

NEW LOCATIONS FOR KAZAKHSTAN, KYRGYZSTAN AND UZBEKISTAN FLORA (CENTRAL ASIA)

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ABSTRACT: New chorological data of various Central Asian taxa are offered through collaboration between citizen science and local research centers. Some species are very rare in the area, and we provide the first georeferenced locations or some new locality far from those already known, as *Alisma gramineum* Lej., *Allium caesium* Schrenk, *Allium kysylkumi* Kamelin, *Alyssum szovitsianum* Fisch. & C.A. Mey., *Astragalus amabilis* Popov, *Astragalus ammodendron* Bunge, *Atraphaxis muschketowii* Krasn., *Dianthus borbasii* Vandas, *Cortusa matthioli* L. subsp. *brotheri* (Pax ex Lipsky) Serra & Shomur., *Echinops acantholepis* Jaub. & Spach, *Eremurus ammophilus* Vved., *Erysimum altaicum* C.A. Mey., *Ferula litwinowiana* Koso-Pol., *Frankenia hirsuta* L., *Jurinea multiflora* (L.) B. Fedtsch., *Jurinea multiloba* Iljin, *Lagochilus bungei* Benth., *Limonium dichroanthum* (Rupr.) Ikonn.-Gal., *Lycium dasystemum* Pojark., *Nonea rossica* Stev., *Seseli ledebourii* G. Don, *Tanacetum santolina* C. Winkl., *Tetracme quadricornis* (Stephan) Bunge, *Thermopsis lanceolata* R.Br., *Triglochin maritima* L., *Veronica spuria* L., *Zygophyllum macropterum* C. A. Meyer, and *Zygophyllum ovigerum* Fisch. & C.A. Mey. ex Bunge. On the other hand, the combination *Cortusa matthioli* L. subsp. *brotheri* (Pax ex Lipsky) Serra & Shomur. is included and justified. **Keywords:** citizen science; phytogeography; *Cortusa*; Central Asia; Kazakhstan; Kyrgyzstan; Uzbekistan.

RESUMEN: Nuevas localizaciones para la flora de Kazajistán, Kirguistán y Uzbekistán (Asia central). Se ofrecen nuevos datos corológicos de varios taxones de Asia Central a través de la colaboración entre la ciencia ciudadana y los centros de investigación locales. Se aportan las primeras localizaciones georeferenciadas o localidades nuevas alejadas de las ya conocidas de algunos taxones poco estudiados de la zona, como es el caso de *Alisma gramineum* Lej., *Allium caesium* Schrenk, *Allium kysylkumi* Kamelin, *Alyssum szovitsianum* Fisch. & C.A. Mey., *Astragalus amabilis* Popov, *Astragalus ammodendron* Bunge, *Atraphaxis muschketowii* Krasn., *Dianthus borbasii* Vandas, *Cortusa matthioli* L. subsp. *brotheri* (Pax ex Lipsky) Serra & Shomur., *Echinops acantholepis* Jaub. & Spach, *Eremurus ammophilus* Vved., *Erysimum altaicum* C.A. Mey., *Ferula litwinowiana* Koso-Pol., *Frankenia hirsuta* L., *Jurinea multiflora* (L.) B. Fedtsch., *Jurinea multiloba* Iljin, *Lagochilus bungei* Benth., *Limonium dichroanthum* (Rupr.) Ikonn.-Gal., *Lycium dasystemum* Pojark., *Nonea rossica* Stev., *Seseli ledebourii* G. Don, *Tanacetum santolina* C. Winkl., *Tetracme quadricornis* (Stephan) Bunge, *Thermopsis lanceolata* R.Br., *Triglochin maritima* L., *Veronica spuria* L., *Zygophyllum macropterum* C. A. Meyer y *Zygophyllum ovigerum* Fisch. & C.A. Mey. ex Bunge. Por otro lado, se realiza y justifica la combinación nomenclatural *Cortusa matthioli* L. subsp. *brotheri* (Pax ex Lipsky) Serra & Shomur. **Palabras clave:** ciencia ciudadana; *Cortusa*; fitogeografía; Asia Central; Kazajistán; Kirguistán; Uzbekistán.

INTRODUCTION

During a recent trip to Central Asia (Kazakhstan and Kyrgyzstan) made to visit one of the Hotspots of the planet (MYERS & al., 2000; MITTERMEIER & al. 2004) and better understand the relationships between the Asian steppe flora and those present in the areas of continental climate of Southern of Spain we have been able to collect various material deposited in LSH (private herbarium of one of the authors) and in the MA herbarium of the Royal Botanical Garden of Madrid. In addition, material recently collected from 11 locations in Uzbekistan deposited in the TASH Herbarium of the Institute of Botany of the Academy of Sciences of Uzbekistan in Tashkent and unpublished is included (THIERS, 2023+).

As has been indicated for some years now (MILLER-RUSHING & AL., 2012; CHANDLER & AL., 2017) citizen

science has been contributing to the knowledge of biodiversity and providing necessary data to help its conservation. In this sense, it has been shown to be very useful, for example, in the study and management of IAS (CARDOSO & al., 2012), especially in large territories where georeferenced information on biodiversity is scarce (AMANO & al., 2016).

The flora of Central Asia is currently known in some depth since the five countries that comprise it (Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan and Turkmenistan) present floras carried out or revised a few years ago and there are compilation projects of the territorial flora in as a whole (LI & al., 2020), however due to the vast extension of this territory and the low density of researchers, the distribution of the species, even the most frequent, is far from being known for the most part, the-

refore any well-known reference documented is a valuable contribution to improve information on local flora.

The intention of this work is precisely to provide the information collected to help improve the distribution of the taxa studied in such a vast territory.

MATERIALS AND METHODS

For the georeferencing all the localities visited, the GPS of a smartphone was used. The information was embedded in the ©OruxMaps program and offered in 1 km² UTM grid cell in the ETRS89 Datum.

To determine the materials collected, the compilation works of the flora of Kazakhstan (PAVLOV, 1956-1966), the former USSR (KOMAROV, 1934-1964), as well as the checklists of Kazakhstan and Kyrgyzstan (ABDULINA, 1999; LAZKOV & SULTANOVA, 2011) has been used. It has also been complemented with other graphic works of the territory (IVASHCHENKO & BELYALOV, 2012; NOWAK & NOBIS, 2020) or existing resources on the web: EFLORAS, PLANTARIUM & GBIF.

The nomenclature of the mentioned taxa follows that adopted in The Plant List. The cited material is found in the herbaria MA and TASH (THIERS, 2023+) and LSH (private herbarium of one of the authors).

RESULTS AND DISCUSSION

An itinerary was carried out from May 30 to June 12, collecting 202 sheets plus 26 duplicates in 62 locations in Kazakhstan (153 taxa), Kyrgyzstan (49 taxa), in elevations between 316 m and 3810 m. And other collections were made for 10 days, between April 7 and June 26 in Uzbekistan (50 taxa), in elevations between 15 m and 1007 m (Fig. 1). The collected sheets correspond to the following families into Table 1.

List of sheets collected:

Abbreviations of Kazakhstan (Kz), Kyrgyzstan (Kg) and (Uz) Uzbekistan.

Cupressaceae

Juniperus pseudosabina Fisch. & C.A. Mey., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3298, 2960 m, 3-VI-2022, *L. Serra 13210 & al.*, alpine scrub, LSH 15097.

J. semiglobosa Regel, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, pr. Jeti-Ögüz, 44TKM7192, 1970 m, 2-VI-2022, *L. Serra 13204 & al.*, montane forest border, LSH 15091, MA 961038.

Ephedraceae

Ephedra distachya L., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13293 & al.*, dry scrub, LSH 15180.

E. equisetina Bunge, Kz, ALMATÝ: (Jengbekschiqasq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-2022, *L. Serra 13167 & al.*, steppe on stony soil, LSH 15058.

Pinaceae

Abies sibirica subsp. **semenovii** (B. Fedtsch.) Farjon, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jeti-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13248 & al.*, montane forests, LSH 15135.

Picea schrenkiana Fisch. & C.A. Mey., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3198, 2780 m, 3-VI-2022, *L. Serra 13222 & al.*, subalpine forests, LSH 15109.

Apiaceae

Ferula litwinowiana Koso-Pol., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119985. Species with a Turanian type of habitat, mainly distributed in the deserts of Kyzylkum, Karakum and Betpakdala, but it is not mapped in central Uzbekistan (Fig. 2A).

Oedibasis apiculata (Kar. & Kir.) Koso-Pol., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK 3312, 410 m, 8-VI-2022, *L. Serra 13288 & al.*, sandy desert, LSH 15175.

Seseli glabratum Willd. ex Schult., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119954.

S. ledebourii G. Don, Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13334 & al.*, steppe on brackish soils, LSH 15220. An endemic species of Central Asia with a few localities mapped in Kazakhstan, present in the Northern Central lakes (Fig. 2B).

Apocynaceae

Poacynum lancifolium (Russanov) Mavrodiev & al., Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2138, 620 m, 6-VI-2022, *L. Serra 13261 & al.*, wet riparian grasslands, LSH 15148.

Asclepiadaceae

Cynanchum acutum subsp. **sibiricum** (Willd.) Rech.fil., Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2138, 620 m, 6-VI-2022, *L. Serra 13260 & al.*, wet riparian grasslands, LSH 15147.

Asteraceae

Achillea nobilis L., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13321 & al.*, grasslands, and sparse forests, LSH 15207. Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ 9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119971.

Artemisia scoparia Waldst. & Kit., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119963.

A. terrae-albae Krasch., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119957. Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Shakhbakhty, 40TDN 5021, 170 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH 119990.

Aster tripolium L., Kz, AKMOLA: (Astaná), Yesil, Lake Taldykol, 42UXB6467, 345 m, 9-VI-2022, *L. Serra 13303 & al.*, salt marsh grasslands, LSH 15190.

Cancrinia discoidea (Ledebour) Poljakov ex Tzvelev, Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP4716, 970 m, 1-VI-2022, *L. Serra 13181 & al.*, steppe on stony-sandy soils, LSH 15072. Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 7-VI-2022, *L. Serra 13270 & al.*, steppe on stony-sandy soils, LSH 15157.

Centaurea pulchella Ledeb., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 7-VI-2022, *L. Serra 13269 & al.*, steppe on sandy soils, LSH 15156.

C. scabiosa subsp. **apiculata** (Ledeb.) Mikheev, Kz, AKMOLA: (Korgalzhyn), Lake Saumalkol, 42UWB4913, 320 m, 10-VI-2022, *L. Serra 13313 & al.*, steppe on sandy soils, LSH 15200.

C. virgata subsp. **squarrosa** (Willd.) Gugler, Kz, ALMATÝ: (Ile), Taukum desert, pr. Kurty, 43TFJ0761, 560 m, 6-VI-2022, *L. Serra 13262 & al.*, steppe on stony soil, LSH 15149, MA 961052.

Cousinia affinis Schrenk, Kz, ALMATÝ: (Ile), Taukum desert, Rodnik Zhel'bulak, 43TEJ7882, 570 m, 6-VI-2022, *L. Serra 13266 & al.*, steppe on sandy soils, LSH 15153.

Echinops acantholepis Jaub. & Spach, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13297 & al.*, steppe on stony-sandy soils, LSH 15184. Iranoturanian species that occupies a wide territory from the Eastern Mediterranean in Israel to eastern Kazakhstan, but with few mapped locations in Central Asia (Fig. 2C).

E. nanus Bunge, Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP5419, 890 m, 1-VI-2022, *L. Serra 13176 & al.*, steppe on stony-sandy soils, LSH 15067.

Jurinea multiflora (L.) B. Fedtsch., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB7417, 325 m, 11-VI-2022, *L. Serra 13326 & al.*, shrublands of steppe areas, LSH 15212, MA 961060. Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13336 & al.*, shrublands of steppe areas, LSH 15222. Species with a Eurasian distribution that appears from Romania to the NW of China, located in Kazakhstan, especially in the North and scarce in the southernmost latitudes of the country (Fig. 2D).

J. multiloba Iljin, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13196 & al.*, shrublands of steppe areas, LSH 15083. Endemic to Central Asia, where it is scattered in the wormwood steppes (Fig. 3A).

Leontopodium ochroleucum Beauverd, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3198, 2780 m, 3-VI-2022, *L. Serra 13225 & al.*, mountain tundra, LSH 15112. Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG1843, 3130 m, 4-VI-2022, *L. Serra 13228 & al.*, mountain tundra, LSH 15115, MA 961037. Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13238 & al.*, mountain tundra, LSH 15125.

Senecio subdentatus (Bunge) Ledeb., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119982.

Scorzonera sericeo-lanata (Bunge) Krasch. & Lipsch., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119967.

Takhtajianantha pusilla (Pall.) Nazarova., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119996.

Tanacetum achilleifolium (M. Bieb.) Sch.Bip., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13323 & al.*, steppe on brackish soils, LSH 15209. Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119961.

T. santolina C. Winkl., Kz, AKMOLA: (Korgalzhyn), Lake Zormankol, 42UXB1316, 350 m, 10-VI-2022, *L. Serra 13310 & al.*, steppe on stony soil, LSH 15197, MA 961046. Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325

m, 11-VI-2022, *L. Serra 13324 & al.*, steppe on stony soil, LSH 15210. Endemic to Central Asia present in southern Russia, Kazakhstan, and NW China (Xinjiang), with few observations in central Kazakhstan (Fig. 3B).

Tephrosia palustris (L.) Fourr., Kz, AKMOLA: (Astaná), Yesil, Lake Taldykol, 42UXB6467, 345 m, 9-VI-2022, *L. Serra 13302 & al.*, wet grasslands, LSH 15189.

Berberidaceae

Berberis heteropoda Schrenk, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, pr. Jeti-Ögüz, 44TKM7192, 1970 m, 2-VI-2022, *L. Serra 13206 & al.*, montane forest border, LSH 15093, MA 961039.

Betulaceae

Betula pendula Roth., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, Alatau Maraly, 43TFH2765, 1950 m, 30-V-2022, *L. Serra 13156 & al.*, montane forests, LSH 15047.

Boraginaceae

Arnebia decumbens (Vent.) Coss. & Kralik, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK 3311, 410 m, 7-VI-2022, *L. Serra 13273 & al.*, sandy desert, LSH 15160. Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119981. Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, western part of Barsakelmes, Itibay well, 40TEN5076, 97 m, 26.V.2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, sandy loamy soil, TASH041557.

A. guttata Bunge, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLP4509, 1054 m, 1-VI-2022, *L. Serra 13184 & al.*, steppe on stony-sandy soils, LSH 15075.

Cynoglossum officinale L., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB7317, 325 m, 11-VI-2022, *L. Serra 13325 & al.*, subnitrophilous grasslands, LSH 15211.

Heliotropium dasycarpum Ledeb., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13299 & al.*, sandy desert, LSH 15186.

Lappula patula (Lehm.) Asch. ex Gürke, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3113, 405 m, 8-VI-2022, *L. Serra 13282 & al.*, sandy desert, LSH 15169.

Nonea caspica (Willd.) G. Don, Kz, ALMATÝ: (Jengbekschiqasq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L. Serra 13159 & al.*, steppe on stony soil, LSH 15050.

N. rossica Stev., Kz, AKMOLA: (Tselingrad), pr. Orazak, 42UXB1341, 348 m, 10-VI-2022, *L. Serra 13305 & al.*, steppe on stony soil, LSH 15192. Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13320 & al.*, steppe on stony soil, LSH 15206. Widespread in temperate Asia and become rare in Central Asia, with few observations in central Kazakhstan (Fig. 3C).

Tournefortia sibirica L., Kz, AKMOLA: (Korgalzhyn), Lake Shalkar, 42UWA7392, 316 m, 12-VI-2022, *L. Serra 13340 & al.*, steppe on brackish soils, LSH 15226, MA 961058.

Brassicaceae

Alyssum szovitsianum Fisch. & C.A. Mey., Kz, ALMATÝ: (Jengbekschiqasq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-2022, *L. Serra 13168 & al.*, steppe on stony soil, LSH 15059. Iranoturanian species that occupies a wide territory from the Eastern Mediterranean in Lebanon, Syria, and Palestine to eastern Kazakhstan or Pakistan, but with few mapped locations in Central Asia (Fig. 3D).

Chorispora bungeana Fisch. & C.A. Mey., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3380 m, 4-VI-2022, *L. Serra 13245 & al.*, alpine grasslands, LSH 15132.

Draba altaica (C. A. Meyer) Bunge, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM

3198, 2780 m, 3-VI-2022, *L. Serra 13221 & al.*, alpine rocky crags, LSH 15108.

D. lanceolata Royle, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3198, 2780 m, 3-VI-2022, *L. Serra 13220 & al.*, alpine rocky crags, LSH 15107.

Erysimum altaicum C.A. Mey., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG 2042, 3360 m, 4-VI-2022, *L. Serra 13231 & al.*, alpine grasslands, LSH 15118. Species endemic to the high mountain ranges of Central Asia, from the Himalayas, Tian-Shan, and Altai, sparsely mentioned in Kyrgyzstan (Fig. 4A).

Eutrema altaicum (C.A. Mey.) Al-Shehbaz & Warwick, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2440, 3810 m, 4-VI-2022, *L. Serra 13241 & al.*, alpine grasslands, LSH 15128.

Hesperis matronalis L. subsp. **matronalis**, Kz, AKMOLA: (Astaná), Yesil, Lake Taldyköl, 42UXB6467, 345 m, 9-VI-2022, *L. Serra 13304 & al.*, nitrohygrophilous grasslands, LSH 15191.

Isatis violascens Bunge, Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119968.

Lepidium latifolium L., Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2138, 620 m, 6-VI-2022, *L. Serra 13259 & al.*, annual grasses on sandy soils, LSH 15146. Kz, AKMOLA: (Korgalzhyn), Lake Shalkar, 42UWA7392, 316 m, 12-VI-2022, *L. Serra 13341 & al.*, wet grasslands, LSH 15227.

L. perfoliatum L., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 7-VI-2022, *L. Serra 13274 & al.*, annual grasses on sandy soils, LSH 15161, MA 961050. Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119988.

L. songaricum Schrenk, Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13332 & al.*, annual grasses on sandy soils, LSH 15218. Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr chink, 40TDL2280, 82 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH 119979.

Matthiola tatarica (Pall.) DC., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119962.

Tetracme quadricornis (Stephan) Bunge, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLP4507, 1070 m, 1-VI-2022, *L. Serra 13189 & al.*, steppe on stony-sandy soils, LSH 15076. Iranoturanian species that occupies a wide territory in Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan, and Xinjiang province in China, but with few mapped locations in eastern Kazakhstan (Fig. 4B).

Capparaceae

Capparis spinosa L., Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, dismissed Karabaur, along the Shakhbakhty road, 40TDN4683, 240 m, 27-VI-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119970.

Caprifoliaceae

Lonicera heterophylla Decne., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jeti-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13247 & al.*, montane forests, LSH 15134.

L. microphylla Willd. ex Roem. & Schult., Kz, ALMATÝ: (Jengbekschiqasq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-

2022, *L. Serra 13171 & al.*, rocky slopes of mountains, LSH 15062.

L. olgae Regel & Schmalh., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3298, 2960 m, 3-VI-2022, *L. Serra 13212 & al.*, alpine screes, LSH 15099.

L. semenovii Regel, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13232 & al.*, alpine screes, LSH 15119.

L. tatarica L., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3070, 1450 m, 30-V-2022, *L. Serra 13346 & al.*, montane forests, LSH 15232.

Caryophyllaceae

Acanthophyllum pungens (Bunge) Boiss., Kz, ALMATÝ: (Jengbekschiqasq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L. Serra 13162 & al.*, steppe on stony soil, LSH 15053.

Dianthus borbasii Vandas, Kz, AKMOLA: (Korgalzhyn), Korgalzhyn - Duskey, 42UWB7308, 328 m, 12-VI-2022, *L. Serra 13344 & al.*, meadows of steppe areas, LSH 15230. Widespread from the Baltic to West Siberia, with few observations in central Kazakhstan (Fig. 4C).

Dianthus kuschakewiczii Regel & Schmalh., Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13198 & al.*, shrublands of steppe areas, LSH 15085.

Gypsophila paniculata L., Kz, AKMOLA: (Korgalzhyn), Lake Zormankol, 42UXB1316, 350 m, 10-VI-2022, *L. Serra 13309 & al.*, steppe on stony soil, LSH 15196.

Chenopodiaceae

Arthrophytum longibracteatum Korovin, Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP5419, 890 m, 1-VI-2022, *L. Serra 13175 & al.*, steppe on stony-sandy soils, LSH 15066.

Bassia prostrata (L.) G. Beck, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13199 & al.*, shrublands of steppe areas, LSH 15086.

Ceratocarpus arenarius L., Kz, ALMATÝ: (Ile), Taukum desert, Rodnik Zhel'bulak, 43TEJ7882, 570 m, 6-VI-2022, *L. Serra 13267 & al.*, steppe on stony-sandy soils, LSH 15154.

Krascheninnikovia ceratoides (L.) Gueldenst., Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13192 & al.*, dry scrub, LSH 15079.

Cistaceae

Helianthemum songaricum Schrenk, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13191 & al.*, shrublands of steppe areas, LSH 15078, MA 961041.

Convolvulaceae

Convolvulus fruticosus Pall., Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13194 & al.*, steppe on stony-sandy soils, LSH 15081.

C. subsericeus Schrenk, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13300 & al.*, sandy desert, LSH 15187.

Crassulaceae

Rhodiola coccinea (Royle) Boriss., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3198, 2780 m, 3-VI-2022, *L. Serra 13223 & al.*, alpine screes, LSH 15110.

R. kirilowii (Regel) Maximowicz, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3298, 2960 m, 3-VI-2022, *L. Serra 13217 & al.*, alpine screes, LSH 15104.

Rosularia platyphylla (Schrenk) Berger, Kz, ALMATÝ: (Jengbekschiqasaq), Pass Kopkek, 44TLP0622, 860 m, 31-V-2022, *L. Serra 13165 & al.*, steppe on stony soil, LSH 15056.

Eleagnaceae

Elaeagnus angustifolia L., Kz, ALMATÝ: (Jengbekschiqasaq), pr. Akshiy, 43TGJ3726, 600 m, 31-V-2022, *L. Serra 13157 & al.*, riparian forests, LSH 15048, MA 961043.

Hippophae rhamnoides subsp. **turkestanica** Rousi, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, pr. Jeti-Ögüz, 44TKM7192, 1970 m, 2-VI-2022, *L. Serra 13207 & al.*, riparian forests, LSH 15094.

Euphorbiaceae

Euphorbia turczaninowii Kar. & Kir., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13290 & al.*, sandy desert, LSH 15177.

Fabaceae

Ammodendron bifolium (Pall.) Yakovlev, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13301 & al.*, sandy desert, LSH 15188.

A. karelinii Fisch. & C.A. Mey. ex Ledeb., Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr gorge chinka, 40TDL1980, 15 m, 30-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119976.

Astragalus amabilis Popov, Kz, ALMATÝ: (Ughyr), pr. Kurtogay, 44TLN3393, 1240 m, 5-VI-2022, *L. Serra 13253 & al.*, steppe on stony-sandy soils, LSH 15140. Iranoturanian endemic species only known of Kazakhstan and Xinjiang, province of China, with no occurrences with coordinates in www.gbif.org (Fig. 4D).

A. ammodendron Bunge, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13284 & al.*, sandy desert, LSH 15171.

Endemic to Central Asia, known only in Kazakhstan, SW of Russia, Turkmenistan, and Uzbekistan, where it is scattered in the wormwood steppes (Fig. 5A).

A. ammotrophus Bunge, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr gorge chinka, 40TDL1980, 15 m, 30-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119975.

A. chaetodon Bunge, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13286 & al.*, sandy desert, LSH 15173.

A. erioceras Ledeb., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119997.

A. flexus Fisch., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119983.

A. lithophilus Kar. & Kir., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3380 m, 4-VI-2022, *L. Serra 13243 & al.*, subalpine stony grasslands, LSH 15130.

A. onobrychis L., Kz, AKMOLA: (Korgalzhyn), Korgalzhyn - Duskey, 42UWB7308, 328 m, 12-VI-2022, *L. Serra 13342 & al.*, shrublands of steppe areas, LSH 15228, MA 961057.

A. sphaerophysa Kar. & Kir., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13287 & al.*, sandy desert, LSH 15174.

A. tibetanus Bunge, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3380 m, 4-VI-2022, *L. Serra 13242 & al.*, alpine screes, LSH 15129.

A. turczaninowii Kar. & Kir., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13285 & al.*, sandy desert, LSH 15172.

Caragana grandiflora (M. Bieb.) DC., Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Shakhbakhty, 40TDN 5021, 170 m, 28-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH 119989.

C. jubata (Pall.) Poir., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3298, 2960 m, 3-VI-2022, *L. Serra 13213 & al.*, snow covered alpine slopes, LSH 15100.

Glycyrrhiza uralensis Fisch. ex DC., Kz, ALMATÝ: (Jengbekschiqasaq), pr. Akshiy, 43TGJ3726, 600 m, 31-V-2022, *L. Serra 13158 & al.*, wet riparian grasslands, LSH 15049. Kz, AKMOLA: (Korgalzhyn), pr. Kembidaik, 42UXB 1323, 340 m, 10-VI-2022, *L. Serra 13306 & al.*, wet riparian grasslands, LSH 15193.

Halimodendron halodendron (Pallas) Druce, Kz, ALMATÝ: (Balqasch), Taukum desert, hachia Topar, 43TDK9987, 360 m, 7-VI-2022, *L. Serra 13276 & al.*, forests on saline soils, LSH 15163.

Lathyrus gmelinii (Fisch. ex Ser.) Fritsch, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jeti-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13250 & al.*, montane forests, LSH 15137.

Medicago falcata L., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13319 & al.*, subnitrophilous grasslands, LSH 15205. Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13337 & al.*, subnitrophilous grasslands, LSH 15223, MA 961059.

Sophora alopecuroides L., Kz, ALMATÝ: (Qarassai), Tian Shan, pr. Kaskelen, 43TFH3077, 1110 m, 30-V-2022, *L. Serra 13141 & al.*, wet grasslands nitrofilous, LSH 15031.

S. songorica Schrenk, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK4211, 410 m, 7-VI-2022, *L. Serra 13281 & al.*, sandy desert, LSH 15168.

Thermopsis lanceolata R.Br., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13318 & al.*, steppe on brackish soils, LSH 15204. Widespread in temperate Asia and become rare in Central Asia, with few observations in central Kazakhstan (Fig. 5B).

Frankeniaceae

Frankenia hirsuta L., Kz, AKMOLA: (Korgalzhyn), Lake Shulak, 42UWB5470, 316 m, 11-VI-2022, *L. Serra 13338 & al.*, halophilic dry scrub, LSH 15224. Widespread from Canarian Islands to Central Asia and West Siberia, with few observations in central Kazakhstan (Fig. 5C).

Geraniaceae

Erodium oxyrrhynchum M. Bieb., Kz, ALMATÝ: (Ughyr), pr. crta. A-352, toward Charyn river, 44TLP4716, 970 m, 1-VI-2022, *L. Serra 13180 & al.*, steppe on stony-sandy soils, LSH 15071.

Geranium rectum Trautv., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3068, 1580 m, 30-V-2022, *L. Serra 13151 & al.*, montane wet grasslands, LSH 15042. Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jeti-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13252 & al.*, montane wet grasslands, LSH 15139, MA 961055.

Geranium saxatile Karelin & Kirilov, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3298, 2960 m, 3-VI-2022, *L. Serra 13211 & al.*, alpine grasslands, LSH 15098.

Geranium transversale (Kar. & Kir.) Vved. ex Pavlov., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chin-

ka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH 119992.

Grossulariaceae

Ribes meyeri Maxim., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3298, 2960 m, 3-VI-2022, *L. Serra 13214 & al.*, fresh shrub borders, LSH 15101.

Lamiaceae

Chamaesphacos ilicifolius Schrenk, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 8-VI-2022, *L. Serra 13283 & al.*, sandy desert, LSH 15170.

Dracocephalum integrifolium Bunge, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH 3270, 1610 m, 30-V-2022, *L. Serra 13150 & al.*, fresh montane grasslands, LSH 15041. Kz, ALMATÝ: (Raiymbek), pr. Ke-gen, pass to Kyrgyzstan, 44TLN5480, 1780 m, 1-VI-2022, *L. Serra 13200 & al.*, fresh montane grasslands, LSH 15087.

Lagochilus bungei Benth., Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP5419, 890 m, 1-VI-2022, *L. Serra 13177 & al.*, steppe on stony-sandy soils, LSH 15068. Endemic to Central Asia, known only in Kazakhstan, Mongolia, and Xinjiang, province of China, where it is scattered in the wormwood steppes (Fig. 5D).

L. diacanthophyllus (Pall.) Benth., Kz, ALMATÝ: (Jengbekschiqasq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L. Serra 13163 & al.*, steppe on stony soil, LSH 15054.

Leonurus turkestanicus V. Kreczetovicz & Kuprianova, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3068, 1580 m, 30-V-2022, *L. Serra 13152 & al.*, montane wet grasslands, LSH 15043.

Phlomis nubilans Zakirov., Uz, JIZZAKH: (Farish), ridge Nuratau, tract Ilonchisai, above the camp "Zangori Olov", 42TUK4966, 1007 m, 26-VI-2019, *H.F. Shomurodov, N.Yu. Beshko & O.S. Abduraimov*, sandy plain, TASH081686.

P. thapsoides Bunge., Uz, JIZZAKH: (Farish), the foothill plain Nuratau between village Ok-tash and Egiz-Bulak, 42TUK 8264, 1007 m, 5-IV-2019, *H.F. Shomurodov, N.Yu. Beshko, B.A. Adilov & M. Muminov*, sandy plain, TASH083176.

Phlomoideis oreophila (Kar. & Kir.) Adylov & al., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3298, 2960 m, 3-VI-2022, *L. Serra 13215 & al.*, fresh montane grasslands, LSH 15102.

P. speciosa (Rupr.) Adylov & al., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13149 & al.*, fresh montane grasslands, LSH 15040.

P. tuberosa (L.) Moench, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13149 & al.*, fresh montane grasslands, LSH 15039. Kz, AKMOLA: (Korgalzhyn), Lake Zormankol, 42UXB1316, 350 m, 10-VI-2022, *L. Serra 13308 & al.*, fresh montane grasslands, LSH 15195.

Salvia aethiopis L., Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ3032, 620 m, 6-VI-2022, *L. Serra 13255 & al.*, fresh subnitrophilous grasslands, LSH 15142.

S. deserta Schangin, Kz, AKMOLA: (Korgalzhyn), Korgalzhyn - Duskey, 42UWB7308, 328 m, 12-VI-2022, *L. Serra 13343 & al.*, grasslands of steppe areas, LSH 15229.

S. dumetorum Andr. ex Besser, Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13333 & al.*, shrublands of steppe areas, LSH 15219.

Scutellaria przewalskii Juz., Kz, ALMATÝ: (Jengbekschiqasq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L.*

Serra 13161 & al., screes, mountain rocks, LSH 15052. Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13197 & al.*, screes, mountain rocks, LSH 15084.

S. sieversii Bunge, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13146 & al.*, screes, mountain rocks, LSH 15036.

Thymus marschallianus Willd., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, 43TFH3073, 1300 m, 30-V-2022, *L. Serra 13142 & al.*, steppes and forest clearings, LSH 15032, MA 961045.

Thymus pulegioides subsp. **pannonicus** (All.) Ker-guélén, Kz, AKMOLA: (Korgalzhyn), Lake Zhumay, 42UWB 5515, 320 m, 10-VI-2022, *L. Serra 13314 & al.*, steppe on stony soil, LSH 15201, MA 961047.

Ziziphora bungeana Juzepczuk, Kz, ALMATÝ: (Ile), Taukum desert, pr. Kurty, 43TFJ0761, 560 m, 6-VI-2022, *L. Serra 13264 & al.*, steppe on stony soil, LSH 15151, MA 961054.

Z. tenuior L., Kz, ALMATÝ: (Jengbekschiqasq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L. Serra 13164 & al.*, steppe on stony soil, LSH 15055. Kz, ALMATÝ: (Ile), Taukum desert, pr. Kurty, 43TFJ0761, 560 m, 6-VI-2022, *L. Serra 13265 & al.*, steppe on stony soil, LSH 15152.

Mazaceae

Dodartia orientalis L., Kz, AKMOLA: (Korgalzhyn), Korgalzhyn - Duskey, 42UWB7308, 328 m, 12-VI-2022, *L. Serra 13345 & al.*, steppe on brackish soils, LSH 15231.

Oleaceae

Fraxinus sogdiana Bunge, Kz, ALMATÝ: (Ughyr), Río Charyn, pr. Shonzhy, 44TLP6121, 730 m, 1-VI-2022, *L. Serra 13203 & al.*, riparian forests, LSH 15090, MA 961040.

Orobanchaceae

Orobanche caesia Rchb., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13289 & al.*, sandy desert, parasitizing *Artemisia* sp., LSH 15176.

Papaveraceae

Glaucium squamigerum Karelin & Kirilov, Kz, ALMATÝ: (Jengbekschiqasq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-2022, *L. Serra 13169 & al.*, steppe on stony soil, LSH 15060.

Hypecoum parviflorum Kar. & Kir., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13295 & al.*, grasslands on sandy soils, LSH 15182.

Roemeria refracta DC., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 7-VI-2022, *L. Serra 13272 & al.*, sandy desert, LSH 15159.

Pyrolaceae

Pyrola rotundifolia L., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jeti-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13251 & al.*, montane coniferous forests, LSH 15138.

Plantaginaceae

Plantago minuta Pall., Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP4716, 970 m, 1-VI-2022, *L. Serra 13178 & al.*, steppe on stony-sandy soils, LSH 15069.

Plumbaginaceae

Goniolimon callicomum (C.A. Mey.) Boiss., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel,

43TEK3312, 410 m, 8-VI-2022, *L. Serra 13291* & al., sandy desert, LSH 15178, MA.

G. orthocladum Rupr., Kz, ALMATÝ: (Ughyr), pr. Kurtogay, 44TLN3393, 1240 m, 5-VI-2022, *L. Serra 13254* & al., steppe on stony-sandy soils, LSH 15141, MA.

Limonium dichroanthum (Rupr.) Ikonn.-Gal., Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP5419, 890 m, 1-VI-2022, *L. Serra 13174* & al., steppe on stony-sandy soils, LSH 15065, MA 961042. Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP4716, 970 m, 1-VI-2022, *L. Serra 13179* & al., steppe on stony-sandy soils, LSH 15070. Endemic to Central Asia, known only in Kazakhstan, Kyrgyzstan, and Xinjiang, province of China, where it is scattered in the wormwood steppes. In GBIF database it is not mapped in Kazakhstan (Fig. 6A).

L. otolepis (Schrenk) Kuntze, Kz, ALMATÝ: (Balqasch), Taukum desert, hacia Topar, 43TDK9987, 360 m, 7-VI-2022, *L. Serra 13277* & al., salt marshes, LSH 15164.

L. suffruticosum (L.) Kuntze, Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119956.

Polemoniaceae

Polemonium caucasicum N. Busch, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, Alatau Maraly, 43TFH2765, 1950 m, 30-V-2022, *L. Serra 13155* & al., montane wet grasslands, LSH 15046.

Polygonaceae

Atraphaxis frutescens (L.) Eversm., Kz, ALMATÝ: (Ile), Taukum desert, pr. Kurty, 43TFJ0761, 560 m, 6-VI-2022, *L. Serra 13263* & al., steppe on stony soil, LSH 15150, MA 961053.

A. muschketowii Krasn., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13147* & al., fresh montane grasslands, LSH 15037. Endemic species of a little area near Almaty, with widespread locations with coordinates in GBIF database (Fig. 6B).

A. pyrifolia Bunge, Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP2515, 1250 m, 31-V-2022, *L. Serra 13173* & al., rocky slopes of mountains, LSH 15064.

Calligonum junceum (Fisch. & C.A. Mey.) Litv., Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr chink, 40TDL2280, 82 m, 30-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119977.

C. leucocladum (Schrenk) Bunge, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13292* & al., sandy desert, LSH 15179.

Primulaceae

Androsace sericea Ovcz., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG1843, 3130 m, 4-VI-2022, *L. Serra 13230* & al., alpine rocky crags, LSH 15117.

Cortusa matthioli L. Sp. Pl. 1: 144 (1753) subsp. **brotheri** (Pax ex R. Knuth) Serra & Shomur., *comb. & stat. nov.*

≡ *C. matthioli* f. *brotheri* Pax ex R. Knuth, Pflanzenr. (Engler) 4, 237 (Heft 22): 221 (1905) [basion.]; ≡ *C. brotheri* (Pax ex R. Knuth) Losinsk., Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 1, Fl. Sist. Vyssh. Rast. 3: 236 (1937); ≡ *C. brotheri* Pax ex Lipsky, Trudy Imp. S.-Peterburgsk. Bot. Sada 18: 87 (1901), *nom. inval.*; ≡ *Primula matthioli* subsp. *brotheri* (Pax ex R. Knuth) Kovt. Novosti Sist. Vyssh. Rast. 44: 155 (2013); ≡ *P.m.* subsp. *brotheri* Kovt., Bot. Zhurn. (Moscow & Leningrad)

96(7): 963 (2011), *nom. inval.*; ≡ *P. brotheri* Sutorý, Acta Mus. Morav. Sci. Biol. 95(2): 72 (2010), *nom. inval.*

Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Alatau Terskey, pr. Chon-Ashuu Pass, 44TLN2811, 2400 m, 3-VI-2022, *L. Serra 13226* & al., limestone rocks, LSH 15113, (Fig. 6C).

Cortusa L. is a genus with around 11 taxa distributed from C Europe and N Asia to Japan (KOVTONYUK, 2013), although it is currently included by some authors in *Primula* (MARTINS & al., 2003) and others maintain it independent (MOROZOWSKA, 2011). In our opinion it presents enough morphological characters to consider it independent. Within the genus *Cortusa* L. *C. matthioli* presents a wide distribution with some variability formerly considered at the specific level as 7 species (FEDOROV, 1952) and more recently as 7 subspecies of *C. matthioli* (KOVTONYUK, 2013). In this context *C. matthioli* subsp. *brotheri* is a taxon for which the subspecific combination did not exist. This seems the most appropriate for this taxon described from Kazakhstan and exclusive from the Tian Shan and Altai Mountains (BAASAN-MUNKH & al., 2020). From the morphological point of view, it is well differentiated from both *C. matthioli* subsp. *matthioli* as *C. matthioli* subsp. *altaica* (Losinsk.) Korobkov for its leaves with small teeth of up to 2 mm while the other two subspecies have clearly lobed leaves, and with very densely pubescent petioles, while *C. matthioli* subsp. *brotheri* has slightly pubescent petioles.

Glaux maritima L., Kz, AKMOLA: (Korgalzhyn), pr. lake Kumkol, 42UWB7926, 340 m, 11-VI-2022, *L. Serra 13331* & al., brackish soils, LSH 15217.

Primula algida Adams, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLN3001, 2750 m, 3-VI-2022, *L. Serra 13209* & al., alpine meadows, LSH 15096.

Ranunculaceae

Aquilegia atrovinosa Popov ex Gamajun., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, Alatau Maraly, 43TFH2765, 1950 m, 30-V-2022, *L. Serra 13153* & al., very humid deciduous forests, LSH 15044.

Callianthemum alatavicum Freyn, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG1843, 3130 m, 4-VI-2022, *L. Serra 13229* & al., alpine grasslands, LSH 15116. Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13237* & al., alpine grasslands, LSH 15124.

Clematis sibirica (L.) Mill., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, Jety-Ögüz, 43TKM7488, 2150 m, 4-VI-2022, *L. Serra 13249* & al., montane forests, LSH 15136, MA 961056.

Delphinium camptocarpum Fisch. & C.A. Mey. ex Ledeb., Kz, ALMATÝ: (Schambyl), Taukum desert, hacia Topar, 43TEK2644, 380 m, 7-VI-2022, *L. Serra 13275* & al., sandy desert, LSH 15162, MA 961049.

D. leptocarpum (Nevski) Butkov, Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119980.

Pulsatilla campanella Fisch. ex Krylov, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13236* & al., alpine grasslands, LSH 15123.

Ranunculus brotherusii Freyn, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3198, 2780 m, 3-VI-2022, *L. Serra 13219* & al., montane moist grasslands, LSH 15106.

R. platyspermus Fisch. ex DC., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR 0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH067943.

R. rionii Lager, Kz, AKMOLA: (Korgalzhyn), pr. lake Kumkol, 42UWB7926, 340 m, 11-VI-2022, *L. Serra 13327 & al.*, aquatic in brackish lakes, LSH 15213.

Thalictrum isopyroides C.A. Mey., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR 0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119993.

Trollius dschungaricus Regel, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3598, 3175 m, 3-VI-2022, *L. Serra 13218 & al.*, alpine grasslands, LSH 15105.

Rosaceae

Crataegus dsungarica Zabel ex Lange, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH 3070, 1450 m, 30-V-2022, *L. Serra 13143 & al.*, deciduous forests, LSH 15033, MA 961044.

Dasiphora fruticosa (L.) Rydb., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM 3298, 2960 m, 3-VI-2022, *L. Serra 13216 & al.*, alpine rocky crags, LSH 15103.

Potentilla anserina L. subsp. *anserina*, Kz, AKMOLA: (Korgalzhyn), pr. lake Kumkol, 42UWB7926, 340 m, 11-VI-2022, *L. Serra 13330 & al.*, grasslands on sandy soils, LSH 15216.

P. bifurca Hook.f., Kz, AKMOLA: (Korgalzhyn), Lake Saumalkol, 42UWB4913, 320 m, 10-VI-2022, *L. Serra 13311 & al.*, steppe on sandy soils, LSH 15198.

Prunus armeniaca L., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Terskey, pr. Jeti-Ögüz, 44TKM7192, 1970 m, 2-VI-2022, *L. Serra 13205 & al.*, montane forest border, LSH 15092.

Rosa persica Michx. ex J.F. Gmel., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13294 & al.*, sandy desert, LSH 15181. Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119959.

Sorbus tianschanica Rupr., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Alatau Terskey, pr. Chon-Ashuu Pass, 44TLN2811, 2400 m, 3-VI-2022, *L. Serra 13227 & al.*, montane forest border, LSH 15114.

Rubiaceae

Galium verum L. subsp. *verum*, Kz, AKMOLA: (Korgalzhyn), pr. lake Shulak, 42UWB5806, 320 m, 11-VI-2022, *L. Serra 13335 & al.*, wet grasslands, LSH 15221.

Salicaceae

Populus euphratica Olivier, Kz, ALMATÝ: (Balqasch), Taukum desert, pr. Zheltorangy, 43TEK2289, 370 m, 7-VI-2022, *L. Serra 13279 & al.*, forests on saline soils, LSH 15166, MA 961048.

Salix triandra L., Kz, AKMOLA: (Korgalzhyn), Lake Shalkar, 42UWA7392, 316 m, 12-VI-2022, *L. Serra 13339 & al.*, riverside forests, LSH 15225.

Saxifragaceae

Chrysosplenium nudicaule Bunge, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2440, 3810 m, 4-VI-2022, *L. Serra 13240 & al.*, alpine screes, LSH 15127.

Saxifraga sibirica L., Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Ala. Ters., pr. Chon-Ashuu pass, 44TLM3198, 2780 m, 3-VI-2022, *L. Serra 13224 & al.*, alpine rocky crags, LSH 15111.

Scrophulariaceae

Linaria odora (M. Bieb.) Fisch., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13296 & al.*, sandy soils, LSH 15183.

L. transiliensis Kuprian., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13148 & al.*, stony slopes, LSH 15038. Kz, ALMATÝ: (Raiymbek), pr. Kegen, pass to Kyrgyzstan, 44TLN 5480, 1780 m, 1-VI-2022, *L. Serra 13202 & al.*, stony slopes, LSH 15089. Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2432, 620 m, 6-VI-2022, *L. Serra 13256 & al.*, stony slopes, LSH 15143. Kz, ALMATÝ: (Ile), Taukum desert, Rodnik Zhel'bulak, 43TEJ7882, 570 m, 6-VI-2022, *L. Serra 13268 & al.*, stony slopes, LSH 15155, MA 961051.

Pedicularis oederi Vahl ex Hornem., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13233 & al.*, alpine grasslands, LSH 15120.

Scrophularia kiriloviana Schischk., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3380 m, 4-VI-2022, *L. Serra 13244 & al.*, alpine screes, LSH 15131.

Veronica spuria L., Kz, AKMOLA: (Korgalzhyn), Lake Saumalkol, 42UWB4913, 320 m, 10-VI-2022, *L. Serra 13312 & al.*, grasslands in steppes or forests, LSH 15199. Widespread from the Central Europe to West Siberia, with few observations in central Kazakhstan (Fig. 6D).

Solanaceae

Hyoscyamus pusillus L., Kz, ALMATÝ: (Jengbekschiqasq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-2022, *L. Serra 13170 & al.*, steppe on stony soil, LSH 15061.

Lycium dasystemum Pojark., Kz, ALMATÝ: (Balqasch), Taukum desert, pr. Zheltorangy, 43TEK2289, 370 m, 7-VI-2022, *L. Serra 13278 & al.*, forests on saline soils, LSH 15165. Widespread in Central and East Asia, from Afghanistan, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Uzbekistan to East of China, but with few mapped locations in Kazakhstan (Fig. 7A).

L. ruthenicum Murray, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, dismissed Karabaur, along the Shakhbakhthy road, 40TDN4683, 240 m, 27-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119969.

Tamaricaceae

Tamarix ramosissima Ledeb., Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2138, 620 m, 6-VI-2022, *L. Serra 13257 & al.*, halophilic riparian forests, LSH 15144.

Ulmaceae

Ulmus pumila L., Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3070, 1450 m, 30-V-2022, *L. Serra 13144 & al.*, riparian forests, LSH 15034.

Violaceae

Viola biflora L., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13234 & al.*, alpine grasslands, LSH 15121.

V. kunawarensis Royle, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG2042, 3360 m, 4-VI-2022, *L. Serra 13235 & al.*, alpine grasslands, LSH 15122.

Zygophyllaceae

Zygophyllum fabago L., Kz, ALMATÝ: (Uighyr), pr. crta. A-352, toward Charyn river, 44TLP2515, 1250 m, 31-V-2022, *L. Serra 13172 & al.*, subnitrophilous grasslands secos, LSH 15063.

Z. lehmannianum Bunge, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr gorge chinka, 40TDL1980, 15 m, 30-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119974.

Z. macropterum C.A. Meyer, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13190 & al.*, steppe on stony-sandy soils, LSH 15077. Widespread in Central Asia from Kazakhstan, Kyrgyzstan, Southwest Russia, Tajikistan, Turkmenistan, Uzbekistan, and Xinjiang, a province of China, with a few locations with coordinates in Kazakhstan (Fig. 7B).

Z. ovigerum Fisch. & C.A. Mey. ex Bunge, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Shakhbakhty, 40TDN 5021, 170 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH 119998. The range of the species covers the Turan lowland and the south of Russia. However, it has not been mapped from the northwestern part of Uzbekistan (Fig. 7C).

Z. pterocarpum Bunge, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLP4509, 1054 m, 1-VI-2022, *L. Serra 13182 & al.*, steppe on stony-sandy soils, LSH 15073.

Z. turcomanicum Fisch. ex Bunge, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Shakhbakhty, 40TDN5021, 170 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119999.

Alismaceae

Alisma gramineum Lej., Kz, AKMOLA: (Korgalzhyn), pr. lake Kumkol, 42UWB7926, 340 m, 11-VI-2022, *L. Serra 13329 & al.*, aquatic, LSH 15215. Species with holarctic distribution but not mapped in north central Kazakhstan lakes (Fig. 7D).

Araceae

Eminium lehmannii (Bunge) Kuntze, Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119986.

Butomaceae

Butomus umbellatus L., Kz, AKMOLA: (Korgalzhyn), pr. Kembidaik, 42UXB1323, 340 m, 10-VI-2022, *L. Serra 13307 & al.*, aquatic, LSH 15194.

Cyperaceae

Carex melanantha C.A. Mey., Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG 2440, 3810 m, 4-VI-2022, *L. Serra 13239 & al.*, alpine grasslands, LSH 15126.

C. physodes M. Bieb., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119987.

Eleocharis palustris (L.) Roemer & Schultes, Kz, AKMOLA: (Korgalzhyn), pr. lake Kumkol, 42UWB7926, 340 m, 11-VI-2022, *L. Serra 13328 & al.*, wet grasslands, LSH 15214.

Iridaceae

Iris ruthenica Ker-Gawler, Kg, YSYK-KOL: (Jeti-Ögüz), Tian Shan, Alatau Ters., pr. Barskoon pass, 43TGG1947, 2680 m, 4-VI-2022, *L. Serra 13246 & al.*, cool montane grasslands, LSH 15133.

I. sogdiana Bunge, Kg, YSYK-KOL: (Ak-Suu), Tian Shan, Alatau Terskey, pr. Ak-Bulun, 44TLN2319, 1930 m, 3-VI-2022, *L. Serra 13208 & al.*, wet grasslands, LSH 15095.

Ixioliriaceae

Ixiolirion tataricum (Pallas) Herbert, Kz, ALMATÝ: (Raiymbek), pr. Kegen, pass to Kyrgyzstan, 44TLN5480, 1780 m, 1-VI-2022, *L. Serra 13201 & al.*, montane wet grasslands, LSH 15088.

Juncaginaceae

Triglochin maritima L., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13317 & al.*, halophytic sedges, LSH 15203. Species with holarctic distribution in temperate and cold zones, from North America to Eurasia, and Japan, but not mapped in north central Kazakhstan lakes (Fig. 8A).

Liliaceae

Allium borszczowii Regel, Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr chink, 40TDL2280, 82 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119973.

A. caeruleum Pall., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119991.

A. caesium Schrenk, Kz, ALMATÝ: (Jengbekschiqasaq), pr. Pass Kopkek, 44TLP0323, 880 m, 31-V-2022, *L. Serra 13160 & al.*, steppe on stony soil, LSH 15051. Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ 9557, 213 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119953. Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9459, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119958. Widespread in Central Asia from Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Xinjiang, a province of China, with a few locations with coordinates in Uzbekistan (Fig. 8B).

A. kysilkumi Kamelin, Uz, BUKHARA: Kokchatau, 40T PE5699, 253 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy loamy soil, TASH119964. The species is endemic to Uzbekistan. Small individuals are common on the remnant mountains of the Kyzylkum desert and are being mapped for the first time (Fig. 8C).

A. pallasii Murray, Kz, ALMATÝ: (Jengbekschiqasaq), Pass Kopkek, 44TLP0817, 1060 m, 31-V-2022, *L. Serra 13166 & al.*, steppe on stony soil, LSH 15057. Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13193 & al.*, steppe on stony soil, LSH 15080. Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13316 & al.*, steppe on stony soil, LSH 15202.

A. protensum Wendelbo, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3312, 410 m, 8-VI-2022, *L. Serra 13298 & al.*, sandy desert, LSH 15185.

A. sabulosum Steven ex Bunge, Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK4211, 410 m, 7-VI-2022, *L. Serra 13280 & al.*, sandy desert, LSH 15167. Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr chink, 40TDL2280, 82 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH 119978. Uz, KARAKALPAKSTAN: Karakalpak Ustyurt, Kaplankyr chink, 40TDL2080, 111 m, 29-V-2019, *H.F. Shomurodov, B.A. Adilov & Sh. Tamombetova*, the soil is gypsum-bearing, saline, TASH119972.

A. scrobiculatum Vved., Kz, ALMATÝ: (Schambyl), Taukum desert, pr. Qanshenggel, 43TEK3311, 410 m, 7-VI-2022, *L. Serra 13271 & al.*, sandy desert, LSH 15158.

Asparagus angulofractus Iljin, Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLP4509, 1054 m, 1-VI-2022, *L. Serra 13183 & al.*, steppe on stony-sandy soils, LSH 15074.

A. breslerianus Schult. & Schult.f., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119955.

Eremurus altaicus (Pallas) Steven, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, pr. Koktobe, 43TFH3270, 1610 m, 30-V-2022, *L. Serra 13145 & al.*, screes, mountain rocks, LSH 15035.

E. ammophilus Vved., Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119984. Narrowly localized Central Asian endemic species, common in the deserts of Kyzylkum and Karakum. In GBIF database shown two collection points from Turkmenistan, but it is not mapped in Uzbekistan (Fig. 8D).

E. nderiensis (M. Bieb.) Regel, Uz, KHOREZM: Khorezm oasis. South-west Kyzylkum 4-5 km north-west of the village Tuprok kala along the road, 40TLF6075, 125 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy loamy soil, TASH 119965.

Tulipa biflora Pall., Uz, KARAKALPAKSTAN: Eastern chink Duana tract. I chinka terrace, 40TFR0812, 194 m, 7-IV-2019, *H.F. Shomurodov, B.A. Adilov & O.S. Abduraimov*, sandy loamy soil, TASH119995.

Orchidaceae

Dactylorhiza umbrosa (Kar. & Kir.) Nevski, Kz, ALMATÝ: (Qarassai), Tian Shan, P.N. Ile-Alatau, Alatau Maraly, 43TFH2765, 1950 m, 30-V-2022, *L. Serra 13154 & al.*, montane wet grasslands, LSH 15045.

Poaceae

Aegilops cylindrica Host, Kz, ALMATÝ: (Ile), Lake Sorbulak, 43TFJ2138, 620 m, 6-VI-2022, *L. Serra 13258 & al.*, subnitrophilous grasslands, LSH 15145.

Aeluropus littoralis (Gouan) Parl., Uz, KARAKALPAKSTAN: Eastern chink, descent of Kassarma, 40TEQ9557, 217 m, 10-VI-2019, *H.F. Shomurodov, N. Mamutov & G. Bekzhanova*, the soil is gypsum-bearing, saline, TASH119960.

Agropyron cristatum (L.) Gartn., Kz, ALMATÝ: (Uighyr), pr. P.N. Charyn, 44TLN3298, 1430 m, 1-VI-2022, *L. Serra 13195 & al.*, dry grasslands, LSH 15082.

Eremopyrum orientale (L.) Jaub. & Spach, Uz, BUKHARA: the town of Gazli, 41TNE3738, 187 m, 20-IV-2019, *H.F. Shomurodov & B.A. Adilov*, sandy plain, TASH119966.

Stipa lessingiana Trin. & Rupr., Kz, AKMOLA: (Korgalzhyn), pr. lake Ashchikol, 42UWB6919, 325 m, 11-VI-2022, *L. Serra 13322 & al.*, steppe on brackish soils, LSH 15208.

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Table 1. Number of sheets collected by families

<i>Cupressaceae</i>	2	<i>Euphorbiaceae</i>	1	<i>Salicaceae</i>	2
<i>Ephedraceae</i>	2	<i>Fabaceae</i>	24	<i>Saxifragaceae</i>	2
<i>Pinaceae</i>	2	<i>Frankeniaceae</i>	1	<i>Scrophulariaceae</i>	8
<i>Apiaceae</i>	4	<i>Geraniaceae</i>	5	<i>Solanaceae</i>	3
<i>Apocynaceae</i>	1	<i>Grossulariaceae</i>	1	<i>Tamaricaceae</i>	1
<i>Asclepiadaceae</i>	1	<i>Lamiaceae</i>	23	<i>Ulmaceae</i>	1
<i>Asteraceae</i>	28	<i>Mazaceae</i>	1	<i>Violaceae</i>	2
<i>Berberidaceae</i>	1	<i>Oleaceae</i>	1	<i>Zygophyllaceae</i>	6
<i>Betulaceae</i>	1	<i>Orobanchaceae</i>	1	<i>Alismaceae</i>	1
<i>Boraginaceae</i>	11	<i>Papaveraceae</i>	3	<i>Araceae</i>	1
<i>Brassicaceae</i>	14	<i>Pirolaceae</i>	1	<i>Butomaceae</i>	1
<i>Capparaceae</i>	1	<i>Plantaginaceae</i>	1	<i>Cyperaceae</i>	3
<i>Caprifoliaceae</i>	5	<i>Plumbaginaceae</i>	6	<i>Iridaceae</i>	2
<i>Caryophyllaceae</i>	4	<i>Polemoniaceae</i>	1	<i>Ixioliriaceae</i>	1
<i>Chenopodiaceae</i>	4	<i>Polygonaceae</i>	5	<i>Juncaginaceae</i>	1
<i>Cistaceae</i>	1	<i>Primulaceae</i>	13	<i>Liliaceae</i>	20
<i>Convolvulaceae</i>	2	<i>Ranunculaceae</i>	11	<i>Orchidaceae</i>	1
<i>Crassulaceae</i>	3	<i>Rosaceae</i>	8	<i>Poaceae</i>	5
<i>Eleagnaceae</i>	2	<i>Rubiaceae</i>	1		

Figure 1. Locations studied in Kazakhstan, Kyrgyzstan and Uzbekistan (red dots).

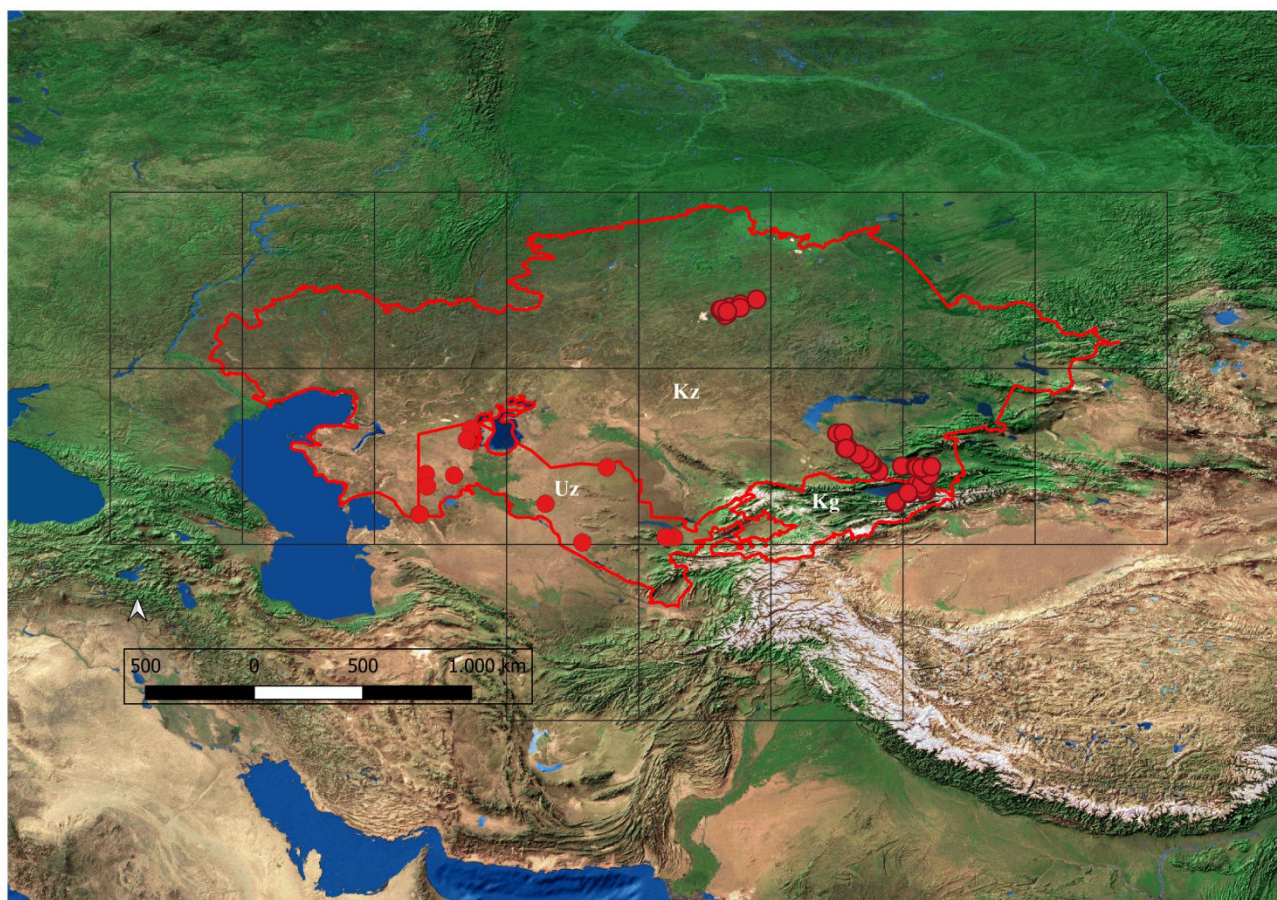




Figure 2. A. *Ferula litwinowiana* B. *Seseli ledebourii* C. *Echinops acantholepis* D. *Jurinea multiflora* (photographs: A - H. Shomurodov, B, C, D - L. Serra).

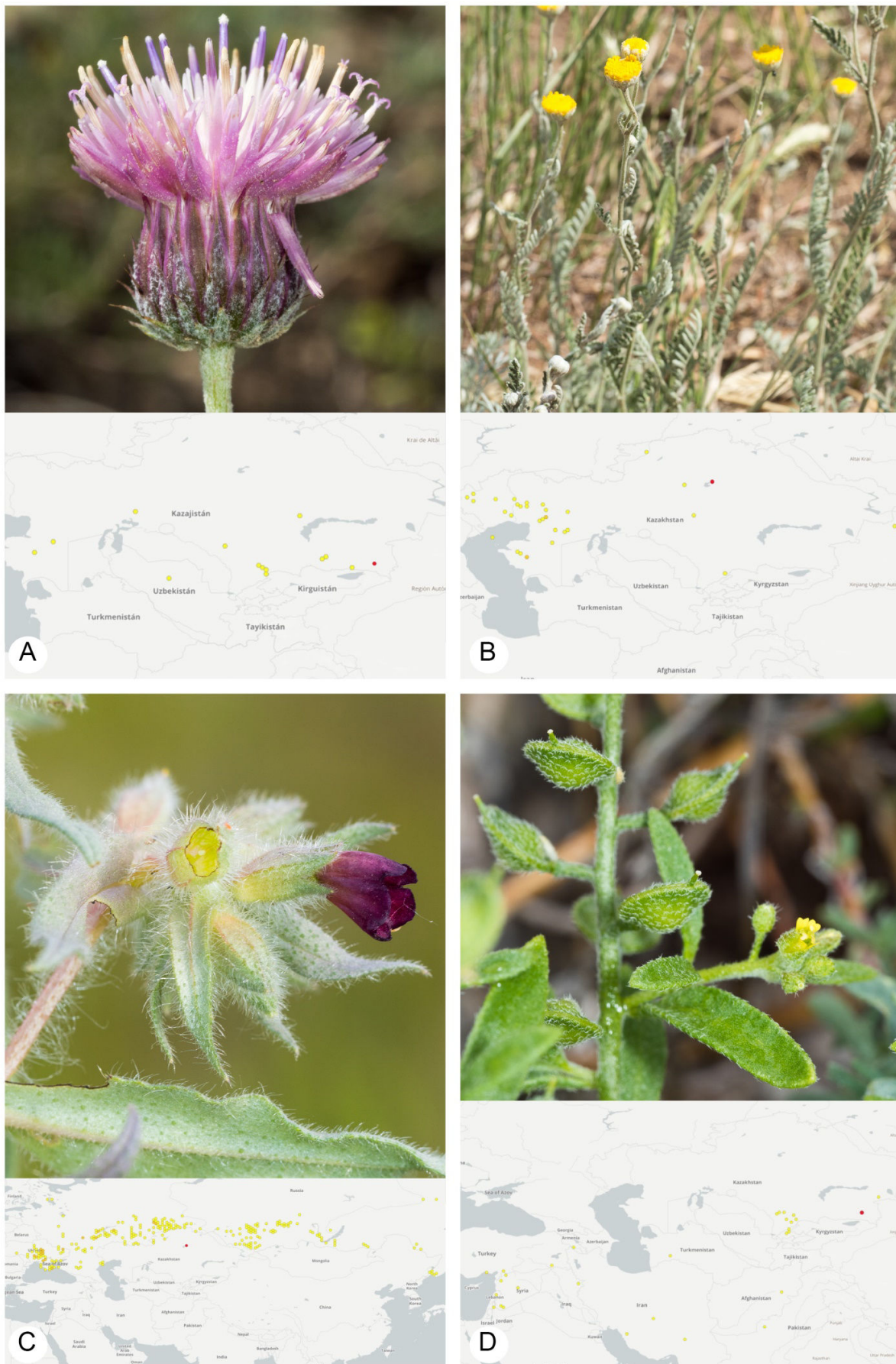


Figure 3. A. *Jurinea multiloba* B. *Tanacetum santolina* C. *Nonea rossica* D. *Alyssum szovitsianum* (photographs: L. Serra).

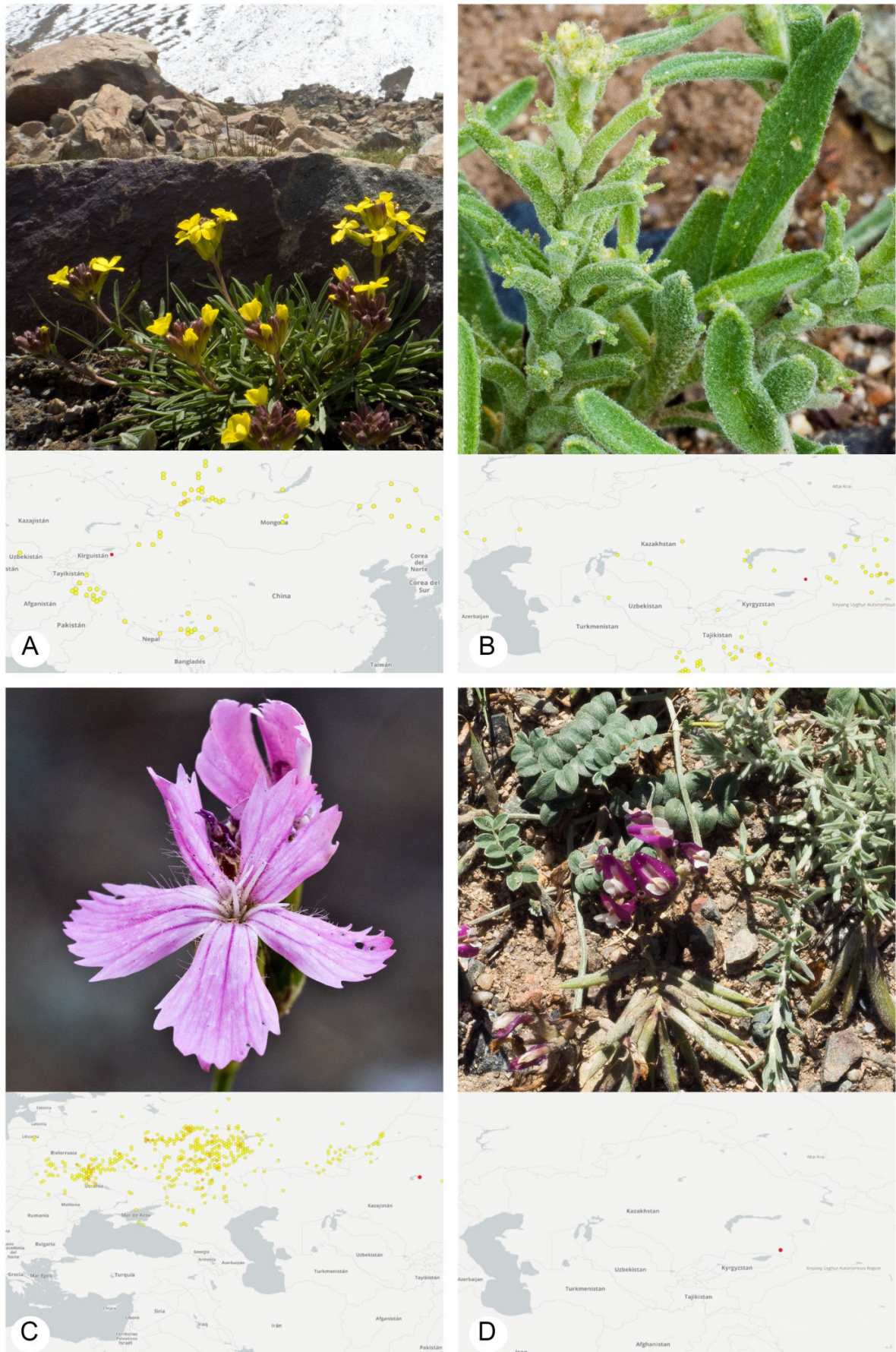


Figure 4. A. *Erysimum altaicum* B. *Tetracme quadricornis* C. *Dianthus borbasii* D. *Astragalus amabilis* (photographs: L. Serra).



Figure 5. A. *Astragalus ammodendron* B. *Thermopsis lanceolata* C. *Frankenia hirsuta* D. *Lagochilus bungei* (photographs: L. Serra).

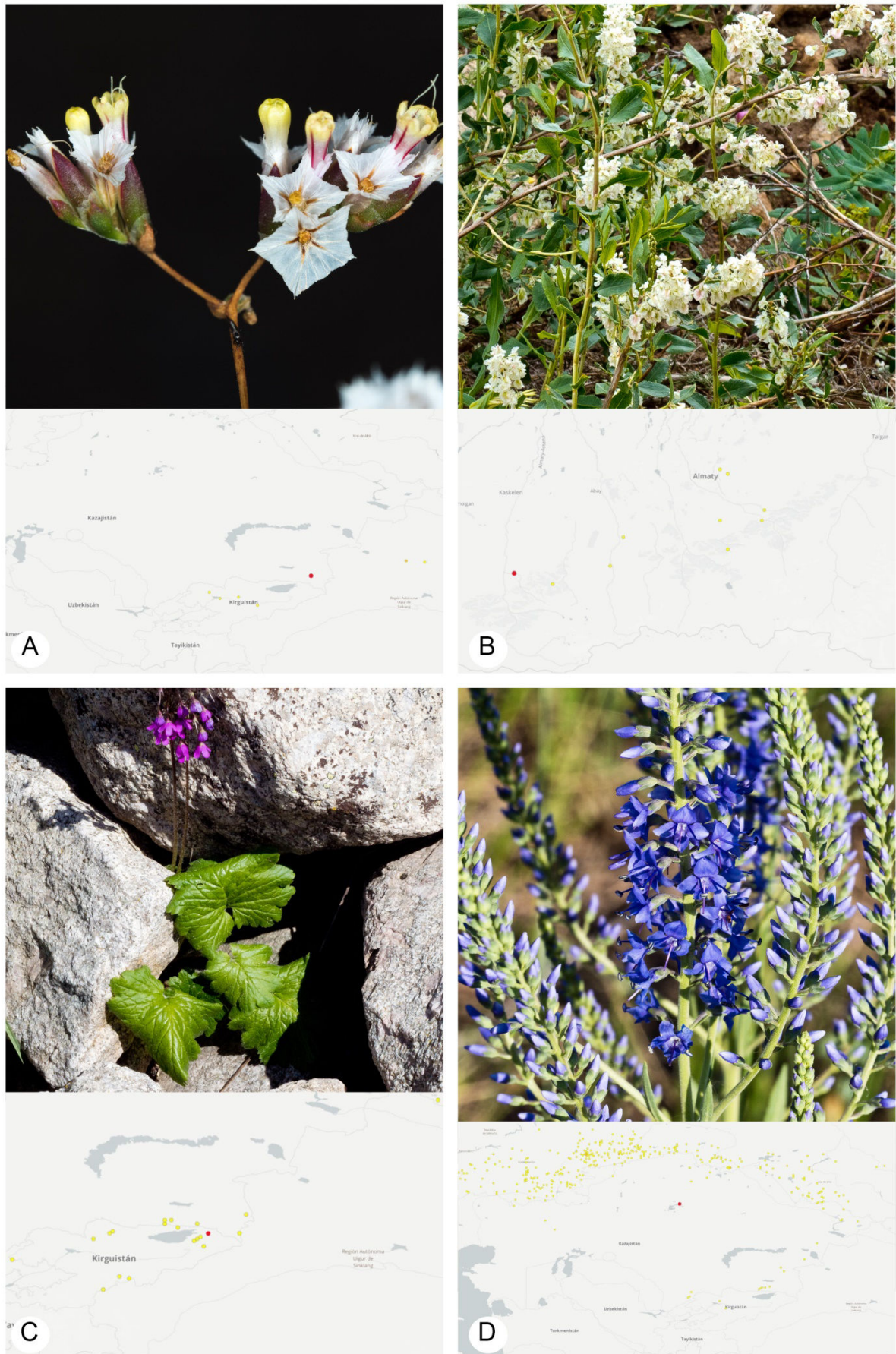


Figure 6. A. *Limonium dichroanthum* B. *Atraphaxis muschketovii* C. *Cortusa matthioli* subsp. *brotheri* D. *Veronica spuria* (photographs: L. Serra).

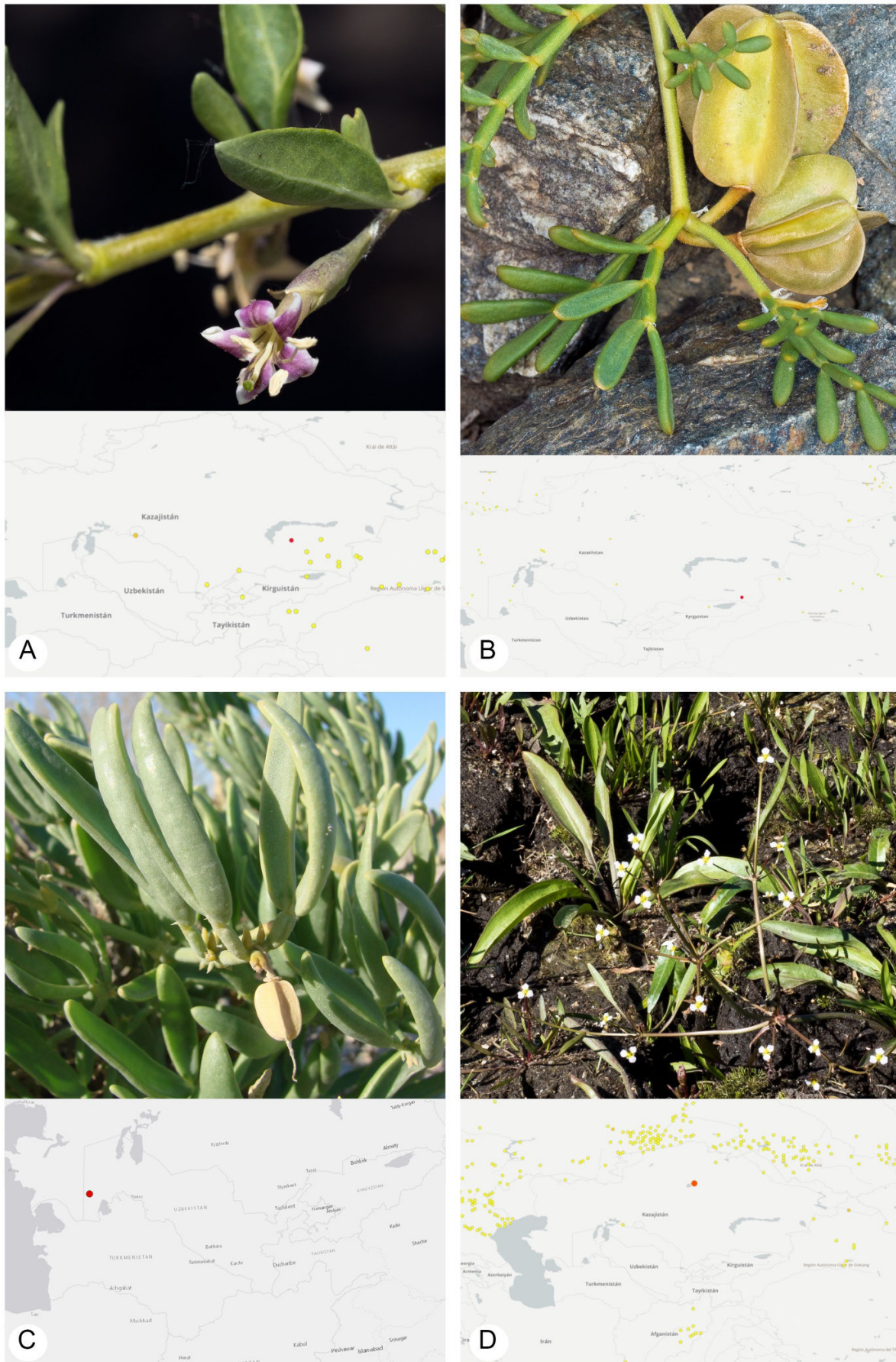


Figure 7. A. *Lycium dasystemum* B. *Zygophyllum macropterum* C. *Zygophyllum ovigerum* D. *Alisma gramineum* (photographs: C - H. Shomurodov, A, B, D - L. Serra).

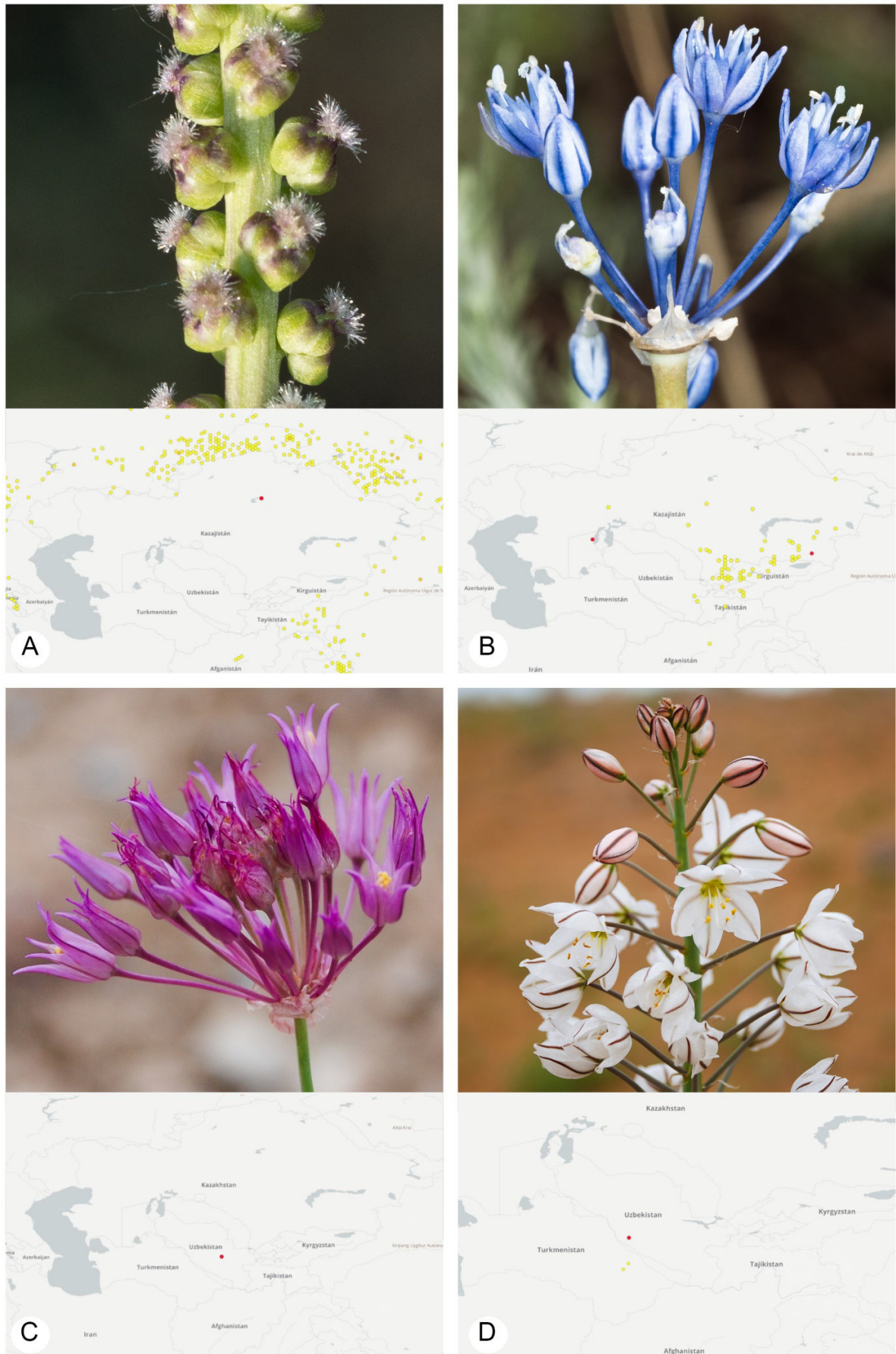


Figure 8. A. *Triglochin maritima* B. *Allium caesium* C. *Allium kysylkumi* D. *Eremurus ammophilus* (photographs: C, D - H. Shomurodov, A, B - L. Serra).

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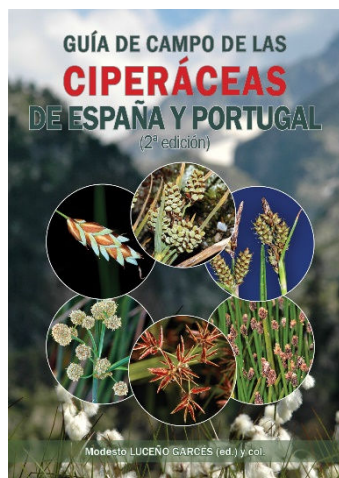
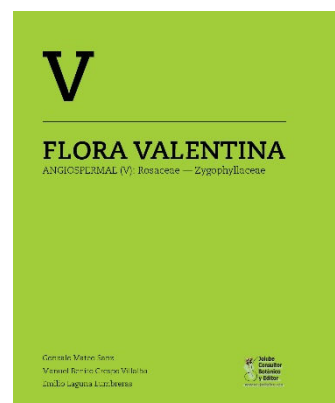
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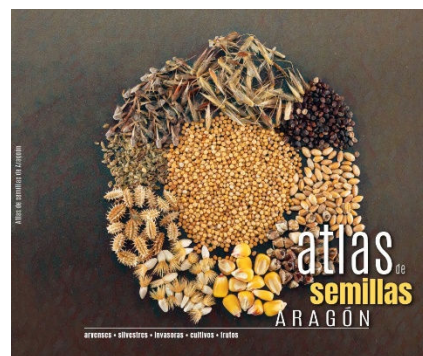
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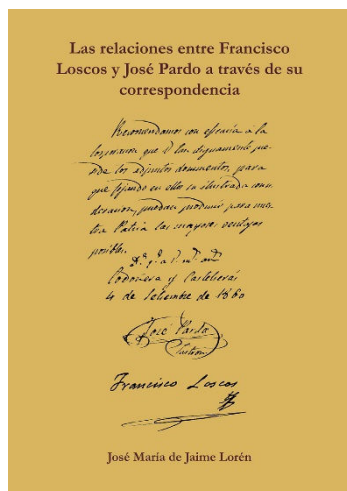
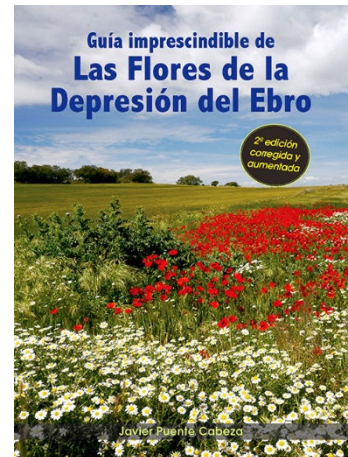
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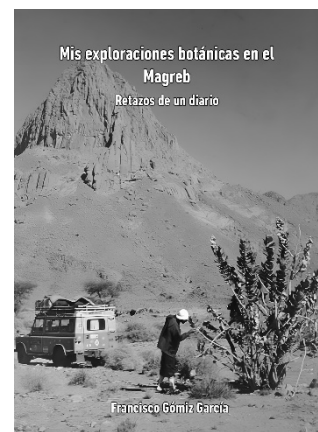
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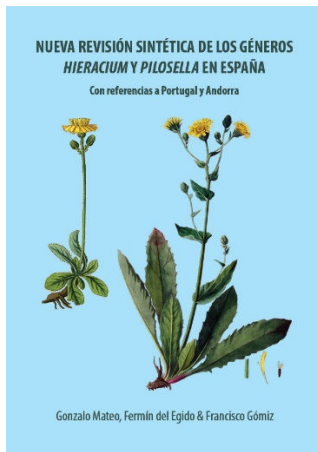
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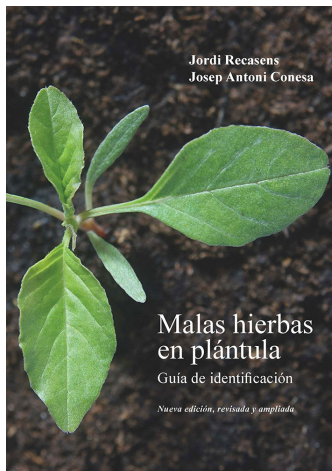
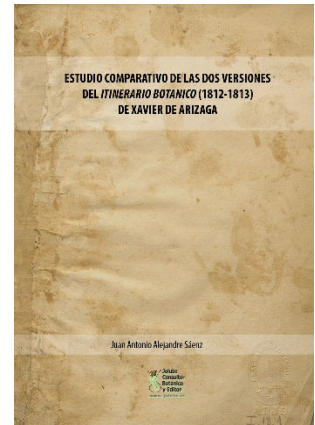
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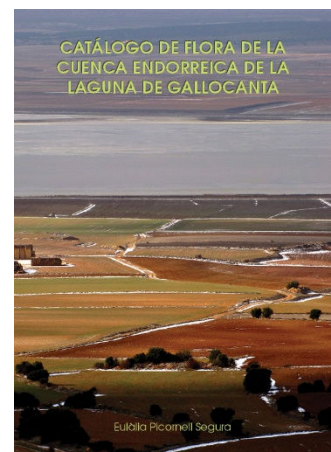
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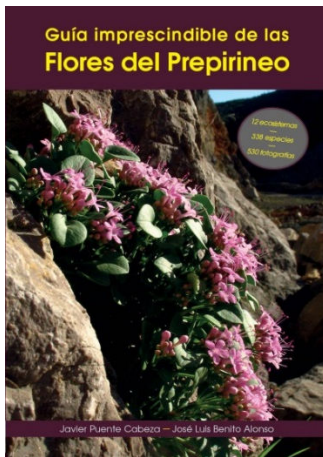
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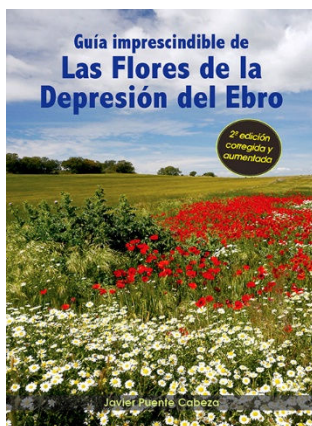
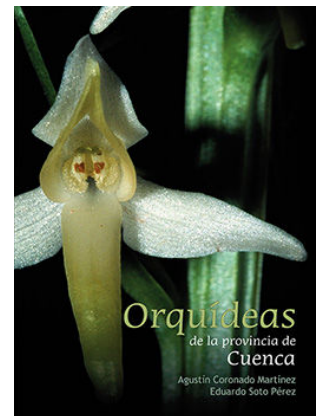
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