



A new species of *Kali* (Salsoloideae, Chenopodiaceae) from Sicily, supported by molecular analysis

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Abstract

Nomenclatural and taxonomical considerations on *Kali*, a controversial genus recently segregated from the polyphyletic *Salsola* s. lat. (*Chenopodiaceae*), are provided. The *Kali* group includes annual plants with leaves ending in a spine and lacking hypodermis, having also a cortex alternate to longitudinal chlorenchymatous striae. The species belonging to this genus mainly have a paleotemperate distribution (Europe, Asia and North Africa), occurring as aliens in North America, Australia and South Africa. A new species collected on Mt. Etna (Sicily), and closely related to *K. australe*, is described and illustrated as *K. basalticum*. Its morphological and molecular features, karyology ($2n=54$), ecology, distribution, phylogeny and conservation status are examined. In addition, a list of the currently known species of *Kali* is provided, with some new combinations: *Kali nepalense* (Grubov) comb. nov., *Kali pellucidum* (Litvinov) comb. nov., *Kali sinkiangense* (A.J. Li) comb. nov., *Kali gobicolum* (Iljin) comb. nov., and *Kali ryanii* (G.F. Hrusa & Gaskin) comb. nov.

Key words: Chenopodiaceae, haplotype, ITS, *Kali*, karyology, new species, phylogeny, Sicily, taxonomy

Introduction

Salsola Linnaeus (1753: 222) is a rather controversial genus within the tribe *Salsoleae* Moq. (*Chenopodiaceae* Vent.) including succulent plants (at least succulent in the leaves and young branches), which are usually characterized by the fruiting perianth with scarious wings that assist in wind dispersion, and spiral embryos (Moquin-Tandon 1840, Bunge 1862, Freitag 1997, Zhu *et al.* 2003, Kadereit *et al.* 2005).

Several morphological and molecular investigations showed that there are many taxonomic and phylogenetic questions, some of which are still unresolved (Meyer 1829, Moquin-Tandon 1840, Bunge 1862, Volkens 1893, Ulbrich 1934, Iljin 1936, Botschantzev 1969a, 1969b, 1970, 1974a, 1974b, 1981, Aellen & Townsend 1972, Brullo 1984, Tzvelev 1993, Hedge *et al.* 1997, Grubov 2000, Pyankov *et al.* 2001, Kadereit *et al.* 2003, 2005, Kapralov *et al.* 2006, Akhani *et al.* 2007, Wen *et al.* 2010, Kadereit & Freitag 2011, Föderova 2011, Akopian 2011, Hrusa 2012, Brullo *et al.* 2013). In particular, some sections, subsections or unranked groups formerly recognized within *Salsola* s.l. were segregated at generic rank. As a consequence, many new genera were described, as well as some misappreciated or neglected ones, such as *Climacoptera* Botschantzev (1956: 111) (see Botschantzev 1969a, and Prатов 1986), *Halothamnus* Jaubert & Spach (1846: 50) (see Botschantzev 1981, and Kothe-Heinrich 1993), *Traganum* Delile (1813: 204), *Darniella* Maire & Weiller (1939: 301) (see Brullo 1984), *Fadenia* Aellen & Townsend (1972: 501), *Xylosalsola* Tzvelev (1993: 80), *Nitrosalsola* Tzvelen (1993: 80), *Kali* Miller (1754: without pagination) (see Akhani *et al.* 2007, and Wen *et al.* 2010), *Turania* Akhani & Roalson in Akhani *et al.* (2007: 946), *Kaviria* Akhani & Roalson in Akhani *et al.* (2007: 248), *Pyankovia* Akhani & Roalson in Akhani *et al.* (2007: 249), *Caroxylon* Thunberg (1782: 37) (see Botschantzev 1974a, Tzvelev 1993, Akhani *et al.* 2007, Brullo *et al.* 2013), *Halimocnemis* C. A. Meyer (1829: 381) (see Ghobadnejhad *et al.* 2004, and Akhani *et al.* 2007), and *Nanophyton* Lessing (1834: 197) (see Prатов 1982, 1985). In some cases, the taxonomic treatment based on morphologic features is not well supported by the molecular studies,

≡ *Salsola kali* L. var. *tragus* (Linnaeus) Moquin-Tandon in Candolle (1849: 187).
 ≡ *Salsola kali* L. subsp. *tragus* (Linnaeus) Čelakovský (1871: 155).
 Type (lectotype designated by Degen 1937):—EUROPE. *Herb. Linnaeus 315.3* (LINN). Type (epitype designated by Rilke 1999):—FRANCE. *Kali spinosum cochleatum, Monspelii, Dania, Beleg, Herb Burser XVI(2)-24* (UPS).
 = *Salsola caroliniana* Walter (1788: 111).
 Type (lectotype designated by Rilke 1999):—U.S.A. America borealis, Carolina, *s.coll.* (BM).
 = *Salsola tragus* L. subsp. *iberica* Sennen & Pau in Sennen (1908:476).
 ≡ *Salsola iberica* (Sennen & Pau) Botschantzev ex Czerepanov (1973: 192).
 ≡ *Salsola kali* L. subsp. *iberica* (Sennen & Pau) Rilke in Rech. fil, (1997: 183).
 Type (lectotype designated by Rilke 1999):—SPAIN. Miranda de Ebro, 6 September 1907, *Elias s.n.* (BSB).
 = *Salsola ruthenica* Iljin (1934: 137).
 ≡ *Salsola kali* Linnaeus subsp. *ruthenica* Soó in Soó & Jávorka (1951: 786).
 Type (lectotype designated by Crompton & Bassett 1985):—EUROPE. In pratis vere inundatis, solo arenoso, 12 September 1899, *I. Schirajewsky s.n.* (K).

18) *Kali turgidum* (Dumortier) Gutermann (2011: 98)

Bas.:—*Salsola turgida* Dumortier (1827: 23).
 Type (lectotype designated by Rilke 1999):—NEDERLAND. In arenosis marit. Holl. près Harlem a Zandvoort (BR).
 ≡ *Salsola kali* Linnaeus (1753: 222).
 Type (lectotype designated by Jonsell & Jarvis 1994):—*Herb. Burser* (UPS XVI(2)-24).
 Type (epitype designated by Rilke 1999):—ORIGIN UNKNOWN. *Herb. Clifford: 86, Salsola 1* (BM).
 = *Kali sodum* Moench (1794: 331), non Scopoli (1772: 175), nom. illeg. (art. 53.1, McNeill *et al.* 2012).
 = *Salsola decumbens* Lamarck (1779: 241), nom illeg. (Art.52.1, McNeill *et al.* 2012).
 = *Salsola acicularis* Salisbury (1796: 153), nom. illeg. (Art.52.1, McNeill *et al.* 2012).

19) *Kali zaimadium* (Iljin) Akhani & Roalson in Akhani *et al.* (2007: 946).

Bas.:—*Salsola zaimadica* Iljin (1955:122).
 Type:—IRAN. Zaidam, August 1879, *Przewalski 838* (holotype LE).

Collections information:

K. australe(a): L. Smith S-036, Fresno, CA, beside RR tracks, USA.
K. australe(b): F. Ryan A1, Avondale, Arizona, USA.
K. basalticum: S. Brullo & G. Giusso, Sicily, C.da Ruvolita (Bronte), ITALY.

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Appendix. Specimens examined.

Kali australe. U.S.A. California: San Joaquin Valley ½ mi. NW of Holt townsite. Sandy low field, 8 November 2013, *Hrusa & Rhode 18529* (CAT!, CDA!); California: San Diego Co., Sacramento, Mission Valley, November 1999, *Ryan s.n.* (CAT!, CDA!); California: Modesto Co., Santa Nella, November 1999, *Ryan s.n.* (CAT!, CDA!).