.5	1.5 – 3
Outer sepals indumentum	only single hairs, especially along the margin	only single or with single and septate, longer hairs (most proximally) along the margin	only single hairs, occasional to sparse throughout
Capsule shape (excluding styles)	elliptic	narrowly oblong	elliptic
Capsule indumentum	very abundant, antrorse appressed hairs	only single or intermixed single and septate hairs along the locules slits	very abundant, antrorse appressed hairs

traits could have evolved independently in the American and Polynesian species. Unfortunately, species of *O.* sect. *Rhombifoliae* have never been included in phylogenetic studies, and the relationship between the American and Polynesian species remains to be tested.

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Declarations

Author's Contributions PF designed the study and prepared a first draft of the manuscript, which was

reviewed by KVG and MP, who also carried out fieldwork in the state of Oaxaca.

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Conflicts of interest The authors declare no conflicting interests in this manuscript.

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