



***Suaeda vera* Forssk. ex J.F.Gmel.**
***Suaeda vermiculata* Forssk. ex J.F. Gmel.**
AMARANTHACEAE

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Synonyms

***Suaeda vera* Forssk. ex J.F.Gmel.:** *Chenopodium fruticosum* L.; *Cochliospermum fruticosum* (L.) Lag.; *Salsola fruticosa* (L.) L.; *Salsola vera* (Forssk. ex J.F.Gmel.) Schult.; *Schoberia vera* (Forssk. ex J.F.Gmel.) Bunge; *Suaeda fruticosa* (L.) Delile; *Suaeda fruticosa* subsp. *vera* (Forssk. ex J.F.Gmel.) Maire & Weiller; *Suaeda fruticosa* var. *brevifolia* Moq; *Suaeda longifolia* K.Koch; *Suaeda vera* subsp. *longifolia* (K.Koch) O.Bolòs & Vigo; *Suaeda vesceritensis* (L.) Chevall. (WFO 2023a).

***Suaeda vermiculata* Forssk. ex J.F. Gmel.:** *Chenopodium alexandrinum* Desf. ex Moq.; *Dondia fruticosa* (Forssk. ex J.F. Gmel.) Druce; *Lerchia fruticosa* (Forssk. ex J.F.Gmel.) Medik.; *Salsola mollis* Desf.; *Schoberia fruticosa* (Forssk. ex J.F. Gmel.) C.A.Mey.; *Suaeda mesopotamica* GIE; *Suaeda mollis* (Desf.) Delile.; *Suaeda fruticosa* Forssk. ex J.F.Gmel. (WFO 2023b).

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Local Names

***Suaeda vera* Forssk. ex J.F.Gmel.:** Morocco: swida (سُوَيْدَة) (Fennane and Rejdali 2016); Libya: Souida (سُوَيْدَة); Sebta (سَبْتَة) (El-Mokasabi 2022); Egypt: Sebta (سَبْتَة) (Shaltout and Galal 2007).

***Suaeda vermiculata* Forssk. ex J.F. Gmel.:** Morocco: suwed (سُوَيْد) (Carri 2016); Libya: Sabta (سَبْتَة) (El-mokasabi 2022); Egypt: Hatab suaedi (حَطَبْ سُوَيْدِي) (Shaltout and Galal 2007).

Endemism

According to El Oualidi et al., *Suaeda vera* Forssk. ex J.F.Gmel. and *Suaeda vermiculata* Forssk. ex J.F. Gmel. are not endemic to North Africa (Oualidi et al. 2012)

Botany and Ecology

***Suaeda vera* Forssk. ex J.F.Gmel.:** This species belongs to a genus of about 100 halophile species, distributed worldwide, mainly in extra-tropical areas, in the Old World centered around the Mediterranean, and in the semi-deserts of Central and Southwest Asia (Freitag et al. 2001).

Suaeda vera Forssk. ex J.F.Gmel. is a therophyte plant, and it is green, sometimes purple. These plants have lying stems or erect, simple, or branched, and the young stems are pale green, completely purple or with longitudinal green lines, and densely leafy. The leaves are alternate, sessile or with a short petiole, and linear to nearly circular, normally narrow-based. The flowers are sessile or subsessile and arranged in glomeruli; the glomeruli situated on a peduncle at some distance from the axils of the leaves, more rarely on short axillary and ebracted branches and supported by 1–7 bracteoles (Ferren and Schenk 2003). The central flowers are bisexual (Zhu et al. 2003) and are composed of 5 sepaloid tepals, fused over 1/5 to 3/5 of their length, green to purple. There are 5 stamens with oval anthers and 5 stigmas without styles (Freitag et al. 2001).

The studies show that *Suaeda vera* grow best in high to moderate salinity which was related to osmotic adjustment by an accumulation of ions and the organic osmolytes (Asghar et al. 2022).

***Suaeda vermiculata* Forssk. ex J.F. Gmel.:** The plant is a perennial shrub and is distributed in the arid zones of North African countries, in eastern tropical Africa, South-West Asia, in the countries of the Arabian Gulf, and in southern Europe. Its length reaches 50 cm, and the stem is pale green and later becomes gray and fissured (Fig. 1) (El Ghazali 2020). The leaves and bracts are highly and are alternate, subsessile, or sessile. The flowers are bisexual, perianth segments persistent, succulent, stamens inserted on the perianth segments, stigmas 3, 0.6–1.5 mm long, seeds vertical with spiral embryos, 1.5 mm in diameter, glossy back, globular and slightly flattened, fruits utricle, and thin walled (Freitag 1989; El Ghazali 2020).

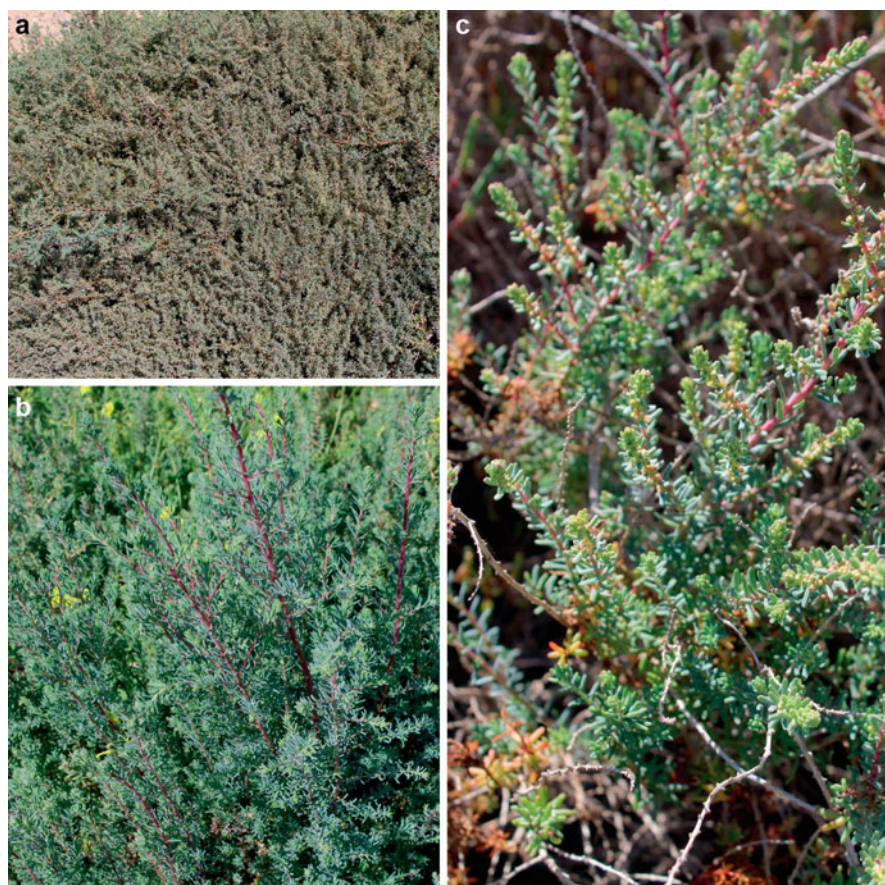


Fig. 1 (a) Life form of *Suaeda vermiculata*. (b) and (c) stem and leaves of *Suaeda vermiculata*. (Photos taken by Prof. Dr. Elachouri Mostafa)

The studies show that *Suaeda vermiculata* grows well in both saline and non-saline soils; it adapts with the environment by changing these physiological characteristics (Fig. 2) (Al-Shamsi et al. 2020).

Local Medicinal Uses

***Suaeda vera* Forssk. ex J.F.Gmel.:** In **Algeria:** The whole plant of *Suaeda vera* Forssk. ex J.F.Gmel is used for digestive and liver diseases, lower blood sugar, osteoarticular disorders, and ophthalmology pathologies (Megharbi and Kechairi 2021; Miara et al. 2021). **Jordan:** The plant is known for its antioxidant properties (Qasem 2015). In **Egypt:** The leaves of this plant are used as ointment for wounds (Mahmoud 2015). In **Libya:** The shoots of plant are used for skin diseases like scabies and herpes (El-Mokasabi 2022).



Fig. 2 (a–c) Border of the Moulouya River, where *Suaeda vermiculata* is widely distributed. Altitude: 95 m. (Photos taken by Prof. Dr. Elachouri Mostafa)

***Suaeda vermiculata* Forssk. ex J.F. Gmel.:** In **Morocco:** The decoction of the whole plant is used in the treatment of cancer (Alami Merrouni and Elachouri 2021), and the aerial parts are used in powder form to treat acne and wound (Ajjoun et al. 2022). For diabetes, aerial parts are used in decoction, and it is administered orally (Fakchich and Elachouri 2021). In **Tunisia:** the essential oil of *Suaeda vermiculata* is used to lower blood sugar and improve lipid balance (Ksouri et al. 2012).

Local Food Uses

In Pakistan, *Suaeda vermiculata* Forssk. ex J.F. Gmel. is used to prepare baking soda used in food preparation (Khan 2016). In Jordan, *Suaeda vera* Forssk. ex J.F. Gmel. is burned and the ashes processed as a source for sodium carbonate for use in glass-making (Qasem 2015).

The plant is very important for the environment and is used to decontaminate the soil of heavy metals (Ayyappan and Ravindran 2014); in this context, the studies show that *Suaeda vera* has a phytoextraction effect: It accumulates heavy metals in their tissues (Gómez-Garrido et al. 2018). Other studies shows that the plant can be used as a soil quality bioindicator (Bader et al. 2019).

The halophyte plants of genus *Suaeda* have been evaluated as forage under drought conditions, and they are used to compensate for the lack of fodder during unfavorable weather conditions (Öztürk et al. 2019); this is due to its content of nitrogen, phosphorus, potassium, and soluble sugars. *Suaeda vera* also appears to be a useful plant for fertilizing the soil, due to its high nitrogen content (Murillo et al. 1987).

Toxicity

After a bibliographic research, we did not find any studies dedicated to the toxicity assessment of *Suaeda vera*; however, for *Suaeda vermiculata*, the authors Mohammed et al. (2020) have demonstrated, in their recent publication, that the treatment of the rat with the aqueous-athanolic extract of *Suaeda vermiculata*, for up to 2 weeks, did not induce any toxicity at doses as high as 5 g/kg, based on Hedge and Sterner scale. Also these authors showed that the cytotoxicity test of aqueous-Extracts exhibited moderate cytotoxicity on HepaG-2 (IC₅₀ 56.19 ± 2.55 µg/mL), designated in accordance with the classification of the cytotoxicity criteria of the natural products extracts on cell lines (Mohammed et al. 2020).

Caution, these findings did not mean that the plant species, *Suaeda vermiculata*, is totally safe, and further tests of toxicity should be done (sub-chronic and chronic), in the aim to confirm the safety of this plant, knowing that the toxicity rate is also affected by several factors such as the rate of ingestion, type and rate of adulteration, and microbial transformation of metabolites.

References

- Ajjoun M, Kharchoufa L, Alami Merrouni I, Elachouri M. Moroccan medicinal plants traditionally used for the treatment of skin diseases: from ethnobotany to clinical trials. *J Ethnopharmacol.* 2022;297:115532. <https://doi.org/10.1016/j.jep.2022.115532>.
- Alami Merrouni I, Elachouri M. Anticancer medicinal plants used by Moroccan people: ethnobotanical, preclinical, phytochemical and clinical evidence. *J Ethnopharmacol.* 2021;266:113435. <https://doi.org/10.1016/j.jep.2020.113435>.
- Al-Shamsi N, Hussain MI, El-Keblawy A. Physiological responses of the xerohalophyte *Suaeda vermiculata* to salinity in its hyper-arid environment. *Flora Morphol Distribut Funct Ecol Plants.* 2020;273:151705. <https://doi.org/10.1016/j.flora.2020.151705>.
- Asghar N, Hameed M, Ahmad MSA. Ion homeostasis in differently adapted populations of *Suaeda vera* Forssk. ex J.F. Gmel. for phytoremediation of hypersaline soils. *Int J Phytoremed.* 2022;25(1):47–65.

- Ayyappan D, Ravindran KC. Potentiality of Suaeda Monoica Forsk. A salt marsh halophyte on bioaccumulation of heavy metals from tannery effluent. *Int J Modern Res Rev.* 2014;2(9): 267–74.
- Bader N, Alsharif E, Nassib M, Alshelmani N, Alalem A. Phytoremediation potential of *Suaeda vera* for some heavy metals in roadside soil in Benghazi, Libya. *Asian J Green Chem.* 2019;3: 82–90. <https://iranjournals.nlai.ir/handle/123456789/40796>
- Carri M. Sharing local ecological knowledge as a human adaptation strategy to arid environments: evidence from an ethnobotany survey in Morocco. *J Arid Environ.* 2016;127:30–43. <https://doi.org/10.1016/j.jaridenv.2015.10.021>.
- El Ghazali G. *Suaeda vermiculata* Forssk. ex J.F. Gmel.: structural characteristics and adaptations to salinity and drought: a review. *Int J Sci.* 2020;9(2):28–33. <https://doi.org/10.18483/ijsci.2268>.
- El-Mokasabi F. Survey of wild trees and shrubs in Eastern Region of Libya and their economical value. *Alq J Med App Sci.* 2022;5:48–55.
- Fakchich J, Elachouri M. An overview on ethnobotanico-pharmacological studies carried out in Morocco, from 1991 to 2015: systematic review (part 1). *J Ethnopharmacol.* 2021;267:113200. <https://doi.org/10.1016/j.jep.2020.113200>.
- Fennane M, Rejdali M. Aromatic and medicinal plants of Morocco: richness, diversity and threats. *Bull L'Inst Sci Rabat Sect Sci Vie.* 2016;38:27–42.
- Ferren WR, Schenk HJ. Suaeda Forsskal ex J. F. Gmel. In: FNA Editorial Committee, editor. *Flora of North America, North of Mexico, vol. 4, Magnoliophyta: Caryophyllidae, part 1.* New York: Oxford University Press; 2003. p. 390–8.
- Freitag H. Contributions to the chenopod Flora of Egyptl. *Flora Morphol Geobotanik Ökol.* 1989;183(1–2):149–73. [https://doi.org/10.1016/S0367-2530\(17\)31550-5](https://doi.org/10.1016/S0367-2530(17)31550-5).
- Freitag H, Hedge I, Jaffri SM, Kothe H, Omer S, Uotila P. *Flora of Pakistan no. 204 Chenopodiaceae.* Karachi: Department of Botany, University of Karachi; 2001.
- Gómez-Garrido M, Mora Navarro J, Murcia Navarro FJ, Faz Cano Á. The chelating effect of citric acid, oxalic acid, amino acids and *Pseudomonas fluorescens* bacteria on phytoremediation of Cu, Zn, and Cr from soil using Suaeda vera. *Int J Phytoremediation.* 2018;20(10):1033–42. <https://doi.org/10.1080/15226514.2018.1452189>.
- Khan MA. Food and water security for dry regions. In: *Halophytes for food security in dry lands 2050.* 2016. p. 231–41. <https://doi.org/10.1016/b978-0-12-801854-5.00014-5>.
- Ksouri R, Ksouri WM, Jallali I, Debez A, Magné C, Hiroko I, Abdelly C. Medicinal halophytes: potent source of health promoting biomolecules with medical, nutraceutical and food applications. *Crit Rev Biotechnol.* 2012;32(4):289–326. <https://doi.org/10.3109/07388551.2011.630647>.
- Mahmoud T. Traditional knowledge and use of medicinal plants in the Eastern Desert of Egypt: a case study from Wadi El-Gemal National Park. *J Med Plants Stud.* 2015;1:10–17. <http://www.plantsjournal.comwww.plantsjournal.com>
- Megharbi A, Kechairi R. Ethnobotanical characterization of halophytes with medicinal virtues, case of the Macta wetland flora: North-West Algeria. *Genet Biodiver J.* 2021;5(2):135–45. <https://doi.org/10.46325/gabj.v5i2.82>.
- Miara MD, Souidi Z, Benhanifa K, Daikh A, Hammou MA, Moumenine A, Sabi IH. Diversity, natural habitats, ethnobotany and conservation of the flora of the Macta marches (North-West Algeria). *Int J Environ Stud.* 2021;78(5):817–37. <https://doi.org/10.1080/00207233.2020.1824867>.
- Mohammed SAA, Khan RA, El-readi MZ, Emwas A-H, Sioud S, Poulson BG, Mohammed HA. *Suaeda vermiculata* aqueous-ethanolic extract-based mitigation of ccl4-induced hepatotoxicity in rats, and hepg-2 and hepg-2/adr cell-lines-based cytotoxicity evaluations. *Plan Theory.* 2020;9(10):1–26. <https://doi.org/10.3390/plants9101291>.
- Murillo JM, Barroso M, Mazuelos C, Sarmiento R. Nutritional and fertiliser values of *Suaeda vera* J. F. Gmelin. *J Sci Food Agric.* 1987;41(2):115–22. <https://doi.org/10.1002/jsfa.2740410204>.

- Oualidi JEL, Khamar H, Fennane M. Checklist des endémiques et spécimens types de la flore vasculaire de l' Afrique du Nord. l'institut scientifique, n°25, 2012, universite Mohammed v-agdal, Rabat. 2012.
- Öztürk M, Altay V, Güvensen A. Sustainable use of halophytic taxa as food and fodder: An important genetic resource in southwest Asia. In: Ecophysiology, abiotic stress responses and utilization of halophytes. 2019. p. 235–57. https://doi.org/10.1007/978-981-13-3762-8_11.
- Qasem JR. Prospects of wild medicinal and industrial plants of saline habitats in the Jordan Valley. Pak J Bot. 2015;47(2):551–70.
- Shaltout KH, Galal TM. Ecosystem of Lake Manzala Prepared by. (August). 2007. <https://doi.org/10.13140/RG.2.1.2044.1448>.
- WFO. *Suaeda vera* Forssk. ex J.F.Gmel. 2023a. <http://www.worldfloraonline.org/taxon/wfo-0000437571>. Accessed 11 Apr 2023.
- WFO. *Suaeda vermiculata* Forssk. ex J.F. Gmel. 2023b. <http://www.worldfloraonline.org/taxon/wfo-0000437561> Accessed 11 Apr 2023.
- Zhu G, Mosyakin SL, Clemants SE. Suaeda. In: Flora of China Editorial Committee, editor. Flora of China, vol. 5. Beijing: Science Press; 2003. p. 384–9.