



A New Record for the Flora of Saudi Arabia: *Portulaca foliosa* Ker Gawl. (Portulacaceae)

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THIS STUDY presents the *Portulaca foliosa* Ker Gawl. as a new species in the flora of Saudi Arabia. The plant was found scattered in limited locations in Alabna escarpment, southwestern Saudi Arabia, growing in a rocky, humid habitat between 1400–1800 m.a.s.l. Five species belonging to the genus *Portulaca* were reported in Saudi Arabia, namely *P. oleracea* L., *P. quadrifida* L., *P. grandiflora* Hook., *P. kermesina* N.E.BR., and *P. pilosa* L. These species have similarities in their shoot and floral structures. However, the obtuse leaves, retuse petals, and the flower's colour are features that distinguish the new taxon from the other species. The newly recorded species is easily distinguishable from the other five *Portulaca* species through its small flower with bright yellow petals. To facilitate identification, distribution and habitat, detailed vegetative and floral descriptions, colour photographs, a map showing locality along with a new key for the genus *Portulaca* in the flora of Saudi Arabia are given.

Keywords: Flora, New record, *Portulaca foliosa*, Saudi Arabia.

Introduction

There are 2,290 plant species in the Kingdom of Saudi Arabia (Thomas et al., 2015). However, the number of species increases year by year due to intensive biodiversity surveys and vegetation studies. The majority of the identified species have been reported as new records (Masrahi et al., 2010, 2011; Thomas et al., 2014; Al-Sodany, 2016; Al-Robai et al., 2018; El-Shaboury et al., 2018; Remesh et al., 2019), while others have been recorded as new species (Al-Zahrani & El-Karemy, 2007; Fayed & Al-Zahrani, 2007; Basahi & Masrahi, 2019). Albaha area, a part of the southwestern region of Saudi Arabia, has more than 80% of the Kingdom's flora (Thomas, 2011). It is considered to be one of the country's areas where its flora is still under exploration (Remesh et al., 2019). Moreover, El-Shaboury et al. (2018) indicated that many species are not well classified in this area and are thus considered unknown species.

The family Portulacaceae comprises about 15–30 genera and 500 species (Augros et al., 2018; Rad et al., 2017). Based on molecular studies, the family is restricted to only one genus, *Portulaca* L. (Nyffeler & Egli, 2010), which includes more than 100 species (Nyffeler & Egli, 2010; Ocampo & Columbus, 2012). In the flora of Saudi Arabia, the Portulacaceae family has two genera: *Portulaca* and *Talinum*. The genus *Portulaca* is represented by five species: *P. grandiflora* Hook.f., *P. kermesina* N.E. Br., *P. oleracea* L., *P. pilosa* L. and *P. quadrifida* L. (Chaudhary, 1999).

The genus *Portulaca* occurs worldwide, especially in tropical, subtropical, and temperate regions, from sea level to high altitudes (Gilbert & Philips, 2000; Kim, 2012). Its species grow in soils with higher nitrate contents, particularly near human-populated areas (Domina & Raimondo, 2009).

P. foliosa is a succulent herb with a

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chromosome complement of $2n=16$ (Nyananyo, 1987). It is native to tropical Africa (Ocampo et al., 2013) and commonly distributed in West Africa, but occurs only sporadically in some East African countries such as Kenya (Ngumbau et al., 2020) and Southern African countries such as Zimbabwe (Mapaura & Timberlake, 2004). According to the recent classifications of the plant kingdom by the Angiosperm Phylogeny Group (APG IV et al., 2016), *P. foliosa* is under the Tracheophyta, Magnoliopsida, Caryophyllales, Portulacaceae.

Materials and Methods

Field trips were conducted to the Alabna escarpment (19°52'N, 42°30'E) from January to December 2018 to study the plant diversity of the area. The escarpment lies 45km south of Albaha City, southwestern Saudi Arabia (Al-Robai et al., 2019). Seven plant species were collected from different locations, and morphological measurements of their parts (stem length, leaf length and width, flower diameter, sepal length, and petal length) were recorded in the field. At the Herbarium of Albaha University, the plant samples were checked, revised, and identified using many references (Collenette, 1985, 1998, 1999; Migahid, 1988, 1989, 1990; Chaudhary, 1999; Chaudhary & Al Jowaid, 1999; Alfarhan et al., 2005).

Identification in the field and the herbarium

pointed to the presence of one new record specimen belonging to the family Portulacaceae. All published sources of the flora of Saudi Arabia were reviewed to verify the identification of the collected specimen, which revealed the presence of *P. foliosa* L. (Family: Portulacaceae) for the first time in the country.

Results

Taxon description

Habit: perennial, herbaceous, spreading, fleshy succulent, main branches 0.3–0.5cm thick, old branches often woody at the base, stem procumbent coloured when young and colourless when old, up to 30cm long. **Leaves:** crowded near the tip of the branches, up to 2.5cm long, 0.3–0.5cm wide, green with or without purplish apex when young, purple when old, linear, sessile, alternate, subcylindrical, glaucous, obtuse apex, hairy stipules not conspicuous. **Flowers:** solitary or cluster, up to 1.5cm in diameter, terminal, bright-yellow, showy, bracts whitish with purple tips, involucre leaves present, red or pinkish sepals up to 0.4cm long, free 5 retuse bright-yellow petals up to 1cm in length, numerous yellow stamens up to 14, branched recurved stigma. **Fruits:** dehiscent ovoid capsule with numerous minute black or dark gray domed-shaped seeds (Fig. 1). A morphological comparison between the newly recorded taxon and the five reported *Portulaca* spp. in the flora of Saudi Arabia is given in Table 1.



Fig. 1 A. Spreading and flowering *P. foliosa* in its natural habitat



Fig. 1 B. A succulent branch with conspicuous green, glaucous leaves terminated by a solitary opening flower



Fig. 1 C. Old colourless stems, purple leaves, and fruit scars

TABLE 1. Morphological comparison between the new record and other reported *Portulaca* species in the flora of Saudi Arabia

Character	<i>P. grandiflora</i>	<i>P. kermesina</i>	<i>P. oleracea</i>	<i>P. pilosa</i>	<i>P. quadrifida</i>	<i>P. foliosa</i>
Habit	Annual or perennial, diffuse ascending herb	Annual, erect or ascendant, slender succulent herb	Annual or perennial, prostrate, succulent herb	Annual or perennial, ascending, spreading, succulent herb	Annual, diffuse, prostrate, clumped, rooting at nodes	Perennial, herb, spreading, succulent, branching, stem colored when young
Leaves	Linear, alternate, crowded at the terminal, upper leaves clustered, forming an involucre	Subterete, alternate, tip acute; axils usually with prominent tuft pale brown to whitish hairs	Obovate-spathulate, alternate or sub-opposite, petiole short	Linear to oblong-lanceolate, alternate	Ovate-oblong to elliptic-oblong, opposite, sessile or sessile, succulent	Linear, sessile, green with or without purplish apex
Stipules	Few axillary, white hairs	Numerous, usually persistent hairs	Few deciduous hairs	Conspicuous hairs	Conspicuous hairs	Few inconspicuous hairs
Flowers	Solitary or clustered, surrounded by tufts of hair, large with different colors, sepals slightly unequal, united at the base, petals 5 or multiples of 5, united at the base, obovate, pale brown or yellow-spotted at the base.	Usually clustered at the tips of branches, leafy bracts, sepals 3–5 mm long, fleshy, subacute, petals 5, red or bright red	Solitary or clustered, sepals green, helmeted, apex acute, keeled, petals 5, yellow, obovate	Sepals free, petals 5, slightly united at the base, obovate, pink to red, pink elliptic minute bracts	Solitary or clustered, sepal small, petal yellow	Solitary or clustered, usually at the terminal of the branch, bright-yellow, bracts whitish with purple tips, 5 red or pinkish sepals, free 5 retuse bright-yellow petals
Fruits	Capsule ovoid or oblong	Ovoid or dome-shaped	Capsule ovoid, dehiscent	Capsule ovoid	Capsule oblong or conical	Ovoid dehiscent capsule
Seeds	Minute, compressed, greyish-black	Convex to conical, black or silvery	Orbicular, shiny black with circular lines	Numerous, reniform, dark brown, tubercled	Reniform, shiny black, stellate	Numerous, minute, black or dark gray

Key to the species of the genus Portulaca in the Kingdom of Saudi Arabia

- | | |
|---|---|
| 1. Leaves succulent, spatulate, or obovate-oblong, hairy stipule
+ Leaves linear to linear-lanceolate | <i>P. oleracea</i>
2 |
| 2. Leaves opposite, hairy stipule both inter and intra petiolar
+ Leaves alternate, hairy stipule axillary | <i>P. quadrifida</i>
3 |
| 3. Flowers large, petals 5 or more, different colours
+ Flowers small, petals otherwise | <i>P. grandiflora</i>
4 |
| 4. Petals 5, bright yellow
+ Petals 5, red to pinkish-purple | <i>P. foliosa</i>
5 |
| 5. Stamens 10, seeds black
+ Stamens 15–30, seeds dark brown | <i>P. kermesina</i>
<i>P. pilosa</i> |

Distribution and habitat

The taxon was distributed in limited areas in the Alabna escarpment (1400–1800 m.a.s.l.), southwestern Saudi Arabia, growing in rocky soil between cracks near anthropogenic sites (Fig. 2). Based on field observations, the area is characterized by many rocky hill ranges with high-elevation valleys in between, rolling lands, sharp sloping topography, and a wet climate with heavy

rains all over the year. The soil in the area varies greatly from one place to another; it is coarse, shallow, and rocky on mountain tops and edges, while the surface at the ground is rich with small pieces of rock, pebbles, and sand grains. The soils of the valley floors and among rocky cracks generally contained a high amount of clay and fine silt particles.

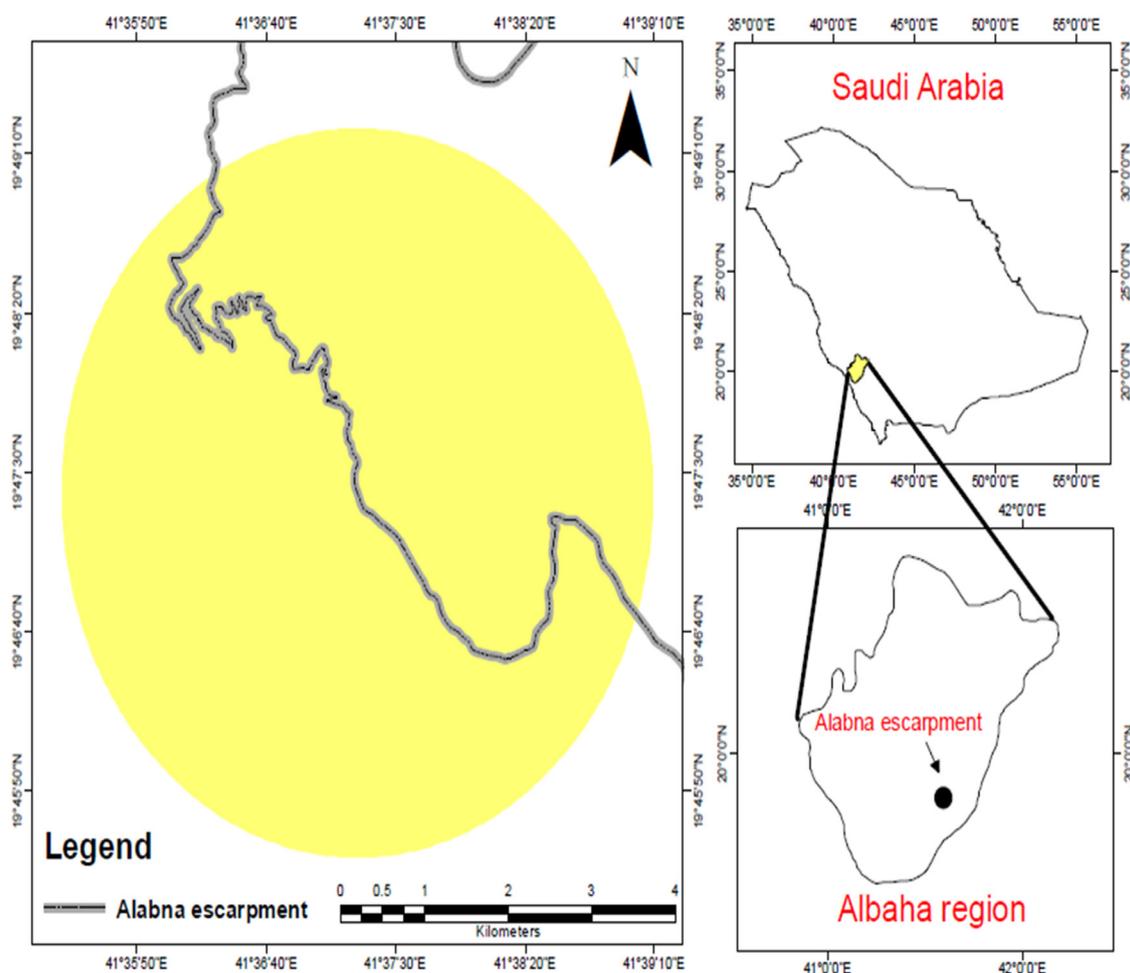


Fig. 2. Distribution map of *P. foliosa* in the Alabna escarpment, Albaha region, southwestern Saudi Arabia

Discussion

The taxon was restricted to wet, humid areas in the Alabna escarpment, a part of Sarawat Asir Highlands with a unique environment and plant diversity (Al-Robai et al., 2019). The population of *P. foliosa* was confined to wet, hard soil away from anthropogenic sites. However, Faye et al. (2012) reported the distribution of *P. foliosa* in dry areas. Only five species, namely *P. oleracea* L., *P. quadrifida* L., *P. grandiflora* Hook., *P. kermesina* N.E.BR., and *P. pilosa* L., were listed by Chaudhary (1999) in the flora of Saudi Arabia, which are not countrywide in distribution. However, *P. oleracea*, *P. quadrifida*, and *P. kermesina* are commonly distributed in the southwestern region of Saudi Arabia (Alfarhan et al., 2005).

The name *P. foliosa* has frequently been misapplied to all yellow-flowered *Portulaca* in the flora area. True *P. foliosa* is common in West Africa, but occurs only sporadically in eastern Africa. It is particularly associated with seasonally dry riverbeds or sandbanks in rivers. It can be distinguished from other yellow-flowered species by its retuse petals, obtuse leaves, extension growth beyond the old flower heads, and short axillary hair-tuft stipules (Phillips, 2002).

In this work, the recorded morphological features and the other taxonomic criteria that can be used to separate the collected plant from the other species in the genus *Portulaca* recorded in the flora of Saudi Arabia were reviewed. Based on these vegetative characteristics, it seems clear that the taxon is *Portulaca foliosa*, and this study represents the first record of this species in Saudi Arabia. After checking, revising, and reviewing all the published sources of the flora of Saudi Arabia, it is clear that the taxon is not listed in these published sources (Collenette, 1985, 1998, 1999; Migahid, 1988, 1989, 1990; Chaudhary, 1999; Chaudhary & Al Jowaid, 1999; Alfarhan et al., 2005).

Conclusions

The new taxon was recorded in restricted places in Alabna escarpment (1400–1800 m.a.s.l.), southwestern Saudi Arabia. After a rainy season, the species was found growing in rocky habitats between cracks. *P. foliosa* has been distinguished from other species by its obtuse leaves, retuse petals, and flower colour.

Competing interests: The authors report no conflicts of interest regarding this work.

Authors' contributions: S.A.A. found and collected plant species. H.M.A. and M.A.K. identified the specimen and provided initial descriptions of the new species. F.O.A. drafted the manuscript while S.A.A. and A.A.A. corrected it and supervised the whole work.

Ethics approval: Not applicable.

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تسجيل نوع نباتي جديد في فلورا المملكة العربية السعودية ينتمي للفصيلة الرجولية:

Portulaca foliosa Ker Gawl

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في هذه الدراسة تم تسجيل نبات *Portulaca foliosa* Ker Gawl كنوع نباتي جديد ينتمي لفلورا المملكة العربية السعودية، حيث وجد أن النبات ينتشر في مواقع محدودة من عقبة الأبنيا في جنوب غرب المملكة العربية السعودية. ينمو نبات *P. foliosa* في البيئات الصخرية الرطبة، وذلك على ارتفاع يتراوح بين 1400 - 1800 م فوق سطح البحر. من خلال الدراسات السابقة تم تسجيل خمسة أنواع نباتية تنتمي لجنس *Portulaca* في المملكة العربية السعودية هي *P. pilosa* N.E.BR.، وقد وجد أن هذه الأنواع تتشابه في تراكيبها الخضريّة والزهرية، مع وجود بعض الاختلافات في شكل الأوراق والبتلات ولون الزهرة، حيث يمكن تمييز النوع الجديد عن الأنواع الأخرى التي تم تسجيلها من خلال زهرته الصغيرة ذات البتلات الصفراء، ومن أجل سهولة التعريف بالنوع النباتي الجديد تم تسجيل الملاحظات المتعلقة بانتشار النبات، بالإضافة إلى تقديم وصف تفصيلي مدعماً بالصور الملونة، مع كتابة مفتاح جديد للجنس *Portulaca* في فلورا المملكة العربية السعودية.