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Salsola griffithii (Chenopodiaceae; Amaranthaceae s. l.): An interesting species new to the flora of United Arab Emirates (UAE)

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Keywords: Abu Dhabi, flora of South-West Asia, habitat, Irano-Turanian Region, new records, psammophytes.

Summary. *Salsola griffithii*, a formerly endemic species in Iran, Afghanistan and Pakistan is reported from UAE as a new record from the south of the Persian Gulf. This record adds another evidence of the Irano-Turanian elements which extend their range into the Saharo-Sindian region. Furthermore, it contributes to a more comprehensive understanding of the flora in the UAE and emphasizes the necessity for continued botanical research in the region. Detailed illustrations of *Salsola griffithii* in UAE, a short description, habitat, an updated distribution map and its phytogeographical importance are provided.

Salsola griffithii (Chenopodiaceae; Amaranthaceae s. l.): интересный вид, новый для флоры Объединённых Арабских Эмиратов (ОАЭ)

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Ключевые слова: Абу-Даби, ареал, Ирано-Туранский регион, новые находки, псаммофиты, флора Юго-Западной Азии.

Аннотация. *Salsola griffithii*, ранее считавшийся эндемичным видом Ирана, Афганистана и Пакистана, обнаружен впервые на юге Персидского залива в Объединённых Арабских Эмиратах (ОАЭ). Эта находка служит ещё одним доказательством наличия ирано-туранских элементов, расширяющих ареал вида до Сахаро-Синдского региона. Эта находка способствует более глубокому пониманию флоры ОАЭ и подчёркивает необходимость продолжения ботанических исследований в регионе. Представлены подробные иллюстрации *Salsola griffithii* в ОАЭ, краткое описание вида, информация о местообитании, обновлённая карта распространения вида и его фитогеографическое значение.

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Introduction

The Chenopodiaceae Vent. (Amaranthaceae s. l.) encompasses diverse plant species distributed worldwide, particularly abundant in arid and semi-arid regions. Chenopodiaceae is one of the largest families, comprising approximately 105 genera and over 1700 species (Kadereit et al., 2003; Hernández-Ledesma et al., 2015). The flora of the United Arab Emirates (UAE) has a significant representation of species from this family, reflecting their adaptability to the arid and saline environments. The family is represented in the flora of UAE by 34 species belonging to 21 genera (Boulos, 1996; Akhani, unpublished data). *Salsola* L. s. l. is known to be one of the largest and ecologically important genera within the family (Mucina, 2017). The tribe *Salsoleae* s. l. is one of the largest tribes within the family Chenopodiaceae, including one-third of the genera currently recognized in the family (Kühn et al., 1993).

Due to polyphyly of the genus *Salsola* s. l., as revealed by several molecular phylogenetic studies (Pyankov et al., 2001; Kadereit et al., 2003), the reclassification of the genus was suggested and widely accepted (Akhani et al., 2007). In its current concept the genus has been segregated into 10 different genera such as: *Afrosalsola* Akhani, *Akhania* Sukhor., *Caroxylon* Thunb., *Climacoptera* Botsch., *Kaviria* Akhani et Roalson, *Oreosalsola* Akhani, *Pyankovia* Akhani et Roalson, *Salsola* L., *Soda* (Dumort.) Fourr., *Turania* Akhani et Roalson, and *Xylosalsola* Tzvelev (Akhani et al., 2007, 2016, 2024; Rudov et al., 2020; Sukhorukov et al., 2022). Two other lineages endemic to Iberian Peninsula and NW Africa (*Salsola genistoides* Juss. ex Poir., and *S. webbii* Moq.) have to be reclassified to complete necessary nomenclatural changes.

The species of *Salsola* s. l. in the flora of UAE was represented by seven species (Boulos, 1996; Jongbloed et al., 2003: Fouwzi, Karim, 2007) (Table 1). All these species have been transferred to other genera than *Salsola*. The new record of a species of *Salsola* is indeed the first record of *Salsola* s. str.

Materials and Methods

During a botanical survey conducted in November 2023 in the Al Ain region of UAE, a specimen resembling the genus *Cornulaca* was encountered. A detailed comparison of its morphological cha-

Table 1. List of *Salsola* and *Seidlitzia* species reported from UAE and their accepted names based on "Plants of the World Online" (POWO, 2026)

Accepted name	Old name according to Flora of the Arabian Peninsula	Reference and note
Caroxylon cyclophyllum (Baker) Akhani et Roalson	*Salsola cyclophylla* Baker	Boulos, 1996
Caroxylon imbricatum (Forssk.) Moq.	*Salsola imbricata* Forssk.	Boulos, 1996
Caroxylon tetrandrum (Forssk.) Akhani et Roalson	*Salsola tetrandra* Forssk.	Jongbloed et al., 2003 (A doubtful record, verification is required)
Kaviria rubescens (Franch.) Akhani	*Salsola rubescens* Franch.	Boulos, 1996
Salsola griffithii (Bunge) Freitag et Khani	The same	This paper
Soda drummondii (Ulbr.) Akhani	*Salsola drummondii* Ulbr.	Boulos, 1996
Soda rosmarinus (Bunge ex Boiss.) Akhani	*Seidlitzia rosmarinus* Bunge ex Boiss.	Boulos, 1996
Soda schweinfurthii (Solms) Akhani	*Salsola schweinfurthii* Solms	Boulos, 1996

racteristics with those of similar species present in the UAE and Iran indicated that this specimen represents a new addition to the UAE's flora. Thorough morphological examination of the specimen and comparing the new collection with those available in the Hb. Akhani (Halophytes and C_4 Plants Research Laboratory, University of Tehran) confirm that this is indeed *Salsola griffithii* (Bunge) Freitag et Khani, not previously recorded in UAE and the Arabian Peninsula (Boulos, 1996; Jongbloed et al., 2003; Karim, Fawzy, 2007) (Fig. 1).

The species is found to be an endemic psammophyte of southeastern Iran, southern Afghanistan and adjacent areas in Pakistani Baluchistan (Freitag, Khani, 1987; Freitag, Rilke, 1997; Rilke, 1999). Voucher specimens were deposited at Royal Botanic Garden Kew (K), Moscow University Herbarium (MW) and Hb. Akhani (without acronym).

Results and Discussion

Salsola griffithii (Bunge) Freitag et Khani, 1987, Pl. Syst. Evol. 155: 50 (Figs. 2–3).

Basionym: *Noaea griffithii* Bunge, 1862, Mém. Acad. Imp. Sci. Saint Pétersbourg, Sér. 7, 4(11): 22.

≡ *Kali griffithii* (Bunge) Akhani et Roalson, 2007, in Int. J. Pl. Sci. 168: 946.

Description

Dwarf spiny shrub, 30–70 cm high; stem and leaves greyish, with a dense papillose indumentum, with axillary dense tufts of whitish hairs; leaves and floral leaves rigid, semiterete, 3–19 mm long, spiny tipped, lower leaves linear; upper floral leaves shortened, triangular; flowers solitary, tepals 5, membranous with a green blotch at the base, 3.5 to 4 mm long, oblong, tapering towards apex; fruiting perianths firm, with scarious horizontal wings, 4–8 mm diameter, upper parts of wings papillose, upper portion ± 2 mm long; anthers rose to pink when fresh, 1.2 mm long, minutely appendiculate; filament 2.5 to 2.8 mm long; ovary 2.5 mm long; style 2mm long; ovary 0.9 mm wide; stigmas 2, recurved; fruit utricle, enclosed with winged fruiting perianth; seeds horizontal (Figs. 2, 3).

Distribution and phytogeography

Salsola griffithii was already known in sandy desert area of southeastern Iran and adjacent similar habitats in southwestern Afghanistan and Baluchistan in Pakistan (Freitag, Khani, 1987). The new record is from Al Ain in UAE extends its range into the southern side of the Persian Gulf in the eastern part of the UAE in Abu Dhabi Emirate (Fig. 1).

The range of *S. griffithii* falls in the Saharo-Sindian region bordering the Irano-Turanian region

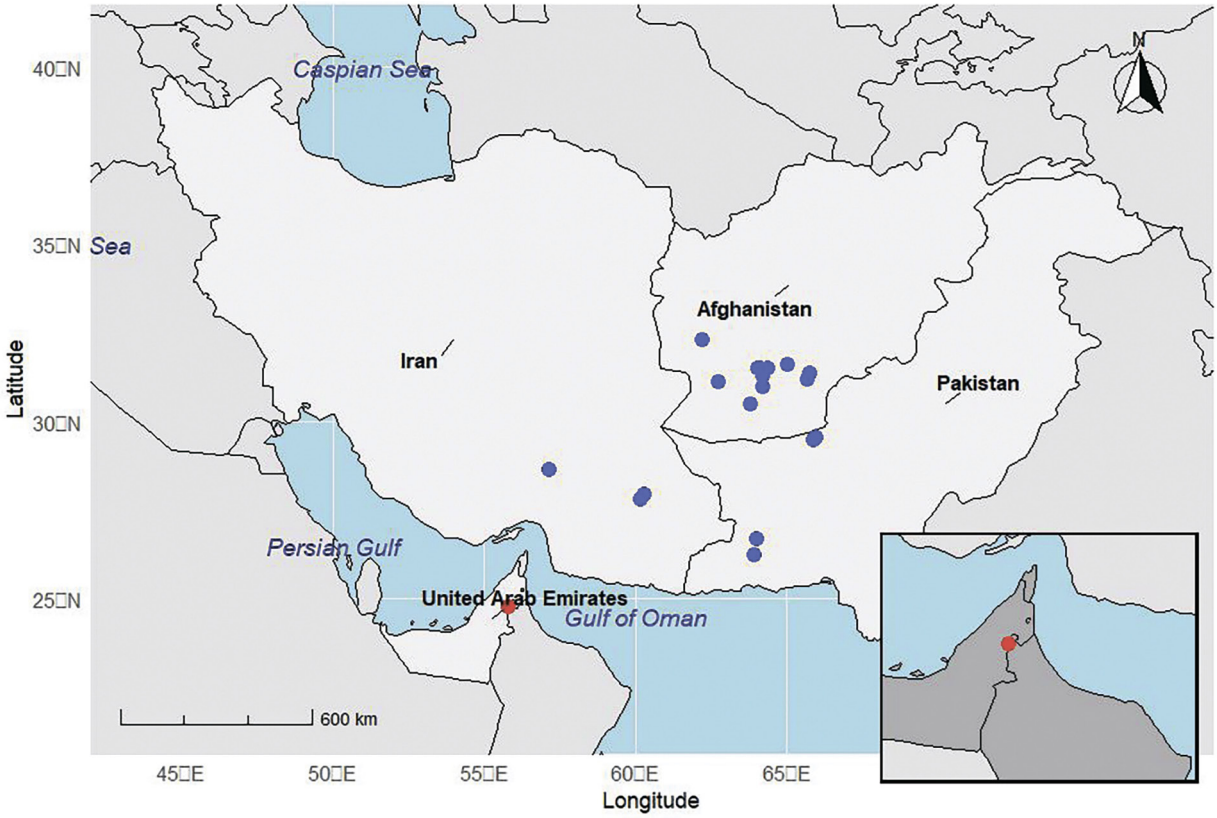

Fig. 1. Distribution map of *Salsola griffithii* with new addition from UAE (enlarged in the inset map).

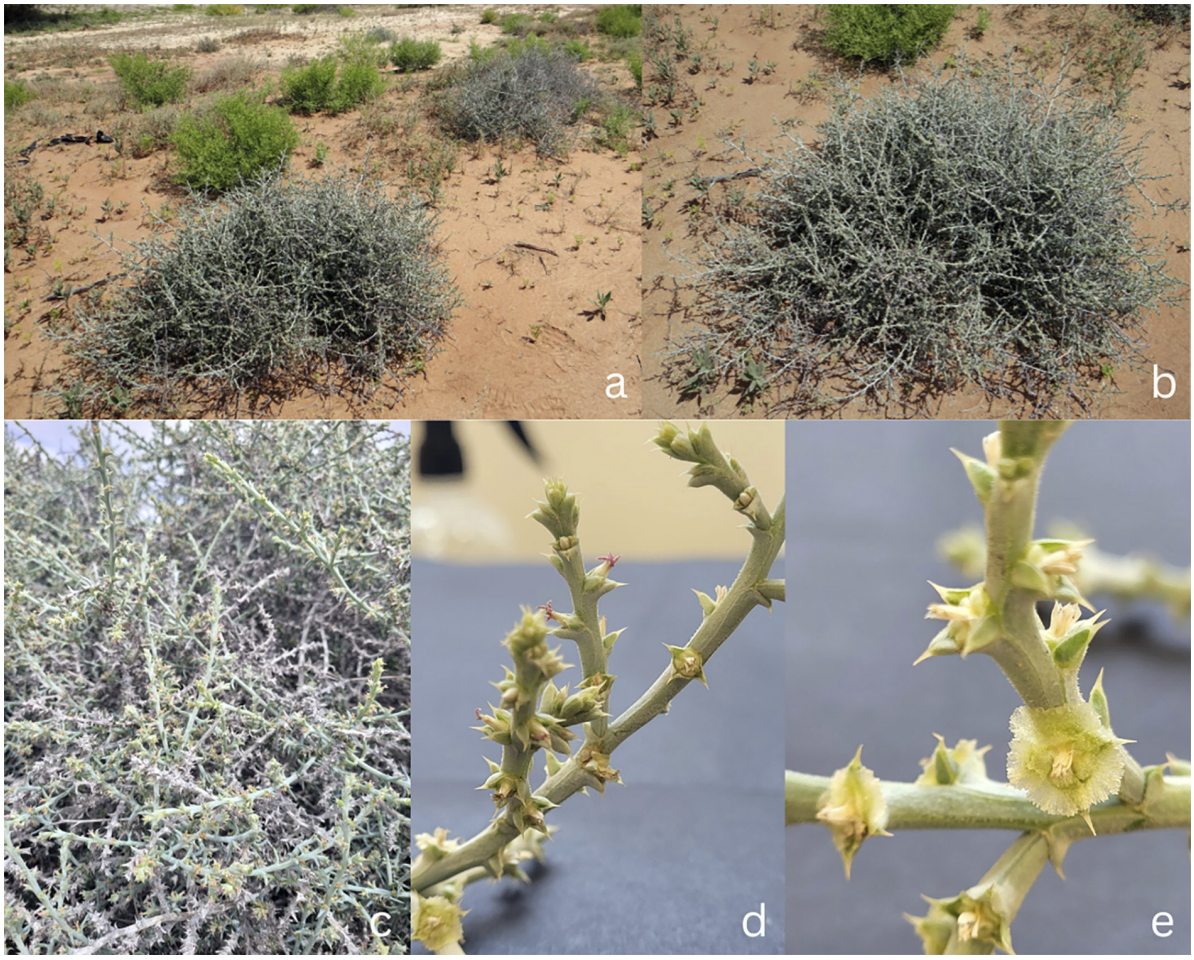

Fig. 2. Photographs of *Salsola griffithii* in natural habitat in Abu-Dhabi: a – habitat; b – habit; c – flowering branch; d – close up of flowering twig; e – fruiting twig.

based on the phytogeographical concept by White and Léonard (1991). The range falls within the Nubo-Sindian local center of endemism of the Saharo-Sindian region. According to Meusel et al. (1992), the range of this species coincides with two floristic Provinces: Beluchestanian belonging to the Orient-to-Turanian (Orientalisch-Turanisch) and Garmsir belonging to Saharo-Sindian regions. Based on the widely used system of Zohary (1973), the area of the species falls in the Nubo-Sindian Province of the Sudanian region.

As it has been evidenced from molecular phylogenetic analysis, *S. griffithii* is sister to all annual species of *Salsola* s. str. (Akhani et al., 2007; Brullo et al., 2015) and it is supposed that the shrubby habit is a plesiomorphic character state in the genus. The main range of the species in so-called "Baluchistanian" area well matches with the Irano-Turanian region than the Saharo-Sindian or Sudanian regions. Previously, several other Chenopod species have been known as endemic in the area with clear Irano-Turanian roots such as *Bienertia sinuspersici* Akhani, *Halimocnemis purpureum* Moq., *Halothamnus iranicus* Botsch., *Soda austro-iranica* (Akhani) Akhani, *Soda drummondii* (Ulbr.) Akhani, *Suaeda baluchestanica* Akhani et Podlech, *S. iranshahrii* Akhani et Freitag, and *S. khalijefarsica* Akhani (Akhani et al., 2005; Freitag et al., 2013; Akhani, 2015). There are many more examples of non-chenopod species having similar distribution range such as: *Heliotropium brevilimbe* Boiss., *H. remotiflorum* Rech. F. et H. Riedl, *Psammogeton stocksii* (Boiss.) Nasir, *Pycnocycla aucheriana* Decne. ex Boiss., *Euphorbia larica* Boiss. (Akhani, 2007; Pahlevani et al., 2020) (Fig. 3).

Specimen examined: "UNITED ARAB EMIRATES. Abu Dhabi, Al Ain, Al Foah, Sand sheets N24.78193°, E55. 81524°. 26 IV 2024. Sabitha Sakkir" (EAD, K, MW, Hb. Akhani).

Ecology: The habitat of the new record is sand sheet associated with perennials such as *Chrozophora oblongifolia* (Delile) A. Juss. ex Spreng., *Echinops erinaceus* Kit Tan, *Hammada salicornica* (Moq.) Iljin, *Heliotropium bacciferum* Forssk., *Leptadenia pyro-*

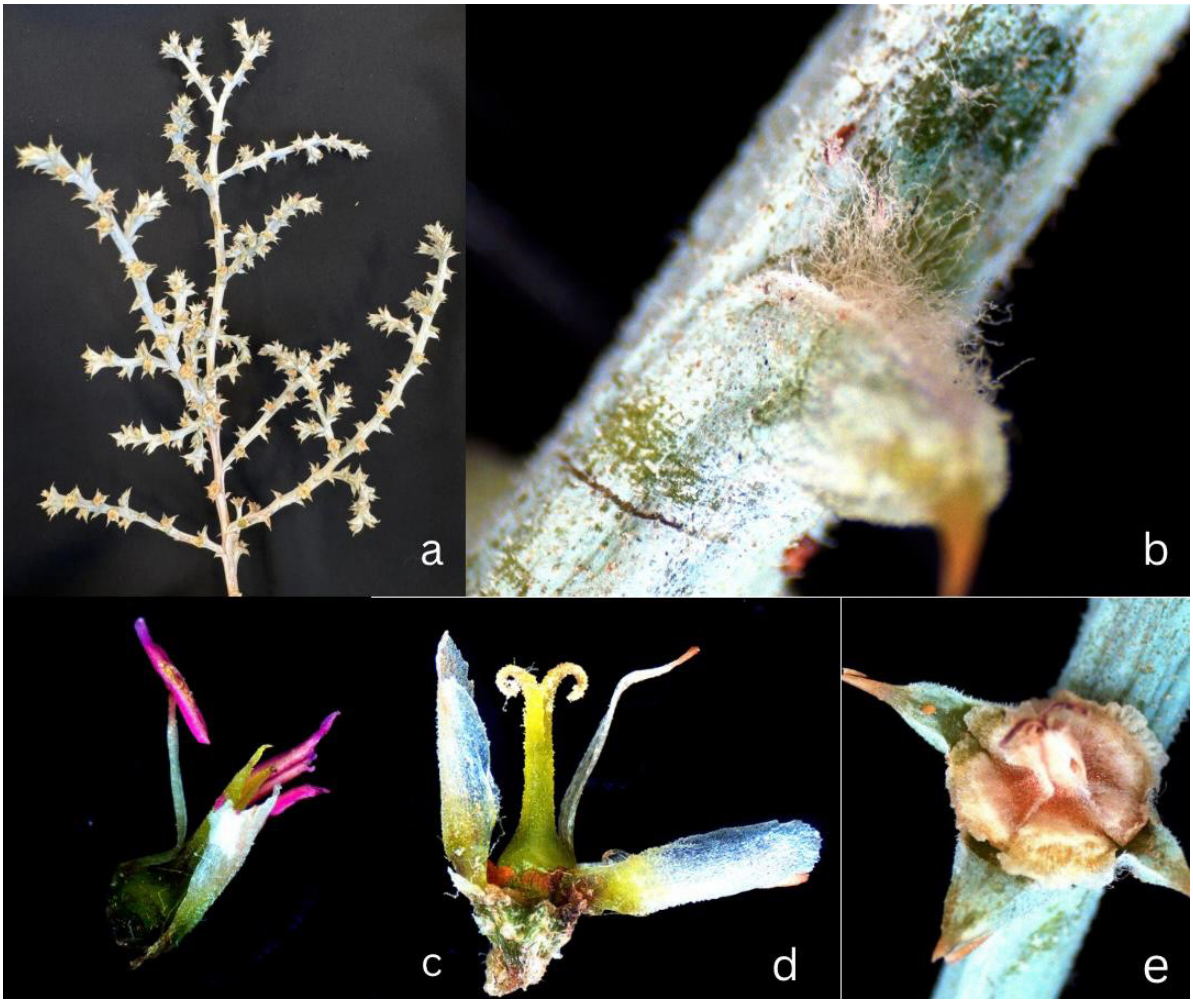

Fig. 3. Photographs of the habit and the flower details of *Salsola griffithii*: a – branch; b – woolly hairs in the axil of spiny tipped leaf; c – anther with filament; d – gynoecium; e – fruiting diaspore incl. winged perianth.

technica (Forssk.) Decne., *Tribulus arabicus* Hosni, *Vachellia tortilis* (Forssk.) Galasso et Banfi, *Zilla spinosa* (L.) Prantl, *Zygophyllum qatarense* Hadidi and *Z. indicum* (Burm. f.) Christenh. et Byng. Annual species include *Aizoon canariense* L., *Ifloga spicata* (Forssk.) Sch. Bip., *Paronychia arabica* (L.) DC., *Plantago ciliata* Boiss., *Polycarpaea robbairea* (Kuntze) Greuter et Burdet, and *Zygophyllum simplex* L.

The sand habitat is similar to the whole range of the species, however, the associated species in Afghanistan and Pakistan are species such as *Cenchrus divisus* (J. F. Gmel.) Verloove, Govaerts et Buttler, *Xylosalsola richteri* (Moq.) Akhani et Roalson, *Cyperus conglomeratus* Rottb., and *Panicum turgidum* Forssk. (Rilke, 1999). In Iran, it is associated with *Calligonum amoenum* Rech. f. et Schiman-Czeika and *Stipagrostis plumosa* (L.) Munro ex T. Anderson (Akhani 17825, Hb. Akhani).

Flowering: February – March, fruiting starts in March to May.

Conservation status. In UAE, *S. griffithii* was known from a single location with around 10 individuals. The area does not fall under any officially declared protected areas of UAE. However, it is designated as a non-grazing zone according to the grazing regulations set forth by Environment Agency – Abu Dhabi. Based on current data a Critically Endangered status in UAE is suggested based on IUCN criteria (Criteria B and E) (IUCN Standards and Petitions Committee, 2019). Based on field observation and presence of a few localities in Iran, its country evaluation is suggested to be Endangered according to the criterion B. As the majority of known localities are in Afghanistan and Pakistan and we have no recent field data, a Vulnerable status is provisionally suggested according to the C and D criteria.

Conclusion. The new record of the species highlights the ongoing contributions to the botanical understanding of the UAE's diverse flora and emphasizes UAE's role in enhancing the botanical understanding of the Arabian Peninsula.

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REFERENCES / ЛИТЕРАТУРА

Akhani H. 2007. Diversity, biogeography, and photosynthetic pathways of *Argusia* and *Heliotropium* (Boraginaceae) in South-West Asia with an analysis of phytogeographical units. *Bot. J. Linn. Soc.* 155(3): 401–425. https://doi.org/10.1111/j.1095-8339.2007.00707.x

Akhani H. 2015. *Plants and vegetation of North-West Persian Gulf: the coasts and islands of Khore Musa, Mahshahr and adjacent areas*. Tehran: University of Tehran Press. 512 pp.

Akhani H., Abdullahi H., Rudov A. 2024. *Afrosalsola* (Amaranthaceae–Chenopodiaceae), an intermediate C_3-C_4 lineage from NW Africa and the Canary Islands, and some new combinations in African species of *Caroxylon* and *Soda*. *Medit. Bot.* 45(2): 1–12. https://doi.org/10.5209/mbot.94654

Akhani H., Barroca J., Koteeva N., Voznesenskaya E., Franceschi V., Edwards G. Ghaffari S. M., Ziegler H. 2005. *Bienertia sinuspersici* (Chenopodiaceae): A new species from southwest Asia and discovery of a third terrestrial C_4 plant without Kranz anatomy. *Syst. Bot.* 30 (2): 290–301.

Akhani H., Edwards G. E., Roalson H. 2007. Diversification of the old world *Salsoleae* s. l. (Chenopodiaceae): Molecular phylogenetic analysis of nuclear and chloroplast data sets and a revised classification. *Int. J. Plant Sci.* 168(6): 931–956. https://doi.org/10.1086/518263

Akhani H., Khoshravesh R. Malekmohammadi M. 2016. Taxonomic novelties from Irano-Turanian region and NE Iran: *Oreosalsola*, a new segregate from *Salsola* s. l., two new species in *Anabasis* and *Salvia*, and two new combinations in *Caroxylon* and *Seseli*. *Phytotaxa* 249(1): 159–180. https://doi.org/10.11646/phytotaxa.249.1.7

Boulos L. 1996. Chenopodiaceae. In: A. G. Miller, T. A. Cope (eds.). *Flora of the Arabian Peninsula and Socotra.* Vol. 1. Edinburgh: Edinbutgh University Press. Pp. 233–283.

Brullo C., Brullo S., Gaskin J. F., Galdo G. G., Hrusa G. F., Salmeri C. 2015. A new species of *Kali* (*Salsoloideae*, Chenopodiaceae) from Sicily, supported by molecular analysis. *Phytotaxa* 201(4): 256–277.

Freitag H., Brandt R., Chatrenoor T., Akhani H. 2013. *Suaeda iranshahrii* Akhani & Freitag, a new species of *Suaeda* subg. *Brezia* (Chenopodiaceae) from the Persian Gulf coasts. *Rostaniha* 14(1): 68–80.

Freitag H., Khani K. 1987. *Salsola griffithii* (Chenopodiaceae) comb. nova – a remarkable species from the sand deserts of SW Asia. *Plant Syst. Evol.* 155 (1–4): 49–54. http://dx.doi.org/10.1007/BF00936286

Freitag H., Rilke R. 1997. *Salsola* [Chenopodiaceae]. In: K. H. Rechinger. (ed.). *Flora Iranica.* Vol. 178. Austria, Graz. Pp. 154–255.

Hernández-Ledesma P., Berendsohn W. G., Borsch T., Mering S., Akhani H., Arias S., et al. 2015. A taxonomic backbone for the global synthesis of species diversity in the angiosperm order Caryophyllales. *Willdenowia* 45(3): 281–384. https://doi.org/10.3372/wi.45.45301

IUCN Standards and Petitions Committee. 2019. *Guidelines for using the IUCN red list categories and criteria*. Version 14. Prepared by the Standards and Petitions Committee. 113 pp. URL: http://www.iucnredlist.org/documents/RedListGuidelines.pdf

Jongbloed M. V. D., Feulner G. R., Boer B., Western A. A. 2003. *The comprehensive guide to the wild flowers of the United Arab Emirates*. Abu Dhabi, Environmental Research and Wildlife Development Agency (ERWDA). 576 pp.

Kadereit G., Borsch T., Weising K., Freitag H. 2003. Phylogeny of Amaranthaceae and Chenopodiaceae and the evolution of C_4 photosynthesis. *Int. J. Plant Sci.* 164(6): 959–986. https://doi.org/10.1086/378649

Karim F. M., Fawzi N. M. 2007. *Flora of the United Arab Emirates*. In 2 vols. Al-Ain: United Arab Emirates University. Vol. 1. 444 pp.; Vol. 2. 502 pp.

Kühn U., Bittrich V., Carolin R., Freitag H., Hedge I. C., Uotila P., Wilson P. G. 1993. Chenopodiaceae. In: K. Kubitzki (ed.). *The families and genera of vascular plants.* Vol. 2. *Flowering plants: Dicotyledons*. Berlin: Springer. Pp. 253–281.

Meusel H., Jäger E., Bräutigam S., Knapp H. D., Rauschert S., Weinert E. 1992. *Vergleichende Chorologie der zentraleuropäischen Flora*. Band III. Jena: Gustav Fischer Verlag. 688 pp.

Mucina L. 2017. *Caroxylon* (Chenopodiaceae s. str.) in continental southern Africa and Madagascar: A preliminary nomenclatural synopsis and biogeographical considerations. *Phytotaxa* 312(2): 151–178. https://doi.org/10.11646/phytotaxa.312.2.1

Pahlevani A. H., Liede-Schumann S., Akhani H. 2020. Diversity, distribution, endemism and conservation status of *Euphorbia* (Euphorbiaceae) in SW Asia and adjacent countries. *Plant Syst. Evol.* 306: 80. https://doi.org/10.1007/s00606-020-01705-4

POWO. 2026. *Plants of the World Online*. Facilitated by the Royal Botanic Gardens, Kew. URL: https://powo.science.kew.org/ (Accessed 08 March 2026).

Pyankov V. I., Artyusheva E. G., Edwards G. E., Black C. C., Soltis P. S. 2001. Phylogenetic analysis of tribe *Salsoleae* (Chenopodiaceae) based on ribosomal ITS sequences: Implications for the evolution of photosynthesis types. *Am. J. Bot.* 88(7): 1189–1198. https://doi.org/10.2307/3558329

Rilke S. 1999. *Revision der Sektion Salsola s.l. der Gattung Salsola (Chenopodiaceae)*. Stuttgart: E. Schweizerbartsche Verlagsbuchhandlung. 189 pp.

Rudov A., Mashkour M., Djamali M., Akhani H. 2020. A review of C_4 plants in Southwest Asia: An ecological, geographical and taxonomical analysis of a region with high diversity of C_4 Eudicots. *Front. Plant Sci.* 11: 546–518. https://doi.org/10.3389/fpls.2020.546518

Sukhorukov A. P., Fedorova A. V., Kushunina M., Mavrodiev E. V. 2022. *Akhania*, a new genus for *Salsola daghestanica*, *Caroxylon canescens* and *C. carpathum* (*Salsoloideae*, Chenopodiaceae, Amaranthaceae). *Phytokeys* 211: 45–61. https://doi.org/10.3897/phytokeys.211.89408

White F., Léonard J. 1991. Phytogeographical links between Africa and Southwest Asia. *Fl. Veg. Mun.* 9: 229–246.

Zohary M. 1973. *Geobotanical Foundations of the Middle East*. In 2 vols. Stuttgart, Amsterdam: Gustav Fischer Verlag. 738 pp.