

NOTES ON THE TAXONOMY AND DISTRIBUTION OF SAMERARIA (BRASSICACEAE) IN IRAN

H. Moazzeni, Sh. Zarre & H. Ranjbar

Moazzeni, H., Zarre, S. & Ranjbar, H. 2006 12 31: Notes on the taxonomy and distribution of the *Sameraria* DESV. (*Brassicaceae*) in Iran. –*Iran. J. Bot.* 12 (2): 163-168. Tehran.

In the course of preparing a revision of *Sameraria* and its allies (tribe *Isatideae*) in Iran, we found some specimens of *S. glastifolia* (sect. *Tetrapterygium*), a species closely related to *S. stylophora*. Moreover, *S. elegans* is reduced to synonymy of *S. armena*. As *S. stenophylla* has also been recorded recently from Iran, a diagnostic key including all species of the genus in Iran is presented

Hamid Moazzeni & Shahin Zarre, Department of Botany, School of Biology, University College of Science, University of Tehran, P.O. Box: 14155-6455, Tehran, Iran. – Hamideh Ranjbar Research Centre of Forests and Rangelands, P. O. Box. 141-5355, Tabriz, Iran,

Key words. *Sameraria*, *Brassicaceae*, identification key, new record, new synonymy, Iran.

یاداشتهایی بر تاکسونومی و پراکنش *Sameraria* (تیره شب بو) در ایران

حمید موذنی، شاهین زارع و حمیده رنجبار

در راستای بررسی تاکسونومی جنس *Sameraria* در ایران، گونه *S. glastifolia* که با *S. stylophora* قرابت زیادی نشان می‌دهد به عنوان گونه جدیدی برای ایران گزارش و همچنین *S. elegans* مترادف با *S. armena* شناخته می‌شود. یک کلید شناسایی و نکاتی در ارتباط با تشخیص افتراقی گونه‌ها در این جنس ارائه می‌شود.

INTRODUCTION

The genus *Sameraria* Desv. (*Brassicaceae*) comprises approximately nine species distributed primarily in SW Asia (Davis 1964, 1965; Jafri 1973; Appel & Al-Shehbaz 2003; Al-Shehbaz & al. 2006). *Sameraria* is a predominantly Irano-Turanian genus (Davis 1964; Jafri 1973), with its major distribution area from Iran to central Asia. Five species (one endemic) grow in Iran, four in Caucasus, three in Armenia and Turkmenistan, two each in Azerbaijan, Turkey, and Afghanistan and one each in Iraq and Pakistan. *Sameraria* is very close to *Isatis* L. in habit, leaf, inflorescence and flower characters (Hedge 1968; Jafri 1973). It is only distinguishable from *Isatis* by having distinct (instead of obsolete) style (Davis 1964; 1965; Hedge 1968; Jafri 1973).

Like many genera in *Brassicaceae*, *Sameraria* has been poorly described and illustrated in the previous studies. In the majority of cases, only the fruit characters have been described and drawn in details. Therefore, some taxonomic characters considered in previous studies as important in circumscribing the species within the tribe *Isatideae* sensu Al-Shehbaz et al. (2006) are discussed below.

Duration and habit: All *Sameraria* species are annual, although some specimens of *S. nummularia* Bornm. are robust annual or biennial with a woody stem. In *S. elegans* Boiss. the stem is sometimes procumbent. It is not known whether these variations are a direct environmental response or the result of inherited differences.

Leaves: Basal (radical) leaves and median stem leaves are always very different in form, and therefore both should be collected for the determination of species. That poses some difficulties, because in many species the basal leaves are withered by the time the plant is in fruit. In many species the basal leaves vary from entire to toothed (*S. elegans*) or even pinnately lobed (*S. stenophylla* Rech. f.). The median stem leaves have acute or obtuse auricles. Leaf size and shape are not useful in the separation of species in *Sameraria*.

Indumentum: Most of the specimens studied are glabrous on leaves and stems. Furthermore, leaf and stem indumentum are unreliable in the separation of species in *Sameraria* due to their variability even among different individuals of the same population.

Inflorescence: The inflorescence is a compound panicle varying in being dense or lax. For example, *S.*

nummularia has a lax and elongated fruiting raceme in comparison to other species with a dense and short fruiting raceme.

Flowers: In *Sameraria* flower size provides valuable characters in separating the species. For example, *S. stenophylla* has large flowers with petals about 7 mm long, while *S. armena* (L.) Desv., a close relative, has petals to 4 mm long. Regarding corolla size, there are overlaps among the species, *Sameraria armena* and *S. elegans* are considered to be distinct species based on petal size, which does not exceed 2.5 mm in *S. armena*, while about 4 mm in *S. elegans*. However, based on our detailed measurements of many herbarium sheets of both species, a continuous range was observed for them. Therefore, we suggest the synonymy of these species. The shape, size, color and indumentum of sepals are again not valuable to be used as differential characters. Sepals are almost 3 × 1 mm in size, their shape is oblong and their color varies from green or violet (some specimens of *S. elegans*) to whitish green.

Fruit: Fruit dehiscence (vs. indehiscence) has always been emphasized as a useful feature in the classification of the *Brassicaceae*. Despite its considerable variability within many taxa, its importance both for classification and identification cannot be denied. It's often impossible to infer from immature fruit what the form of the ripe organ is going to be. However, the indehiscent fruit of *Sameraria* is a silicle with two (sect. *Sameraria*) or four wings (sect. *Tetraptrygium*). The fruit is orbicular to ovate in shape and cordate at base. In many cases the species cannot be recognized when the plants are in flower. However, the role of fruit in distinguishing the taxa is not as important as for *Isatis* species. Style length is valuable in distinguishing some species, such as *S. stylophora* (Jaub. & Spach.) Boiss. (style 0.5-1 mm long) from *S. glastifolia* (Fisch. & C. A. Mey.) Boiss. (style 2-3 mm long).

Although fruit shape and size has been used to identify many taxa in the tribe *Isatideae*, presence or absence of a style is a very important character for separating *Sameraria* from *Isatis*. As shown by molecular systematic studies (Koch & al. 2003; Mitchell-Olds & al. 2005; Mummenhoff & al. 2005; Al-Shehbaz & al. 2006) fruit and embryo features can be subjected to considerable convergence and therefore are sometimes taxonomically unreliable. Phylogenetic studies of *Sameraria* and its generic relatives (*Isatideae*) in Iran are well underway at University of Tehran.

TAXONOMIC ACCOUNT

The study of *Sameraria* and its allies was mainly based on material deposited in the main herbaria of Iran, such as FUMH, IRAN, TUH (abbreviations follow

Holmgren & Holmgren 1998), and the local herbarium of University of Tabriz, Faculty of Agriculture (TABUH). According to Hedge (1968) four species of *Sameraria* are distributed in Iran. Moazzeni & al. (2006) have recently added *S. stenophylla*. Several field studies were also conducted in N and NW Iran in order to study the character variability within certain species and to collect more herbarium material. We had also the opportunity to study some specimens of *S. glastifolia* from Turkey provided to us by Dr Ali Dönmez of Hacettepe University. An updated key and distribution maps of all species of *Sameraria* in Iran are given below.

Key to the species of *Sameraria* distributed in Iran

- 1- Silicles with 4 wings (sect *Tetraptrygium*) 2
- Silicles with 2 lateral wings (Sect. *Sameraria*) 4
- 2-Silicles 9-12 × 8-10 mm; fruiting raceme elongated; petals 2-4 mm wide *S. nummularia*
- Silicles 17-24 × 15-20 mm; petals 1- 3 mm wide; fruiting raceme short 3
- 3-Petals 1-1.5 mm wide; style (1-)2-3 mm long *S. stylophora*
- Petals 2-3 mm wide; style up to 1 mm long *S. glastifolia*
- 4- Petals 6-7 × ca. 2 mm; cauline leaves with sagittate auricles, apex attenuate *S. stenophylla*
- Petals 2-4.5 × 1-1.5 mm; cauline leaves with rounded auricles, apex rounded *S. armena*

New report to Iran

Sameraria glastifolia (Fisch. & C.A. Mey.) Boiss., Fl. Or. 1: 375 (1867).

Syn: *Tetraptrygium glastifolia* Fisch. & C.A. Mey., Ind. Sem. Hort. Petrop. 1:39 (1835). Illustration: Fig. 1. Herb annual. *Stems* 20-35(-40) cm long, branched at base, sometimes branched at middle, glabrous. *Basal leaves* rosulate; petiole 1-1.5 cm long; leaf blade obovate to oblong, (15-)2-2.5 × (1-)1.2-1.4(-1.5) cm, base cuneate, margin entire or dentate to sinuate, apex obtuse to rounded; *cauline leaves* amplexicaul; leaf blade oblong or lanceolate, base auriculate, margin entire to sinuate, apex acute or obtuse. *Fruiting pedicels* 5-7 mm long, slender, deflexed to patent, glabrous. *Sepals* whitish green, oblong, 3-3.5(-4.5) × ca. 1.5 mm, glabrous. *Petals* yellow to yellowish white, obovate, 4.5-5.5(-6) × (1-)1.5-2(-2.5) mm, claw 2-2.5 mm long. *Staminal filaments* (1.5-)2.5-3.5 mm long. *Fruits* orbicular, winged all around, (9-)10-12 × (5-)7-9(-11) mm, base cordate; style 0.5-1 mm, glabrous or rarely villous; *wings* 4, (2.5-)3-4 mm wide at locule;

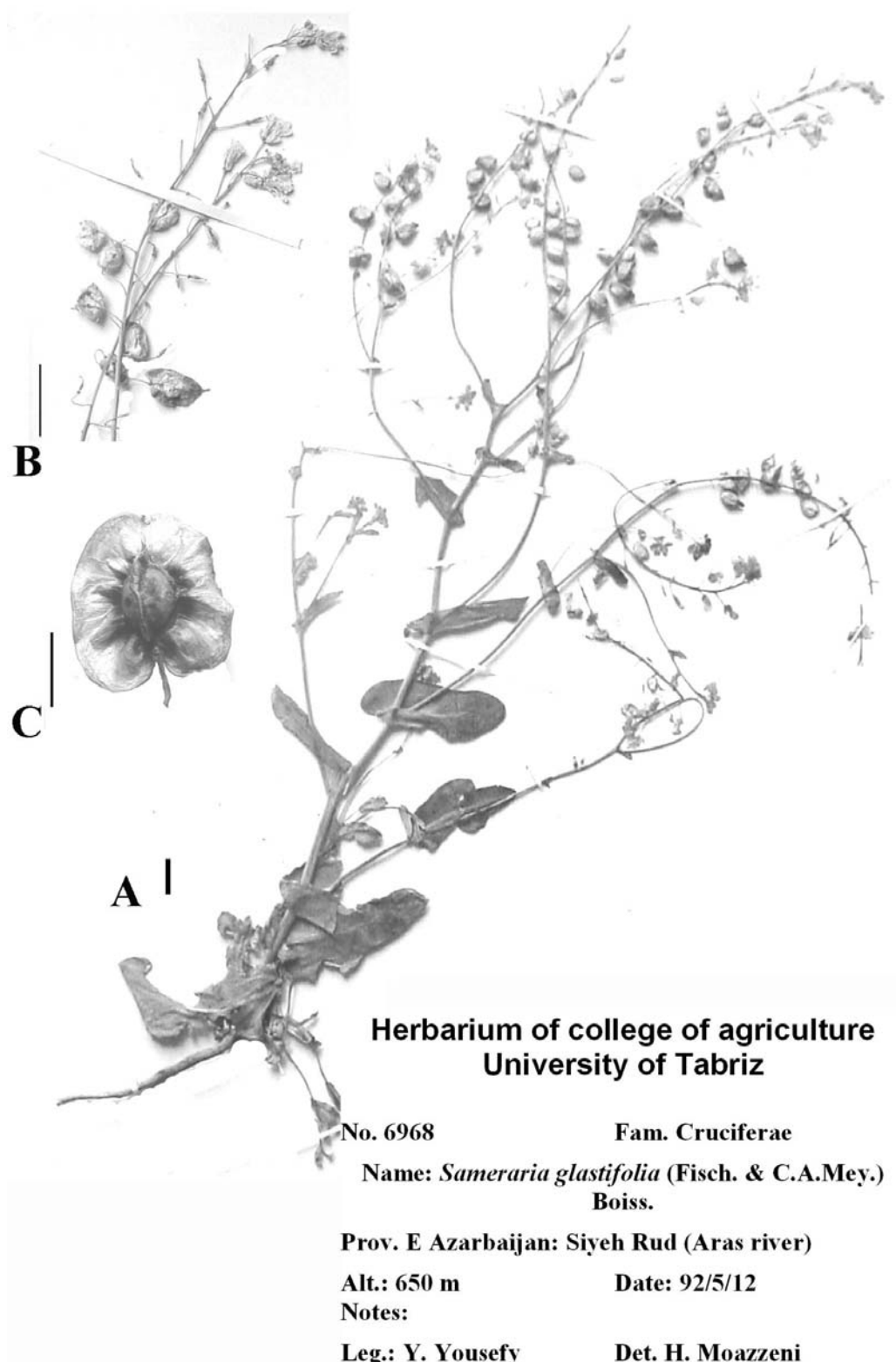


Fig. 1. *Sameraria glastifolia*, A: habit, B: inflorescence, C: mature fruit. Scale bar in A = 1 cm, B = 1 cm, C = 5 mm.

Table 1. Comparison between *Sameraria armena*, *S. elegans* and their closest relative *S. stenophylla*.

Characters	<i>S. armena</i>	<i>S. elegans</i> ¹	<i>S. stenophylla</i>
Basal leaves	spatulate	spatulate	obovate-oblong
Petal length (mm)	2-3(-3.5)	(3-) 3.5-4	6-7
Petal color	yellowish white	yellowish white	yellow
Pedicel length (mm)	5-10(-12)	7-11	7-10
Silicle length (mm)	15-19(-20)	(13-)15-19	15-15
Style length (mm)	0.5-1	0.5-1.5	1-3
Fruit indumentum	absent or villous	absent or villous	densely villous

¹ In the case of *Sameraria elegans* we mean the individuals appropriate with its type, but we do not accept it as a distinct taxon.

locule 4-5 mm wide, positioned at middle or base.

Seeds light brown, oblong, (2-)3-4 × (1-)1.5-2.5 mm.

Flowering period. April-May

General distribution. Iran, Central Asia, Turkey

Specimens examined.

Iran, Prov. East Azarbaijan, Siyah roud, Aras, Youssefy 6968 (TABUH); N Kalibar, Buran Olia, Youssefy 7672 (TABUH); N Tabriz, Marand, Katal, Youssefy 9932 (TABUH).

Sameraria glastifolia is clearly related to *S. stylophora*, from which it is distinguished by having broader petals 2-3 mm wide (vs. 1-1.5 mm wide in *S. stylophora*) and shorter styles (up to 1 mm vs. 2-3 mm in *S. stylophora*). However, distribution patterns of these species overlap with each other (map. 1). *Sameraria stylophora* shows a wide distribution area in Iran, while *S. glastifolia* is known only from Prov. East Azarbaijan near the borders to Azerbaijan country (map. 1). According to Davis (1965) and Bush & Vasilchenko (1939) *Sameraria glastifolia* is also distributed in NE Turkey (A9) and Caucasus (Nakhichevan).

A new synonymy in *Sameraria*

Based on Hedge (1968), *S. armena* is distinguishable from *S. elegans* only by having shorter petals (2-2.5 mm long vs. 4-4.5 mm long in *S. elegans*). However, through our detailed field examination and measurement of several herbarium materials, there are many intermediate forms, and the distinction between them is not as sharp as alleged by Hedge. Moreover, plants with small and large flowers occur in the same population. The type locality of *S. elegans* is between Yazd and Kerman in South Iran, in a same area we found several plants with shorter flowers as those of *S. armena*. Hedge (1968) also attributed some plants collected in this area by Bunge (Numbers 78 and 79) to *S. elegans* and one plant to *S. armena*. We found also mixed individuals (regarding petal size) in populations distributed in provinces Semnan and Khorassan (map. 2). Interestingly, Jafri (1973) described a new subspecies under *S. armena* as subsp. *flaccida* Jafri,

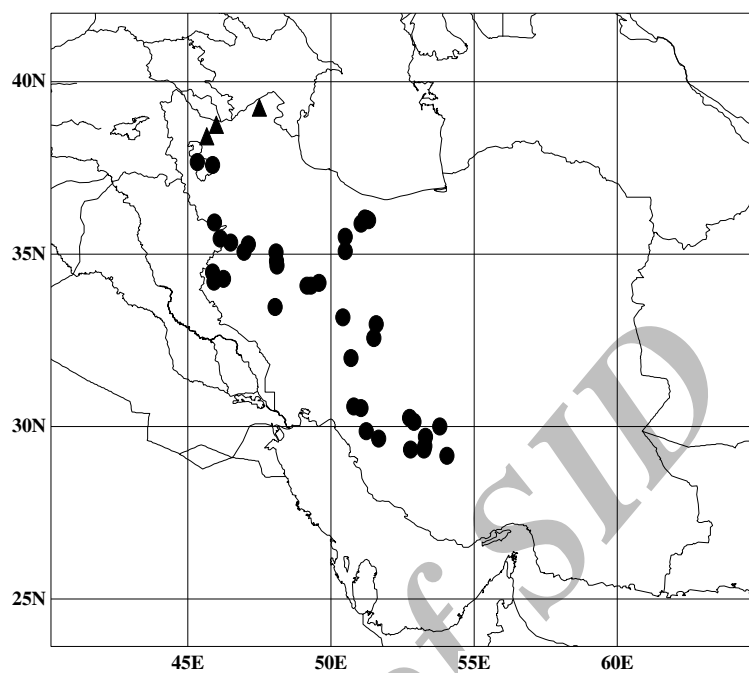
with petals about 4 mm long, which fits with the description of *S. elegans*. The differences in pedicel length are also misleading, as we found several intermediate plants. The pedicels are said to be 3-7 mm long in *S. armena* subsp. *armena*, but 10-15 mm in *S. armena* subsp. *flaccida* (table 1). Rechinger (1976) also mentioned that *S. elegans* is rather frequent, often together with the *S. armena* (fig. 3) in Touran Protected Area in South Semnan. *Sameraria armena* is related to *S. stenophylla*, but it is easily distinguishable from the latter mainly by its large petals (6-7 mm against maximally 4.5 mm in *S. armena*) and its densely villous fruits (against glabrous ones in *S. armena*). A more detailed comparison between these species is given in table 1.

ACKNOWLEDGEMENTS

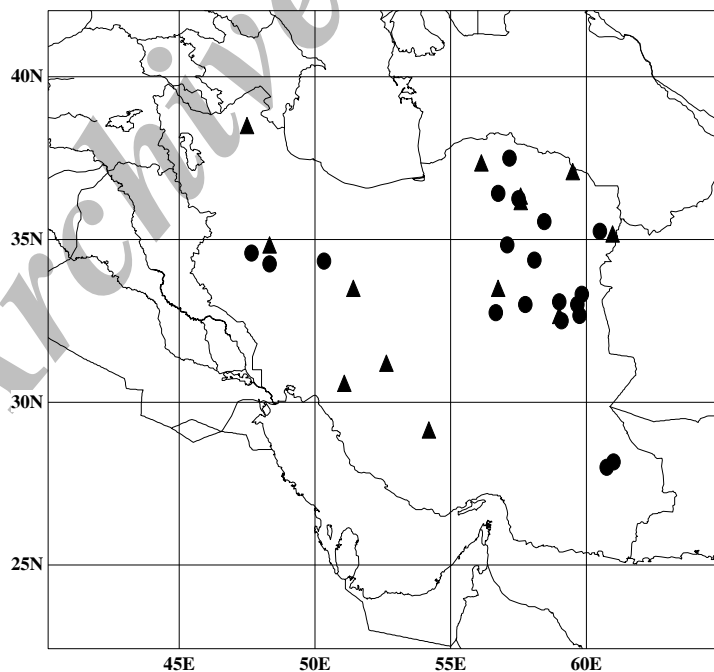
We are grateful to Ihsan Al-Shehbaz (Missouri Botanical Garden) for correcting the English and review of the manuscript. We thank Ali Dönmez (Hacettepe University), Mansur Mirtajedini (Kerman University), Mohammad Reza Joharchi (Mashhad University), Hossein Maroofi (Research Institute of Forests and Rangelands, Kordestan) and Ahmad Gharemani (Research Institute of Forests and Rangelands, Tabriz) for providing herbarium material of several species. The study was supported in part by the Research Council of Tehran University.

REFERENCES

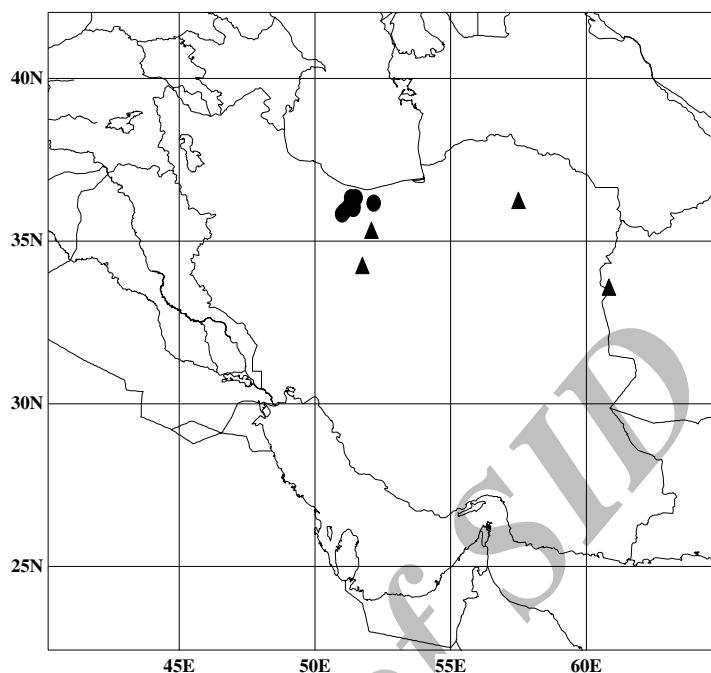
- Al-Shehbaz, I.A., Beilstein, M.A. & Kellogg, E.A. 2006: Systematic and phylogeny of Brassicaceae (Cruciferae): an overview. -Pl. Syst. Evol. 259: 89-120.
- Appel, O. & Al-Shehbaz, I.A. 2003: *Cruciferae*. In: Kubitzki, K. (ed.). Families and Genera of Vascular Plants, Vol. 5: pp.75-174. -Berlin and Heidelberg: Springer-Verlag.
- Boissier, E. 1867: Flora Orientalis. -Basileae. 1: 374-376



Map. 1. Distribution map of *Sameraria stylophora* (●) and *S. glastifolia* (▲) in Iran.



Map.2. Distribution map of *Sameraria armena* (▲) and *S. elegans* (●) in Iran.



Map.3. Distribution map of *Sameraria stenophylla* (▲) and *S. nummularia* (●) in Iran.

- Bush, N.A. & Vasil'chenko, I.T. 1939: *Sameraria*. In Komarov VL (ed) Flora of USSR., Vol. 8: pp. 172-177. -Moskva, Leningrad: Akademii Nauk SSSR.[in Russian]
- Davis, P.H. 1964: Materials for a flora of Turkey: VIII cruciferae 1: Isatis. -Notes from the Royal Botanic Garden Edinburgh Vol. 26: 11-25.
- Davis, P.H. 1965: *Sameraria*. In: Davis PH (ed.) Flora of Turkey and the East Aegean Islands, Vol. 1: pp.1-567. -Edinburgh: Edinburgh University Press.
- Hedge, I.C. 1968: Lepidieae. In: Rechinger KH (ed.) Flora Iranica, no. 57: 63-122. -Graz: Akademische Druck-u. Verlagsanstalt.
- Holmgren, P.K. & Holmgren, N.H. 1998: (continuously updated): Index herbariorum. - <http://sciweb.nybg.org/science2/IndexHerbariorum.asp>
- Jafri, S.M.H. 1973: Brassicaceae. In: Nasir E & Ali SI (eds.) Flora of West Pakistan, no. 55: 1-308. Karachi: University of Karachi.
- Koch M, Al-Shehbaz IA & Mummenhoff K 2003: Molecular systematics, evolution, and population biology in the mustard family (Brassicaceae). -Ann. Missouri Bot. Gard. Vol. 90:151-171.
- Mitchell-Olds T, Al-Shehbaz IA, Koch M & Sharbel TF 2005: Crucifer evolution in the post-genomic era. in: Henry R. J. (ed.), Plant Diversity and Evolution: Genotypic and Phenotypic Variation in Higher Plants. pp. 119-137. CAB International.
- Moazzeni, H., Sajedi, S. & Joharchi, M.R. 2006: *Sameraria stenophylla* (Brassicaceae), A new record for the flora of Iran. -Iran. J. Bot. 12 (1): 63-66.
- Mummenhoff. K., Al-Shehbaz, I.A., Bakker, F.T., Linder, H.P. & Mühlhausen, A. 2005: Phylogeny, morphological evolution, and speciation of endemic *Brassicaceae* genera in the Cape flora of southern Africa. -Ann. Missouri Bot. Gard. 92: 400-424.
- Rechinger, K.H. 1976: Plant of the kavir protected region, Iran. -Iran. J. Bot. 1:23-56.