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RESEARCH ARTICLE

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Reassessment of the taxonomic status of *Oxalis fabaefolia* (*Oxalidaceae*) and the description of a unique variety of *Oxalis flava* from the Northern Cape Province of South Africa

L.L. Dreyer[1], K.C. Oberlander[1], F. Roets[2]

Key words

Oxalidaceae
Oxalis fabaefolia
Oxalis flava
phylogeny
taxonomy

Abstract Southern African *Oxalis* taxonomy is complicated by tremendous morphological variation. The widely distributed *Oxalis flava*, for example, currently contains eight morphologically distinct forms. The remaining members of sect. *Crassulae* display morphological characters distinctive enough to retain specific status, despite resemblance to forms of the broadly defined *O. flava*. Recent collection of a taxon with strong morphological affinities to species in sect. *Crassulae* generated much interest. In this study we assess the placement of this new taxon to members of sect. *Crassulae* based on analyses of DNA sequence data of the Internal Transcribed Spacer (ITS) region and morphological comparisons. Results show that most members of sect. *Crassulae* are distantly related to *O. flava*. However, our morphological and molecular data strongly suggested that the newly collected taxon represents yet another form of *O. flava*. In addition, these data show *O. fabaefolia* to be nested within *O. flava*, suggesting that it should be synonymised under this broadly defined species. Both the new taxon and *O. fabaefolia* display unique morphological characters, allowing them to be considered separate subspecific taxa of *O. flava*. Thus the taxa *O. flava* var. *fabaefolia* and *O. flava* var. *unifoliolata* are here proposed.

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INTRODUCTION

Southern African members of the large genus *Oxalis* L. include numerous species complexes that show considerable morphological variation across their distribution ranges (Salter 1944). The *Oxalis flava* L. complex (sect. *Crassulae*) represents one of the most variable examples. It is widespread in the western coastal belt of the Cape Floristic Region (CFR), where it naturally occurs on both shale and sandstone soils. The extreme variation displayed by this species is reflected in its taxonomic history and the number of described forms. *Oxalis flava* was first described by Linnaeus (1753) in Species Plantarum. Jacquin (1794) recognized *O. flava* as a valid species, and newly described putatively related species *O. flabellifolia* Jacq., *O. lupinifolia* Jacq. and *O. pectinata* Jacq. He failed to recognize the presence of tristyly in *Oxalis*, resulting in his description of the three floral morphs normally found within a single species as separate taxa. Salter (1944) reduced all three of these species to synonyms of *O. flava*, and recognized them as forms based mainly on petiole margin, indument, and leaflet and sepal shape. He suggested that numerous characters (including various bulb and contractile root characters) may aid the demarcation of taxonomic groups in this species, although he failed to recognize any additional characters to support such a classification. He conceded that even the forms recognized in his taxonomic treatment displayed some character overlap, rendering the subdivision of this complex group-species almost impossible based on morphological characters alone. Ultimately Salter (1944) recognized eight morphologically distinct forms (Form A to Form H) based mainly on petiole, leaflet and sepal characters.

[1] Stellenbosch University, Department of Botany and Zoology, Private Bag X1, Matieland, 7602, South Africa;
corresponding author e-mail: kco@sun.ac.za.
[2] Stellenbosch University, Department of Conservation Ecology and Entomology, Private Bag X1, Matieland, 7602, South Africa.

Jacquin (1794) also described another seemingly related group of species, *O. asinina* Jacq., *O. crispa* Jacq., *O. fabaefolia* Jacq., *O. lanceaefolia* Jacq. and *O. leporina* Jacq., and distinguished between them based on corolla colour, leaf shape and stylar morph type. Salter (1944) synonymised all of the species in this group under *O. fabaefolia*, placing *O. asinina*, *O. lanceaefolia* and *O. leporina* under *O. fabaefolia* Form B, but maintained *O. fabaefolia* and *O. flava* as separate species based on the presence of winged petioles in the former. He did, however, concede that certain forms of *O. flava* are scarcely distinguishable from *O. fabaefolia* Form B.

Compared to *O. fabaefolia* and *O. flava*, other species included in sect. *Crassulae* (*O. cathara* T.M.Salter, *O. flaviuscula* T.M.Salter, *O. louisae* T.M.Salter, *O. namaquana* Sond., *O. pulvinata* T.M.Salter and *O. salteri* L.Bolus) are morphologically well defined. However, like most taxonomic sections currently recognized in southern African *Oxalis*, the monophyly of the section is in question. DNA-based phylogenetic reconstructions of the genus (Oberlander et al. 2004) showed that all members of this section are not monophyletic, although *O. fabaefolia* and *O. flava* consistently resolved together with very strong support.

Although sect. *Crassulae* is currently rather loosely defined, several characters are shared by the included species. Members of the section are stemless, somewhat succulent plants often with enlarged petiole bases. The petioles are basally distinctly articulated, and are mostly conspicuously widened below the basal articulation (Salter 1944). Within sect. *Crassulae*, unifoliolate leaves are found in three species: *O. fabaefolia*, *O. flava* Form G and *O. salteri*. Of these, *O. salteri* is the only species in which mature plants consistently develop only one leaflet per leaf. In both of the other species, the formation of unifoliolate leaves is always the exception, present only in a few (mostly younger) individuals in any given population (Salter 1944). The discovery of several populations of individuals with morphol-

Table 1 Morphological characters evaluated in comparisons between various *Oxalis* species.

Character	*O. flava*	*O. fabaefolia*	*O. salteri*	New taxon
Plant indument	Usually entirely glabrous (Form B with short multicellular hairs on petioles and sometimes peduncles)	Entirely glabrous	Entirely glabrous	Rhizome, filaments and styles with glandular hairs; leaflet margins, peduncles, bracts and sepal margins with soft multi-cellular hairs
Bulb shape	Oval to ovoid	Ovoid to ovoid-conical	Globose-conical, often deformed	Oval to ovoid
Petiole base (below basal articulation)	Dilated	Dilated and scale-like	Not dilated	Not dilated
Petiole wings	Mostly absent, with narrow cartilaginous margin in Form F	Foliaceous wings present	Absent	Narrow wings present
Leaflet number	2–12 (Form G: juveniles 1)	2–5, juveniles 1	1	1
Petiole length	20–30 mm	15–25 mm	3–5 mm	20–30 mm
Leaflet shape	Linear, oblong, cuneate, cuneate-obovate or obovate	Suborbicular, elliptical, obovate or oblanceolate	Broadly elliptical or ovate	Obovate to elliptical
Petal length	14–30 mm	20–30 mm	18–23 mm	20–30 mm
Petal orientation	Petals curved back at 30–60° beyond tube	Petals curved back at 30–60° beyond tube	Petals curved back at > 60° beyond tube	Petals curved back at 30–60° beyond tube

ogical similarities to members of sect. *Crassulae*, but with consistently unifoliolate leaves, was thus of considerable interest. These populations were discovered between Nieuwoudtville and Loeriesfontein in the Northern Cape Province, South Africa. Superficially these populations resembled *O. salteri* based on the presence of unifoliolate mature leaves, a character known from only four other unrelated southern African species. Closer examination revealed that it differs from *O. salteri* in terms of bulb, indumentum, petiole and petal characters. The oval to ovoid bulbs, presence of multicellular hairs, petiole length and angle of petal deflection in plants of this population are more similar to characters of *O. fabaefolia* and *O. flava* than to those of *O. salteri*. In addition, *O. salteri* is only known from west of the Nieuwoudtville escarpment. In this study we evaluate the taxonomic placement of plants from these newly collected populations within *Oxalis* sect. *Crassulae* using comparative morphology and DNA sequence data.

MATERIALS AND METHODS

Morphological assessment

The morphology of the newly collected specimens was studied and compared with fresh material of *O. fabaefolia*, *O. flava* and *O. salteri* obtained from the field and the *Oxalis* living collection in the Stellenbosch University Botanical Garden, Stellenbosch, South Africa. This was supplemented by herbarium material from Stellenbosch University (STEU), Compton (NBG) and Bolus (BOL) herbaria. The following specimens of *O. salteri* were included in morphological comparisons: South Africa, Western Cape Province, road leading towards Gifberg, *Siqueira & Zietsman 45*, STEU (MO 755); Suttridge Farm, 21 km on road to Nieuwoudtville, *L.M. Mucina 310508/2*, STEU (MO 1087); on road between Nieuwoudtville and Vanrhynsdorp, *L.L. Dreyer 646*, STEU (MO 1137).

DNA sequencing and molecular analysis

Phylogenetic reconstructions were based on DNA sequence data obtained from the nuclear Internal Transcribed Spacer region (ITS). DNA of the potential new taxon was extracted and sequenced at the DNA sequencing facility of Stellenbosch University. Total genomic DNA was extracted using a NucleoSpin (R) 96 Plant genomic DNA extraction kit (Macherey-Nagel) on a Genesis 200RMP liquid handler (Tecan). PCR, sequencing, contig creation and alignment of the sequence data followed Oberlander et al. (2009b). In order to place the new taxon correctly in the context of southern African *Oxalis*, sequences of seven of the eight species of sect. *Crassulae* were included, along with other potential close relatives (Oberlander et al.

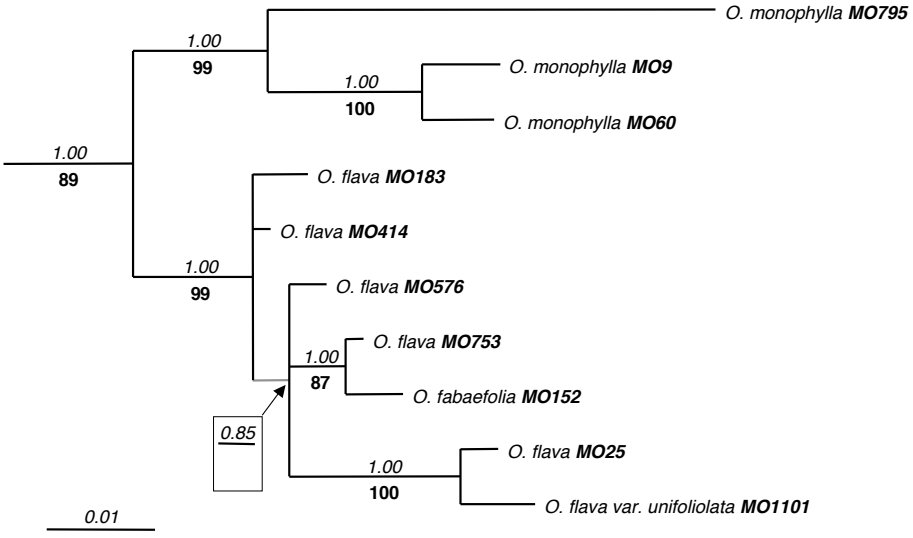

Fig. 1 Excerpt from the larger-scale analyses showing the Bayesian majority-rule consensus tree of *O. monophylla* and the *O. flava* species complex. Numbers above the branches indicate Bayesian Posterior Probability values, numbers below the branches refer to Parsimony Bootstrap values. Branches that collapse in the parsimony strict consensus tree are indicated in grey.

2004). Multiple accessions of *O. flava* were included to represent the morphologically diverse forms of this species. All generated sequences were submitted to the NCBIs GenBank nucleotide database (http://www.ncbi.nlm.nih.gov; Genbank accession numbers available in Oberlander et al. 2009a). Parsimony analyses were conducted in PAUP* v4.0b10 (Swofford 2003), using branch and bound searches. Support levels at nodes were assessed using nonparametric bootstrap (10 000 replicates). Bayesian Inference was conducted using MrBayes v3.1.2 (Ronquist & Huelsenbeck 2003) under the model of sequence evolution as chosen in MrModeltest v2.2 (Nylander 2004). Two separate analyses of five million generations each were run, using four chains per analysis. Burn-in values were determined using standard diagnostic convergence procedures available in MrBayes.

RESULTS

Morphological assessment

Morphological characters included in comparisons between *O. fabaefolia*, *O. flava*, *O. salteri* and the newly collected taxon are presented in Table 1. Morphologically the newly collected taxon is closely related to species in *Oxalis* sect. *Crassulae* based on the semi-succulent habit and the large papery scales at the nodes. It can be distinguished from all three other taxa by the presence of glandular hairs on the rhizome, filaments and styles. Also unique to the newly collected taxon is the presence of multicellular hairs on the leaf margins. Except for the winged petioles of *O. fabaefolia*, no other constant characters separate *O. fabaefolia* and *O. flava*.

DNA sequencing and molecular analysis

The final alignment included 39 taxa and 803 characters, with 106 (13.2 %) parsimony-informative characters. Gaps were coded as missing data. Parsimony analysis yielded 3 202 trees of 371 steps in length. Bayesian Inference was conducted using the GTR + I + Γ model as selected by MrModeltest. The first 1 000 sampled generations were discarded as burn-in and remaining trees from both runs were combined into a 50 % majority-rule consensus tree (Fig. 1).

Members of *Oxalis* sect. *Crassulae* did not resolve in a single clade. The species *O. cathara*, *O. flaviuscula*, *O. louisae*, *O. namaquana* and *O. salteri* are not sister to *O. flava*, and are consequently not discussed further. The specific placement of these species will be dealt with in a more appropriate article (Oberlander et al. in prep.). All included accessions of *O. fabaefolia*, *O. flava* and the newly collected taxon resolved in a strongly supported clade (Fig. 1). *Oxalis monophylla* is sister to this clade with strong support. Both the newly collected taxon and *O. fabaefolia* resolved deeply embedded within *O. flava*.

DISCUSSION

Morphologically the newly-collected taxon shows considerable character overlap with *O. flava*, but is distinct from other species (*O. cathara*, *O. flaviuscula*, *O. louisae*, *O. namaquana*, *O. pulvinata* and *O. salteri*) currently included within *Oxalis* sect. *Crassulae*. The only constant characters that regularly distinguish this taxon from all other forms of *O. flava* are the presence of glandular hairs and the consistent formation of unifoliolate leaves. Similarly, the only distinction between *O. fabaefolia* and *O. flava* is the presence of winged petioles in the latter species.

Phylogenetically the newly-collected taxon resolved within the *O. flava* complex, with strong support. It forms a well-supported sister relationship with *O. flava* collected from the De Doorns (MO 25) area in South Africa, more than 200 km further south. This population represents the typical form (Form A, Salter 1944) of *O. flava*. Similarly, the ITS sequence of *O. fabaefolia* is strongly supported as being sister to an accession of *O. flava* (MO 753) collected near Nieuwoudtville in the Northern Cape Province, South Africa. This population of *O. flava* (MO 753) is morphologically very dissimilar to *O. fabaefolia* in being slender and delicate with linear, vertically oriented, almost graminoid leaflets. Both taxa are from the same general geographic area (Nieuwoudtville / Vanrhynsdorp), but occupy very different habitats.

Oxalis flava represents one of the morphologically most variable species complexes among South African *Oxalis*. Leaflet numbers vary from 2 to 12, leaflet shapes vary from linear to obovate and levels of above-ground stem exertion vary from absent in most forms to well-developed in populations near Klawer, Western Cape Province, South Africa. This species displays considerable flower colour polymorphism, with more than one colour often occurring sympatrically in the same population. These characters stay constant between forms when these are removed from the field and cultivated under nursery conditions, suggesting a genetic basis for these characters.

The intra-specific demarcation of *O. flava* is thus extremely complicated, and it may be subdivided once focused studies on this complex have been conducted. Preliminary cytological results (Jan Suda, pers. comm.) have revealed extensive cytological variation in this species, with ploidy levels of 2n = 2, 4, 6, 8, 10 and 12 reported. A focused, large-scale, intra-specific phylogeographical and cytological study of *O. flava* is needed to tease apart potentially separate lineages in this complex. Given that both *O. fabaefolia* and the new taxon form well supported sister relations with members of *O. flava* in the molecular phylogeny, and in the interest of consistency, we propose that both the newly collected taxon and *O. fabaefolia* be synonymised as conspecific with *O. flava*. In recognition of their distinctive morphological characters and geographical distribution, however, we propose that both taxa be recognized as varieties of *O. flava*.

TAXONOMIC TREATMENT

1. *Oxalis flava* L.

Oxalis flava L. (1753) 433. — *Acetosella flava* (L.) Kuntze (1891) 91. — Iconotype: Burman Rariorum africanarum plantarum 1738: 68, t. 27, f. 4.

Oxalis lupinifolia Jacq. (1794) 115. — *Acetosella lupinifolia* (Jacq.) Kuntze (1891) 91. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 72.

Oxalis flabellifolia Jacq. (1794) 117. — *Acetosella flabellifolia* (Jacq.) Kuntze (1891) 91. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 74.

Oxalis pectinata Jacq. (1794) 118. — *Oxalis flava* L. var. *pectinata* (Jacq.) Sond. (1860) 347. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 75 & 78, f. 2.

Stemless geophyte, 10–190 mm tall when in flower. *Bulb* ovate, widely ovate, widely elliptical or circular, base round, apex tapering to acute, dark brown, reddish brown or light brown; tunics glabrous, hard or papery and smooth. *Rhizome* 30–160 mm, tunic thin and soft to thick and hard, mostly glabrous, seldom scantly covered with glandular hair towards apex and glabrescent below; scales mostly present, positioned at regular intervals along rhizome, attachment sheathing. *Above-ground stem* absent or well exerted, up to 200 mm long, many-branched with short or elongated internodes. *Leaves* rosulate, 2–30 per plant, petiolate, petioles (5–)20–30(–130) mm long, semi-succulent, round in cross-section, with distinct upper and lower articulations, sometimes narrowly (0.5 mm) to broadly (10–12 mm) winged, base widened. *Leaflets* 1–12, sessile to shortly

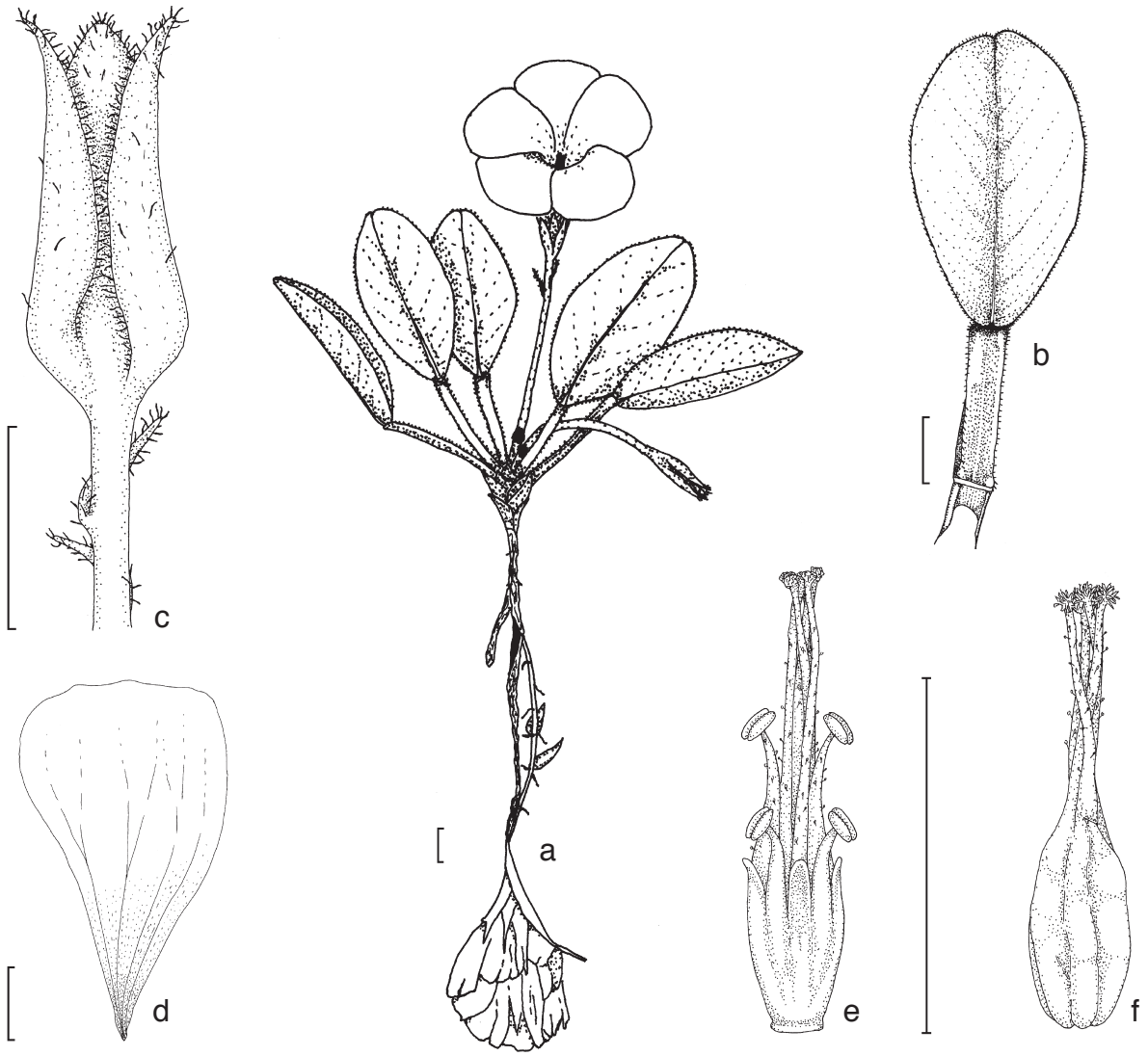

Fig. 2 *Oxalis flava* L. var. *unifoliolata* Dreyer & Oberl. a. Mature plant; b. leaf; c. calyx; d. petal; e. androecium and gynoecium; f. gynoecium. — Scale bars = 5 mm.

petiolulate, erect to palmately spreading, 8.5–63.0 by 11–38 mm, linear, oblong, elliptical, cuneate, cuneate-obovate or obovate, occasionally beset with small reddish dots, abaxially and adaxially glabrous, occasionally shortly petiolulate, sometimes with multicellular hairs restricted to the margin, base attenuate, obtuse or cuneate, margin entire, more or less cartilaginous, occasionally undulate, apex obtuse to minutely emarginate. *Peduncle* 1-flowered, 4–170 mm long, green, glabrous to sparsely covered with long multicellular hairs, base articulated and occasionally widened; *bracts* 2, alternate, above middle of peduncle to just under sepals, filiform, narrowly oblong or narrowly elliptical, glabrous or occasionally with multicellular hairs, 2–5 mm long, apex round, occasionally callose. *Sepals* 4–11 by 1–4 mm, shape variable, margin entire, apex round, obtuse, acute to acuminate, occasionally callose, abaxially and adaxially glabrous, sometimes with multicellular or simple hairs along margins. *Petals* 14–30 by 6–19 mm, lobes yellow, white or pale rose mauve, occasionally with red borders, obovate to spathulate, glabrous, margin entire, apex round or truncate, a few calli occasionally present at the tip, tube broad, yellow, funnel-shaped. *Stamens* 10, in two whorls at two different heights in the long, mid or short position of this tristylous species, short position anthers 2–4 mm long, mid position anthers 4–5 mm long, long position anthers 5–7 mm long. *Filaments* with sparse glandular hairs along entire length, blunt teeth separate to adnate to longer filaments, sometimes apically outwardly deflexed. *Anthers* dorsifixed, oblong, extrorse. *Pollen* yellow, tricolporate, tectum reticulate. *Ovary* ovoid, 5-lobed, 2.5 mm long, 5-loculed with 3 ovules per locule, translucent, glabrous; styles 5, separate, erect, short (2–4 mm long), mid (4–5 mm long) or long (5–7 mm long) depending on floral morph, covered with simple or glandular hairs on upper half; stigma yellow, fimbriate. *Fruit* a 5-locular capsule, globular to subglobular, shorter than sepals. *Seed* exendospermous.

Distribution — South Africa, Northern and Western Cape Provinces. Namaqualand south to Cape Peninsula, eastwards to Riversdale.

Diagnostic characters — Geophyte with fibrous bulb, mostly semi-succulent. Number of leaflets ranging from 1–10. Petiole round, sometimes winged. Leaflet margins smooth to undulate. Flowers large, funnel-shaped with broad tube, petals white, light pink or yellow.

KEY TO THE VARIETIES

1. Plant entirely glabrous, leaflets 2–5, petiole wings 10–12 mm wide . . . . . a. var. *fabaefolia*
1. Plant covered with multicellular hairs on most plant parts, leaflets 1, petiole wings up to 0.5 mm wide . . . . . b. var. *unifoliolata*

Fig. 3 a–c: *Oxalis flava* L. var. *unifoliolata* Dreyer & Oberl. a. Flower; b. typical habit; c. side view. — d. *Oxalis salteri* L.Bolus side view.

a. var. ***fabaefolia*** (Jacq.) Dreyer & Oberl., *comb. nov.*

Oxalis fabaefolia Jacq. *Oxalis* Monographia Iconibus Illustrata (1794) 27. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 27.
Oxalis crispa Jacq. (1794) 23. — *Acetosella crispa* (Jacq.) Kuntze (1891) 90. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 23.
Oxalis asinina Jacq. (1794) 59. — *Acetosella asinina* (Jacq.) Kuntze (1891) 91. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 24.
Oxalis leporina Jacq. (1794) 60. — Iconotype: *Oxalis* Monographia Iconibus Illustrata 1794: t. 26.
Oxalis lanceaefolia Jacq. (1794) 61. — Iconotype: Jacq. *Oxalis* Monographia Iconibus Illustrata 1794: t. 26.

Diagnostic characters — Stemless, succulent geophyte. Petioles with prominent wings, 10–12 mm broad. Leaflets 2–5, broadly elliptical to obovate, margins sometimes undulate. Flowers yellow, pale mauve or white.

Geographic distribution — *Oxalis flava* var. *fabaefolia* occurs in a restricted area from Vanrhynsdorp in the west to the foot of the Nieuwoudtville escarpment in the east, but is locally abundant within this region. It prefers clay substrates and is mostly associated with Succulent Karoo vegetation. The plants grow in direct sunlight.

b. var. ***unifoliolata*** Dreyer & Oberl. — Fig. 2, 3

Geophytum acaule, foliis unifoliolatatis, petiolis anguste alatis articulo superno prominenti et in marginibus pilis serrato-denticulatis, floribus flavis vel albis. — Typus: *L.L. Dreyer 829* (holo STEU; iso BOL, NBG), South Africa, Northern Cape Province, Gannabos, between Nieuwoudtville and Loeriesfontein, 12.6.2008.

Stemless geophyte, 35–50 mm tall, aggregated into intertwined clonal clumps. *Bulb* regularly ovate with acute apex, reddish to chocolate brown, smooth; tunics glabrous, soft. *Rhizome* 30–160 mm, scantly covered with thin tunic, scantly covered with glandular hair towards apex, glabrescent below. *Aboveground stem* absent. *Leaves* 2–8 per plant, consistently unifoliolate. *Petioles* (6–)20–30(–120) mm, semi-succulent, red with narrow wings (c. 0.5 mm broad), with distinct upper and lower articulations. *Leaflets* 15–40 by 11–28 mm, erect and orientated at different angles, enhancing tufted appearance of plant, obovate to elliptical, apex obtuse to minutely emarginate, base obtuse to cuneate, abaxially and adaxially glabrous, but with long multicellular hairs restricted to the margin, adaxially apple green with narrow red margin, abaxially green to red, entire leaflet beset with small reddish dots; petiolule 0.2–1.0 mm long. *Peduncle* 1-flowered, 20–40 mm long, green, sparsely covered with long multicellular hairs. *Bracts* 2, alternate, above middle of peduncle, filiform, covered with multicellular hairs, 3 mm long. *Sepals* 8–10 by 2.0–2.5 mm, lanceolate, acute to acuminate, abaxially and adaxially glabrous, with long multicellular hairs along margins. *Petals* 20–30 mm long, lobes yellow or white, spathulate with long, narrow claw, glabrous, ecallose, tube yellow, broad, funnel-shaped. *Stamens* in 3 series, 2 series per plant, lower level 2 mm long, middle series 4 mm long, longest series 7 mm long. *Filaments* with sparse glandular hairs along entire length, blunt teeth separate to adnate to longer filaments, and apically outwardly deflexed. *Anthers* oblong. *Pollen* yellow, tricolporate, tectum reticulate. *Ovary* ovoid, 5-lobed, 2.5 mm long, 5-loculed with 3 ovules per locule, translucent, glabrous. *Styles* 5, separate, erect, scantly covered with glandular hairs; stigma yellow, fimbriate. *Fruit* a 5-locular capsule, globular, shorter than sepals. *Seed* exendospermous.

Diagnostic characters — Stemless semi-succulent geophyte, often clumped. Most plant parts covered with multicellular hairs. Leaves unifoliolate. Petioles exceeding 20 mm in length. Flowers yellow or white.

Geographic distribution — Three populations of *O. flava* var. *unifoliolata* were found between Nieuwoudtville and Loeriesfontein. One population occurs about 15 km from Nieuwoudtville along this route, with another large population just beyond the Knersvlakte turnoff from this same road. The third population was found on the flats at Gannabos, growing below the *Aloe dichotoma* Masson forest at this locality. All three populations had both yellow and white flowered individuals. This taxon is restricted to flat plains on clay substrates, where they grow in direct sunlight. Plants are mostly clustered into clonal clumps comprised of many individuals. Natural seed set was found to be abundant.

Note — *Oxalis flava* var. *unifoliolata* superficially resembles *O. salteri* in that both species have unifoliolate leaves. Unlike *O. salteri*, whose leaves appear almost sessile, *O. flava* var. *unifoliolata* individuals have prominent petioles (Fig. 3). *Oxalis flava* var. *unifoliolata* flowers in June and most plants were already in full fruit by the end of June.

Additional specimens. South Africa, Northern Cape Province, at turn-off to Knersvlakte, on Nieuwoudtville to Loeriesfontein road, *L.L. Dreyer 848* (STEU); along Nieuwoudtville to Loeriesfontein road, c. 15 km before turn-off to Gannabos, *L.L. Dreyer 845* (STEU).

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IDENTIFICATION LIST

The number after each collection refers to the following taxa.

1 = *O. flava* var. *flava*
2 = *O. flava* var. *fabaefolia*

Bayer 614: 1; 627: 1; 1335: 2; 1900: 1; 2143 : 1; 2211: 1; 2234: 1; 2737: 1; 3516: 1; 3987: 1; 4796: 1.
Compton 18034: 1 – Curran 8: 1.
Dreyer 616:1; 642: 2 – Dreyer, Roets, Krige & Curran 11: 1 – Dreyer, Roets & Zietsman 22: 2.
Edwards 227: 1.
Forrester 52: 1; 57: 1.
Helme 1300: 2.
Leipoldt 3494: 1.
Oliver 3390: 1; 5899: 1; 5906: 1; 9541: 1; 9631a: 1.
Paterson-Jones 793: 1 – Perry & Snijman 2034: 1; 2066: 1; 2102: 1 – Pretorius 705: 1; 706: 1.
Runnalls 999: 1.
Salter 2293: 1; 5311: 2 – Suda 82: 2; 89: 2.
Thompson 11: 1; 1163: 1; 1181: 1; 3001: 1.
Van Jaarsveld 4370: 1 – Viviers 1308: 1.
Walters 1955: 1.