Scorzonera L.

Subjects: Plant Sciences
Contributor: Karolina Lendzion

Scorzonera L. is a genus in the *Cichorieae* tribe of the *Asteraceae* family. It is spread mostly in central and southern parts of Europe, Eurasia, and Africa in arid areas. The genus comprises approximately 180–190 species.

Keywords: Scorzonera ; biological activity ; herbal medicine ; phytochemical composition

---

1. Introduction

Scorzonera L. is a genus in the *Cichorieae* tribe of the *Asteraceae* family. It is spread mostly in central and southern parts of Europe, Eurasia, and Africa in arid areas [1][2]. Numerous species are endemic to Anatolia (Turkey) [1][3][4][5][6][7][8][9][10][11], Mongolia [12][13][14][15], and China [16][17][18] The genus comprises approximately 180–190 species [19], including *S. hispanica,* whose roots are a valued vegetable, with the taste similar to asparagus [20], and *S. tau-saghyz* (a species of interest in terms of obtaining natural rubber) [21]. Several *Scorzonera* species are a source of feed for farming animals in arid regions [15]. Typically, plants within the *Scorzonera* genus are perennial herbs characterized by the presence of a caudex or tuber. Biennial plants or dwarf subshrubs are rare [19]. Plants within the genus *Scorzonera* are reported to contain flavonoids [12][13][22][23][24], phenolic acid derivatives [8][13][25][26], triterpenoids [18][23][27][28][29][30][31], sesquiterpenoids [14][17][20][32][33][34], dihydroisocoumarins [7][35][36][37], and other bioactive compounds. *Scorzonera* species have been commonly used as medicinal plants in European and Asian herbal therapy for ages. In Turkey, they are known as hemostatic agents, as well as, when used externally, as plasters in the process of wound healing [38]. The plants are also present in folk medicine as a remedy for hypertension, atherosclerosis, or kidney dysfunction [39].

2. *Scorzonera* in Traditional Medicine

Genera within the family *Asteraceae* have been present in folk medicine across Europe, Asia, and northern Africa. That includes species within the *Scorzonera* genus, which are a significant part of Turkish traditional medicine in the therapy of arteriosclerosis, kidney disorders, wounds, rheumatism, but also as antidiabetic, antihypertensive, and antinociceptive medications [5]. The leaves of *S. latifolia* (Fisch and Mey.) DC., applied topically, act as plaster and prevent nausea. Turkish folk medicine uses latex obtained from *S. latifolia* to treat infertility and as an anthelmintic and pain-relieving medication [3][6][38][40]. Roots of *S. tomentosa* L. are believed to have hemostatic properties when ingested [38]. Aerial parts of *S. laciniata* L. are known as antipyretic, antipyogenic, antiatherosclerotic, antidiabetic, antirheumatic, and blood pressure-lowering agents in folk therapy [39]. Turkish folk medicine uses *S. phaeopappa* Boiss., *S. sosnowskyii* Lipsch., and *S. mirabilis* Lipsch. for headaches. *S. mollis* Biela is used as a diuretic and against kidney stones [41]. In Algerian traditional medicine, *S. undulata* ssp. *deliciosa* is a part of the treatment of snake bites [42]. Mongolian folk remedies for various ailments include *Scorzonera* species as well. There are reports for the use of *S. pseudodivaricata* Lipsch. as antipyretic in viral and bacterial infections, anti-diarrheal and diuretic agents, as well as for the treatment of lung edema and diseases caused by parasite infections. Aerial and subaerial parts of *S. divaricata* Turcz. are used to treat ulcers and stomach tumors. [14]. Leaves and shoots of *S. divaricata* are also present in the folk medicine of India in the therapy of jaundice [43]. Traditional Chinese medicine uses *S. mongolica* Maxim. root to reduce fever and treat carbuncle mastitis, as well as an antineoplastic agent [31]. Roots of *Scorzonera hispanica* L., currently cultivated and eaten as a vegetable, were formerly used in European folk medicine as a mucolytic agent in pulmonary diseases, appetite stimulator, and to defeat a cold. [14][32]. Tibetan folk medicine has used *S. austriaca* Willd. for the treatment of carbuncle, inflammation, and fever [17][28]. *Scorzonera radiata* Fisch. is a Mongolian traditional remedy for bacterial and viral infection-induced fever, poisonous ulcers, and as a lactation-inducing and diuretic agent [15]. In Libya, *Scorzonera resedifolia* L. is known as a folk medication for liver pain [44].

3. Phytochemical Composition of *Scorzonera* Species

Species within the *Scorzonera* genus are a source of flavonoid aglycones and glycosides, phenolic acids and their derivatives, lignans, triterpenoids, sesquiterpenoids, dihydroisocoumarins, bibenzyl derivatives, as well other compounds [4][10][14][27][35][36][45][46][47][48].

Biological Activity

The biological activity of species within the *Scorzonera* genus is the subject of research due to their presence in folk medicine in Eurasia and northern Africa. Species that belong to the *Scorzonera* genus are reported to be the source of numerous bioactive compounds. Researchers evaluate their potential as antioxidant [49][50][51][52], anti-inflammatory [27][53][54], and pain-relieving agents [6][55], as well as their cytotoxicity against cancer cell lines [20][28][50] and wound healing properties [4][5].

References

1. Duran, A.; Hamzaoğlu, E. A new species of Scorzonera L. (Asteraceae) from South Anatolia, Turkey. Biologia 2004, 59, 47–50.
2. Karaer, F.; Celep, F. Rediscovery of Scorzonera amasiana Hausskn. and Bornm.—A threatened endemic species in Tur key. Bangladesh J. Bot. 2007, 36, 139–144.
3. Bahadir-Acikara, Ö.; Citoğlu-Gülçin, S.; Dall'Acqua, S.; Özbek, H.; Cvačka, J.; Žemlička, M.; Šmejkal, K. Bioassay-guid ed isolation of the antinociceptive compounds motiol and β-sitosterol from Scorzonera latifolia root extract. Pharmazie 2014, 69, 711–714.
4. Küpeli-Akkol, E.; Šmejkal, K.; Kurtul, E.; Ilhan, M.; Güragac, F.T.; Çitoğlu, G.S.; Acıkara, Ö.B.; Cvačka, J.; Buděšínský, M. Inhibitory activity of Scorzonera latifolia and its components on enzymes connected with healing process. J. Ethnop harmacol. 2019, 245.
5. Küpeli-Akkol, E.; Acikara, O.B.; Süntar, I.; Citolu, G.S.; Kele, H.; Ergene, B. Enhancement of wound healing by topical a pplication of Scorzonera species: Determination of the constituents by HPLC with new validated reverse phase metho d. J. Ethnopharmacol. 2011, 137, 1018–1027.
6. Bahadır, Ö.; Citoğlu, G.S.; Smejkal, K.; Dall'Acqua, S.; Ozbek, H.; Cvacka, J.; Zemlicka, M. Analgesic compounds from Scorzonera latifolia (Fisch. and Mey.) DC. J. Ethnopharmacol. 2010, 131, 83–87.
7. Erik, İ.; Yaylı, N.; Coşkunçelebi, K.; Makbul, S.; Karaoğlu, Ş.A. Three new dihydroisocoumarin glycosides with antimicro bial activities from Scorzonera aucheriana. Phytochem. Lett. 2021, 43, 45–52.
8. Sarı, A.; Şahin, H.; Özsoy, N.; Özbek Çelik, B. Phenolic compounds and in vitro antioxidant, anti-inflammatory, antimicr obial activities of Scorzonera hieraciifolia Hayek roots. S. Afr. J. Bot. 2019, 125, 116–119.
9. Süntar, I.; Bahadır-Acıkara, Ö.; Saltan-Çitoğlu, G.; Keleş, H.; Ergene, B.; Küpeli Akkol, E. In vivo and in vitro evaluation of the therapeutic potential of some Turkish Scorzonera species as wound healing agent. Curr. Pharm. Des. 2012, 18, 1421–1433.
10. Bahadır-Acikara, Ö.; Hošek, J.; Babula, P.; Cvačka, J.; Budešínský, M.; Dračinský, M.; Saltan İşcan, G.; Kadlecová, D.; Ballová, L.; Šmejkal, K. Turkish Scorzonera species Extracts attenuate cytokine secretion via inhibition of NF-κB activat ion, showing anti-inflammatory effect in vitro. Molecules 2016, 21, 43.
11. Coşkunçelebi, K.; Makbul, S.; Gültepe, M.; Okur, S.; Güzel, M.E. A conspectus of Scorzonera s.l. in Turkey. Turk. J. Bo t. 2015, 39, 76–87.
12. Tsevegsuren, N.; Proksch, P.; Wang, Y.; Davaakhuu, G. Bioactive phenolic acids from Scorzonera radiata Fisch. Mong. J. Chem. 2014, 12, 78–84.
13. Wang, Y.; Wray, V.; Tsevegsuren, N.; Lin, W.; Proksch, P. Phenolic compounds from the Mongolian medicinal plant Scor zonera radiata. Z. Naturforsch. Sect. C J. Biosci. 2012, 67, 135–143.
14. Tsevegsuren, N.; Edrada, R.A.; Lin, W.; Ebel, R.; Torre, C.; Ortlepp, S.; Wray, V.; Proksch, P. Biologically active natural products from Mongolian medicinal plants Scorzonera divaricata and Scorzonera pseudodivaricata. J. Nat. Prod. 2007, 70, 962–967.
15. Wang, Y.; Edrada-Ebel, R.; Tsevegsuren, N.; Sendker, J.; Braun, M.; Wray, V.; Lin, W.; Proksch, P. Dihydrostilbene deri vatives from the mongolian medicinal plant Scorzonera radiata. J. Nat. Prod. 2009, 72, 671–675.

16. Li, J.; Wu, Q.X.; Shi, Y.P.; Zhu, Y. A new sesquiterpene lactone from Scorzonera austriaca. Chin. Chem. Lett. 2004, 15, 1309–1310.
17. Zhu, Y.; Wu, Q.X.; Hu, P.Z.; Wu, W.S. Biguaiascorzolides A and B: Two novel dimeric guaianolides with a rare skeleton, from Scorzonera austriaca. Food Chem. 2009, 114, 1316–1320.
18. Wang, B.; Li, G.Q.; Qiu, P.J.; Guan, H.S. Two new olean-type triterpene fatty esters from Scorzonera mongolica. Chin. Chem. Lett. 2007, 18, 708–710.
19. Zaika, M.A.; Kilian, N.; Jones, K.; Krinitsina, A.A.; Nilova, M.V.; Speranskaya, A.S.; Sukhorukov, A.P. Scorzonera sensu lato (Asteraceae, Cichorieae)—Taxonomic reassessment in the light of new molecular phylogenetic and carpological an alyses. PhytoKeys 2020, 137, 1–85.
20. Granica, S.; Lohwasser, U.; Jöhrer, K.; Zidorn, C. Qualitative and quantitative analyses of secondary metabolites in aeri al and subaerial of Scorzonera hispanica L. (black salsify). Food Chem. 2015, 173, 321–331.
21. Buranov, A.U.; Elmuradov, B.J. Extraction and characterization of latex and natural rubber from rubber-bearing plants. J. Agric. Food Chem. 2010, 58, 734–743.
22. Erden, Y.; Kırbağ, S.; Yılmaz, Ö. Phytochemical composition and antioxidant activity of some Scorzonera species. Pro c. Natl. Acad. Sci. India Sect. B Biol. Sci. 2013, 83, 271–276.
23. Benabdelaziz, I.; Haba, H.; Lavaud, C.; Benkhaled, M. Triterpenoids and flavonoid from Scorzonera undulata ssp. alex andrina. Int. J. Chem. Biochem. Sci. 2014, 5, 1–5.
24. Xie, Y.; Guo, Q.S.; Wang, G.S. Flavonoid glycosides and their derivatives from the herbs of Scorzonera austriaca Willd. Molecules 2016, 21, 803.
25. Bader, A.; de Tommasi, N.; Cotugno, R.; Braca, A. Phenolic compounds from the roots of jordanian viper's grass, Scorz onera judaica. J. Nat. Prod. 2011, 74, 1421–1426.
26. Granica, S.; Zidorn, C. Phenolic compounds from aerial parts as chemosystematic markers in the Scorzonerinae (Aster aceae). Biochem. Syst. Ecol. 2015, 58, 102–113.
27. Bahadır-Acıkara, Ö.; Özbilgin, S.; Saltan-İşcan, G.; Dall'Acqua, S.; Rjašková, V.; Özgökçe, F.; Suchý, V.; Šmejkal, K. P hytochemical analysis of Podospermum and Scorzonera n-hexane extracts and the HPLC quantitation of triterpenes. M olecules 2018, 23, 1813.
28. Wu, Q.X.; Su, Y.B.; Zhu, Y. Triterpenes and steroids from the roots of Scorzonera austriaca. Fitoterapia 2011, 82, 493–496.
29. Erik, İ.; Coşkunçelebi, K.; Makbul, S.; Yayli, N. New chlorogenic acid derivatives and triterpenoids from Scorzonera auc heriana. Turk. J. Chem. 2021, 45, 199–209.
30. Çetin, B.; Şahin, H.; Sarı, A. Triterpenoids from Scorzonera veratrifolia Fenzl. Istanbul J. Pharm. 2019, 48, 23–27.
31. Wang, B.; Li, G.-Q.; Guan, H.; Yang, L.; Tong, G. A new erythrodiol triterpene fatty ester from Scorzonera mongolica. Ya o Xue Xue Bao 2009, 44, 1258–1261.
32. Zidorn, C.; Ellmerer-Müller, E.P.; Stuppner, H. Sesquiterpenoids from Scorzonera hispanica L. Pharmazie 2000, 55, 55 0–551.
33. Zhu, Y.; Hu, P.Z.; He, Z.W.; Wu, Q.X.; Li, J.; Wu, W.S. Sesquiterpene lactones from Scorzonera austriaca. J. Nat. Prod. 2010, 73, 237–241.
34. Wu, Q.X.; He, X.F.; Jiang, C.X.; Zhang, W.; Shi, Z.N.; Li, H.F.; Zhu, Y. Two novel bioactive sulfated guaiane sesquiterpe noid salt alkaloids from the aerial parts of Scorzonera divaricata. Fitoterapia 2017, 124, 113–119.
35. Şahin, H.; Sarı, A.; Özsoy, N.; Özbek Çelik, B.; Koyuncu, O. Two new phenolic compounds and some biological activitie s of Scorzonera pygmaea Sibth. and Sm. subaerial parts. Nat. Prod. Res. 2020, 34, 621–628.
36. Sarı, A.; Zidorn, C.; Ellmerer, E.P.; Özgökçe, F.; Ongania, K.H.; Stuppner, H. Phenolic compounds from Scorzonera tom entosa L. Helv. Chim. Acta 2007, 90, 311–317.
37. Paraschos, S.; Magiatis, P.; Kalpoutzakis, E.; Harvala, C.; Skaltsounis, A.L. Three new dihydroisocoumarins from the G reek endemic species Scorzonera cretica. J. Nat. Prod. 2001, 64, 1585–1587.
38. Karakaya, S.; Polat, A.; Aksakal, Ö.; Sümbüllü, Y.Z.; İncekara, Ü. Ethnobotanical study of medicinal plants in aziziye dis trict (Erzurum, Turkey). Turk. J. Pharm. Sci. 2020, 17, 211–220.
39. Yaldiz, G.; Koca Çalişkan, U.; Aka, C. In vitro screening of natural drug potentials for mass production. Not. Bot. Horti A grobot. Cluj-Napoca 2017, 45, 292–300.
40. Bahadır-Acıkara, Ö.; Saltan-Çitoğlu, G.; Dall'Acqua, S.; Šmejkal, K.; Cvačka, J.; Žemlička, M. A new triterpene from Sc orzonera latifolia (Fisch. and Mey.) DC. Nat. Prod. Res. 2012, 26, 1892–1897.

41. Yildirim, B.; Terzioglu, Ö.; Özgökçe, F.; Türközü, D. Ethnobotanical and pharmacological uses of some plants in the dist ricts of Karpuzalan and Adigüzel (Van-Turkey). J. Anim. Vet. Adv. 2008, 7, 873–878.
42. Harkati, B.; Salah, A.; Bayet, C.; Laouer, H.; Dijoux-Franca, M.-G. Evaluation of antioxidant activity, free radical scaven ging and CUPRAC of two compounds isolated from Scorzonera undulata ssp. deliciosa. Adv. Environ. Biol. 2013, 7, 59 1–594.
43. Sharma, J.; Gairola, S.; Gaur, R.D.; Painuli, R.M. The treatment of jaundice with medicinal plants in indigenous commu nities of the Sub-Himalayan region of Uttarakhand, India. J. Ethnopharmacol. 2012, 143, 262–291.
44. Auzi, A.R.A.; Hawisa, N.T.; Sherif, F.M.; Sarker, S.D. Neuropharmacological properties of Launaea resedifolia. Rev. Bra s. Farmacogn. 2007, 17, 160–165.
45. Nasseri, M.A.; Bigy, S.S.; Allahresani, A.; Malekaneh, M. Assessment of antioxidant activity, chemical characterization a nd evaluation of fatty acid compositions of Scorzonera paradoxa Fisch and C. A. Mey. Jundishapur J. Nat. Pharm. Pro d. 2015, 10.
46. Zidorn, C.; Spitaler, R.; Ellmerer-Müller, E.P.; Perry, N.B.; Gerhäuser, C.; Stuppner, H. Structure of tyrolobibenzyl D and biological activity of tyrolobibenzyls from Scorzonera humilis. Z. Naturforsch. Sect. C J. Biosci. 2002, 57, 614–619.
47. Zidorn, C.; Ellmerer-Müller, E.P.; Stuppner, H. Tyrolobibenzyls—Novel secondary metabolites from Scorzonera humilis. Helv. Chim. Acta 2000, 83, 2920–2925.
48. Zidorn, C.; Ellmerer, E.P.; Sturm, S.; Stuppner, H. Tyrolobibenzyls E and F from Scorzonera humilis and distribution of c affeic acid derivatives, lignans and tyrolobibenzyls in European taxa of the subtribe Scorzonerinae (Lactuceae, Asterac eae). Phytochemistry 2003, 63, 61–67.
49. Yang, Y.-J.; Liu, X.; Wu, H.-R.; He, X.-F.; Bi, Y.-R.; Zhu, Y.; Liu, Z.-L. Radical scavenging activity and cytotoxicity of activ e quinic acid derivatives from Scorzonera divaricata roots. Food Chem. 2013, 138, 2057–2063.
50. Yang, Y.-J.; Yao, J.; Jin, X.-J.; Shi, Z.-N.; Shen, T.-F.; Fang, J.-G.; Yao, X.-J.; Zhu, Y. Sesquiterpenoids and tirucallane tr iterpenoids from the roots of Scorzonera divaricata. Phytochemistry 2016, 124, 86–98.
51. Milella, L.; Bader, A.; de Tommasi, N.; Russo, D.; Braca, A. Antioxidant and free radical-scavenging activity of constitue nts from two Scorzonera species. Food Chem. 2014, 160, 298–304.
52. Erden, Y.; Kırbağ, S. Chemical and biological activities of some Scorzonera species: An in vitro study. Proc. Natl. Acad. Sci. India Sect. B Biol. Sci. 2015, 85, 319–326.
53. Bahadır-Acıkara, Ö.; Küpeli-Akkol, E.; Süntar, I.; Ergene, B.; Saltan-Çitoğlu, G.; Çoban, T. Assessment of anti-inflamma tory and free radical scavenger activities of selected Scorzonera species and determination of active components. Int. J. Pharmacogn. Phytochem. Res. 2014, 6, 492–498.
54. Donia, A.E.R.M. Phytochemical and pharmacological studies on Scorzonera alexandrina Boiss. J. Saudi Chem. Soc. 2 016, 20, S433–S439.
55. Bahadır, Ö.; Saltan, H.G.; Özbek, H. Antinociceptive activity of some Scorzonera L. species. Turk. J. Med. Sci. 2012, 4 2, 861–866.