

Supplementary Figures (S1–S9) and Tables (S1–S2)

Getting back to the Sources: New Insights on the Phylogenetic Placement and Circumscription of *Sclerosiphon (Iridaceae)* and its Relationships to the Re-circumscribed *Cryptobasis*

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Table S1. Summary of GenBank accessions, collections, isolates, and voucher specimens. Information regarding newly added accessions from reference [18] is also provided (highlighted in blue), as well as newly generated sequences (in orangish).

Species (*as named in the GenBank)	Maturase K (<i>matK</i>) gene	<i>trnL</i> (UAA) - <i>trnF</i> (GAA) loci	<i>rpl14</i> - <i>rps8</i> IGS	Voucher; collection and/or isolate	Reference
<i>Iris junzifengensis</i> S.P.Chen, Xin Y.Chen & Liang Ma (<i>I. j.</i> Xin Y.Chen & Liang Ma*)	-	OK137199	-	China: Fujian Province, Mingxi County, Junzifeng, under the forest on slope, 500 m, 4 April 2018, X.Y. Chen JZF18000556	Chen et al. (2022); https://doi.org/10.11926/jtsb.4438
<i>Phaeiris hexagona</i> (Walter) M.B.Crespo, Mart.-Azorín & Mavrodiev	KJ772866.1	-	-	Abbott (FLAS-18098)	Germain-Aubrey et al. (2015); http://2015.botanyconference.org/engine/search/index.php?func=detail&id=855
<i>Chamaeiris sogdiana</i> (Bunge) M.B.Crespo	MZ054598	-	-	N. Beshko (TASH-20192306)	Nikitia et al. (2023); https://doi.org/10.14719/pst.2596
<i>Xiphion fontanesii</i> Baker	OP715658	OP715658	OP715658	Isolate Carol Wilson Font-11_S41_pla	Wilson et al. (2023) https://doi.org/10.1600/036364423X16847773873116
<i>Xiphion heracleantum</i> J.Mart.Rodr. & M.B.Crespo*	OP715664	OP715664	OP715664	Isolate Carol Wilson Hera-12_S40_pla	Wilson et al. (2023); https://doi.org/10.1600/036364423X16847773873116
<i>Iridodictyum</i> sp. nova affinitas <i>vartanii</i> (<i>I. vartanii</i> Foster*)	OP715673	OP715673	OP715673	Isolate Carol Wilson Vart_S7_pla	Wilson et al. (2023); https://doi.org/10.1600/036364423X16847773873116
<i>Iridodictyum zagricum</i> (B.Mathew & Zarrei) M.B.Crespo, Mart.-Azorín & Mavrodiev*	OP715676	OP715676	OP715676	Isolate Carol Wilson Zag_S10_pla	Wilson et al. (2023); https://doi.org/10.1600/036364423X16847773873116
<i>Alatavia pskemensis</i> (Rukšāns) M.B.Crespo, Mart.-Azorín & Mavrodiev	OP715671	OP715671	OP715671	Isolate Carol Wilson Pske-15_S42_pla	Wilson et al. (2023); https://doi.org/10.1600/036364423X16847773873116
<i>Xiphion junceum</i> (Poir.) Parl.	OP715657	OP715657	OP715657	Isolate Carol Wilson Junc-19_S43_pla	Wilson et al. (2023); https://doi.org/10.1600/036364423X16847773873116
<i>Iris tibetica</i> (Dykes) Bolt.	-	LT627934	-	Isolate QIN: China: Qinghai, Yushu Zang, near Gonghe	Boltenkov et al. (2018); https://doi.org/10.11646/phytotaxa.338.3.1
<i>Eremiris oxypetala</i> (Bunge) Rodion.	-	LT627917	-	Isolate PAK: Pakistan: Gilgite-Hunza, Nagar Valley, Pisan	Boltenkov et al. (2018); https://doi.org/10.11646/phytotaxa.338.3.1
<i>Sclerosiphon qinghainicum</i> (Y.T.Zhao) M.B.Crespo, Mart.-Azorín & Mavrodiev	KT280220	-	-	China: Gansu Province, Maqu County, Azi Branch Station (eastern Tibetan Plateau), 33°40'N 101°52'E, 3550 m a.s.l.; in Oecologia 182: 419–428 [421]. 2016	Li et al. (2016); https://doi.org/10.1007/s00442-016-3666-6
<i>Sclerosiphon kobayashii</i> (Kitag.) M.B.Crespo, Mart.-Azorín & Mavrodiev	-	MW819787	MW819824	Wang et al. Isolate H1	Wang et al. (unpublished)
<i>Sclerosiphon kobayashii</i> (Kitag.) M.B.Crespo, Mart.-Azorín & Mavrodiev	-	MW819790	MW819826	Wang et al. Isoalte H4	Wang et al. (unpublished)
<i>Sclerosiphon songaricum</i> (Schrenk ex Fisch. & C.A.Mey.) Nevski	PZ205666	PZ205678	-	Kazakhstan: Kyzylorda Region, Aral district, 150 km east of Aralsk, sandy desert, June 1960, Gorsky & Popov s.n. (MW-0816599); Isolate 3948	this study
<i>Sclerosiphon songaricum</i> (Schrenk ex Fisch. & C.A.Mey.) Nevski	PZ205667	PZ205679	-	Iran: East Azerbaijan province, Miyaneh city, 5 km from Miyaneh to Tabriz, 1150 m, 37°28'02"N 47°40'14"E, 4 May 2024, M. Firat 40220; individual 1; Isolate 3981	this study
<i>Sclerosiphon songaricum</i> (Schrenk ex Fisch. & C.A.Mey.) Nevski	PZ205668	PZ205680	-	Iran: East Azerbaijan province, Miyaneh city, 5 km from Miyaneh to Tabriz, 1150 m, 37°28'02"N 47°40'14"E, 4 May 2024, M. Firat 40220; individual 2; Isolate 3982	this study
<i>Sclerosiphon songaricum</i> (Schrenk ex Fisch. & C.A.Mey.) Nevski	PZ205669	PZ205681	-	Iran: East Azerbaijan province, Miyaneh city, 5 km from Miyaneh to Tabriz, 1150 m, 37°28'02"N 47°40'14"E, 4 May 2024, M. Firat 40220; Individual 3; Isolate 3983	this study
<i>Sclerosiphon songaricum</i> (Schrenk ex Fisch. & C.A.Mey.) Nevski	PZ205670	PZ205682	-	Kazakhstan: [Jambyl Region], Moyunkum District, river Shu, sandy soils along the road (loc-7), 44°07'01"N 73°28'15"E, 399 m a.s.l., 16 April 2025, J.L. Villar et al. s.n. (ABH); Isolate 3988	this study
<i>Sclerosiphon bungei</i> (Maxim.) Rodion. (<i>Cryptobasis bungei</i> (Maxim.) M.B.Crespo & al.)	PZ205671	PZ205683	-	Mongolia: South Gobi Aimag [Omnogovi Province]: Galdyn Gobi Desert, 190 km south of Dalanzadgad, among saxaul open woodland, 24 June 1980, I. A. Gubanov 5668 (MW0173886); Isolate 3991	this study
<i>Sclerosiphon ventricosum</i> (Pall.) Rodion. (<i>C. ventricosa</i> (Pall.) M.B.Crespo & al.)	PZ205672	PZ205684	-	[Transbaikalia]: Transbaikal district: 15 km from Kailastuy Station on the road to Bogdanovka, meadow [slope?], 23 June 1972, V. Kuvaev et al. 210-3 (MW-0048974); Individual 1; Isolate 3992	this study
<i>Sclerosiphon ventricosum</i> (Pall.) Rodion. (<i>C. ventricosa</i> (Pall.) M.B.Crespo & al.)	PZ205673	PZ205685	-	[Transbaikalia]: Transbaikal district: 15 km from Kailastuy Station on the road to Bogdanovka, meadow [slope?], 23 June 1972, V. Kuvaev et al. 210-3 (TK); Individual 2; Isolate 3993	this study
<i>Cryptobasis mariae</i> Mavrodiev	PZ205674	PZ205686	-	Russia: Volgograd Region, Krasnoarmejsk district of Volgograd, in sand near Old Sarepta, rare, 25 April 2001, E.V. Mavrodiev s.n. (MW-0021781); Isolate 3985	this study
<i>Cryptobasis mariae</i> Mavrodiev	PZ205675	PZ205687	-	Kazakhstan: Ulytau Region, Zhezkazgan District, 48°34'17"N 70°49'482E [Loc-44], 434 m a.s.l., 22 April 2025, J.L. Villar et al. s.n. (ABH); Isolate 3986	this study
<i>Cryptobasis mariae</i> Mavrodiev	PZ205676	PZ205688	-	Kazakhstan: Karaganda Region, Shet, 47°55'22"N 74°02'20"E [Loc-48], 671 m a.s.l., 23 April 2025, J.L. Villar et al. s.n. (ABH); Isolate 3987	this study
<i>Cryptobasis regelii</i> (Maxim.) M.B.Crespo, Mart.-Azorín & Mavrodiev	MT917270	-	-	China: Changji Hui, Fukang, Shixi Oilfield, 4 May 2014, J. Qiu Q-061 rec. 778579 (IBSC-0813069)	Song et al. (2023); https://doi.org/10.1111/1755-0998.13797
<i>Cryptobasis regelii</i> (Maxim.) M.B.Crespo, Mart.-Azorín & Mavrodiev	JF954183	-	-	China: Xinjiang Province, Changji Hui, Qitai county, 3 May 1982, G.J. Liu s.n. (XJBI-00056335)	China Plant BOL Group 1 et al. (2011); https://doi.org/10.1073/pnas.1104551108
<i>Cryptobasis tenuifolia</i> (Pall.) Nevski	PZ205677	PZ205689	-	P. N. Krylov Herb. at Tomsk Univ. named after V. V. Kuibyshev; Russian Federation: Agin Nat. Okrug [Agin Buryat-Mongol Nat. Okrug]: SW shore of Lake Nozhiy; feathers'grass steppe; 11 June 1969; L. P. Sergievskaya s.n. (TK); isolate 3989	this study
<i>Cryptobasis loczyi</i> (Kanitz) Ikonn.	MT254070	MT254070	MT254070	Kyrgyzstan: Issyk-kul (KHB-1544459)	Choi et al. (2020); https://doi.org/10.1080/23802359.2020.1790312
<i>Cryptobasis loczyi</i> (Kanitz) Ikonn.	JF954158	-	-	China: ZhouSL-bole-Z091 (PE)	China Plant BOL Group 1 et al. (2011); https://doi.org/10.1073/pnas.1104551108
<i>Cryptobasis loczyi</i> (Kanitz) Ikonn.	-	OL982568	-	China: Qinghai-Tibet Plateau; Isolate 13	Shen et al. (unpublished)

Table S2. Summary of input data for the final 3TA cladogram construction (Figure 1). Each row corresponds to a separate 3TA analysis and summarises the number of non-operational outgroup terminals, the number of three-taxon statements, the number of resulting hierarchies (trees), tree length, and tree retention index.

	The name of the 3TA analysis	Number of non-OO terminals	Number of three-taxon statements	Number of 3TA hierarchies (trees)	3TA tree length	RI	MRP input
1	"Summary"	87	2428192	9	3099486	0.7235	SC
2	<i>Juno</i>	58	377503	100	451182	0.8048	SC
3	<i>Junopsis</i>	10	1159	1	1240	0.9301	Tree
4	<i>Iris</i> s.str.	37	63697	90	68959	0.9174	SC
5	<i>Limniris</i> - <i>Phaeiris</i>	46	318735	100	376167	0.8198	SC
6	<i>Eremiris</i> - <i>Joniris</i>	7	1598	3	1636	0.9906	SC
7	<i>Cryptobasis</i> - <i>Sclerosiphon</i>	19	15807	243	16938	0.9284	SC
8	"<i>Xiphion</i> s.l. clade"	32	155857	20	189660	0.7831	SC

Abbreviations: **3TA** – Three-Taxon Statement Analysis; **MRP** – Matrix Representation with Parsimony; **OO** – Operational Outgroup; **RI** – tree retention index; **SC** – Strict Consensus. See the main text for references.

3TA

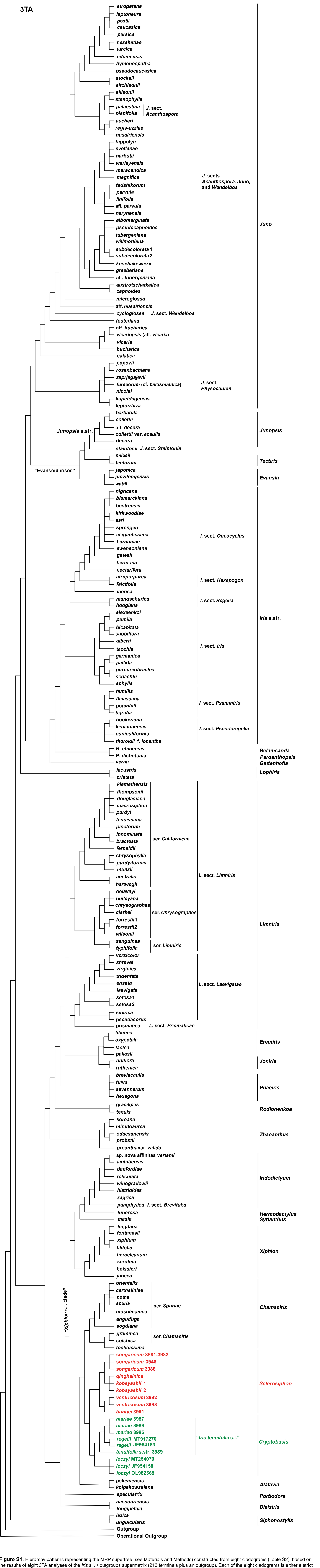


Figure S1. Hierarchy patterns representing the MRP supertree (see Materials and Methods) constructed from eight cladograms (Table S2), based on the results of eight 3TA analyses of the *Iris* s.l. + outgroups supermatrix (213 terminals plus an outgroup). Each of the eight cladograms is either a strict consensus of several or multiple most-parsimonious trees or a single most-parsimonious tree (see Table S2).

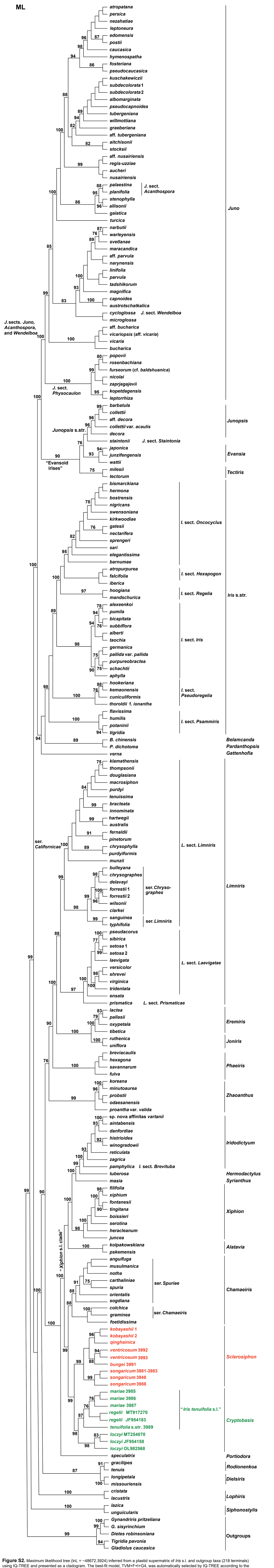


Figure S2. Maximum likelihood tree (InL = -48672.3924) inferred from a plastid supermatrix of *Iris* s.l. and outgroup taxa (218 terminals) using IQ-TREE and presented as a cladogram. The best-fit model, TVM+F+I+G4, was automatically selected by IQ-TREE according to the Schwarz (Bayesian) Information Criterion. The aLRT support values (see Materials and Methods) were rounded to the nearest whole number and shown above or below branches when equal to 75% or higher.



(a)



(b)



(c)

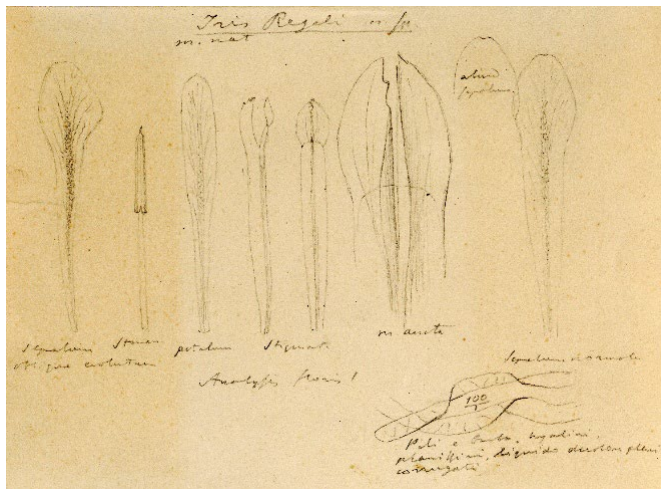
Figure S3. *Cryptobasis tenuifolia* (Pall.) Nevski. Pallas's type vouchers labelled *Iris tenuifolia* Pall.: (a) Lectotype: "In arenosis Davuriae" (LINN-61.13); (b–c) Isolectotypes: "Davuria" (BM-000958407, BM-000958410).



(a)



(b)



(c)



(d)

Figure S4. *Cryptobasis regelii* (Maxim.) M.B.Crespo, Mart.-Azorin & Mavrodiev. Type material of *Iris regelii* Maxim.: (a) Lectotype: [CHINA. Xinjiang Province], "Kuiankus [Qoianköz Village], auf den Bergspitze, in Rasen, 3000', 19 April 1877, A. Regel 311" (LE-00050098); (b) Isolectotype: "Kuiankus, nördlich, vom Ili, 3000', [Iter Turkestanicum] 19 April 1877, A. Regel 311" (LE-00050097); (c) Close-up view of the original drawing by Maximowicz, on a piece of paper attached to the lectotype; (d) Close-up view of a dissected flower on the isolectotype voucher, showing the hairy outer segments.



(a)



(b)



(c)



(d)

Figure S5. *Cryptobasis mariae* Mavrodiev. Pallas's type vouchers labelled *Iris juncifolia* Pall. (nom. nud.): (a) "In arenosis ad Volgam lecta" (LINN-HL61.14); (b) "In arenosis sublimosis deserti Volgensis" (BM-000958409); (c) "In arenosis versus mare Caspium" and "In collibus ad Sarpam" [Volgograd] (BM-000958408); (d) "Tauria" [Crimea] (LINN-HS92.30).



(a)



(b)



(c)

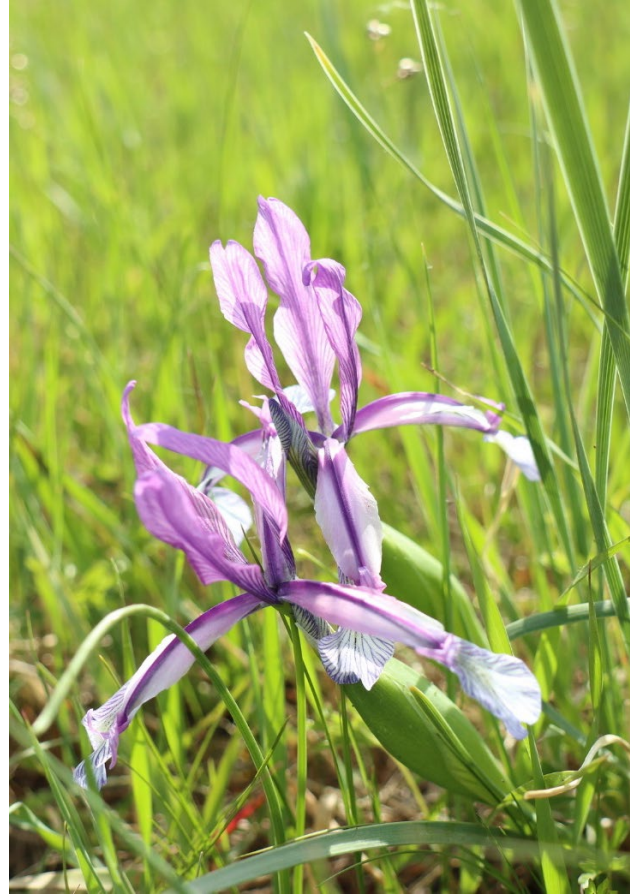


(d)

Figure S6. *Sclerosiphon* ser. *Sclerosiphon*. *Sclerosiphon songaricum*: (a) General aspect of a flowering individual (Iran: Rahjerd Qom Province; photo by MRN, 5 May 2024); (b) Detail of flowers and spathes at anthesis (Iran: Kashan Ispahan; photo by Frédéric-Médail, 21 May 2016); (c) Detail of flowers at anthesis and withering, with swollen bracts (Uzbekistan: Nurobod; photo by Karimov Boburbek, 8 May 2025); (d) Ripening fruits (Kazakhstan, Zhambyl District; photo by Alexander Dubynin, 11 June-2024). Images from iNaturalist.



(a)



(b)



(c)



(d)

Figure S7. *Sclerosiphon* ser. *Ventricosa*. *Sclerosiphon ventricosum*: (a) General aspect of a flowering individual (China: Hebei, Chingli; photo by Xiqueliang K. Dong, 18 May 2024); (b) Detail of flowers and spathes at anthesis (China: Heilongjiang, Daqing; photo by Plebejus Hang, 19 May 2024). *Sclerosiphon bungei*: (c) General aspect of a flowering individual (Mongolia: Ömnögov, Khan Khongor; photo by Morkvonork, 22 May 2019); (d) Detail of open fruits with ripe seeds (Mongolia: Ömnögov, Khanbogd; photo by Urgamal Magsar, 2 August 2025). Images from iNaturalist.



(a)



(b)

Figure S8. *Sclerosiphon* ser. *Ventricosa*. *Sclerosiphon cathayense*: (a) General aspect of a flowering individual (China: Jiangsu, Nanjing; photo by Sybil-1111, April 2024). *Sclerosiphon farreri*: (b) Detail of a flower at anthesis (China: Sichuan, Ruorgai; photo by Mengshuai Ge, 2 July 2024). Images from iNaturalist.



(a)



(b)

Figure S9. *Sclerosiphon* ser. *Ventricosa*. *Sclerosiphon kobayashii*: (a) General aspect of a flowering plant (China: Shandong, Jinan; photo by Friendssofausers, April 2024). *Sclerosiphon qinghainicum*: (b) General aspect of a flowering plant at anthesis (China: Qinghai, Haiyan, near Qinghai Lake; photo by Mengshuai Ge, 16 June 2024). Images from iNaturalist.