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Limonium ksamilum (Plumbaginaceae), a new species from Albania

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Abstract

Limonium ksamilum, a new species is described and illustrated from southern Albania, where it grows along the calcareous rocky coast near Ksamil. It shows close taxonomical relationships with *L. dictyophorum*, as well as with *L. himariense* and *L. arcuatum*, with which it shares similar ecological requirements. Remarks on its morphological features, distribution, ecology, conservation status and an analytical key for the species of *Limonium* occurring in Albania are provided.

Keywords: Adriatic, Ionian Sea, *Limonium dictyophorum* complex, Mediterranean flora, taxonomy

Introduction

Within taxonomical investigations on the genus *Limonium* Miller (1754: 1328) in in the central-eastern Mediterranean Area (Brullo 1980, Bogdanović & Brullo 2015, Brullo & Erben 2016, Brullo & Guarino 2017), a contribution on this genus in Albania is provided. *Limonium* shows a cosmopolitan distribution, currently represented by about 600 species (Malekmohammadi *et al.* 2017, Koutroumpa *et al.* 2018, Doğan *et al.* 2020), with the most of them occurring in the Mediterranean area.

According to the literature (Qosja *et al.* 1996, Hoda & Mersinllari 2000, Meyer 2011, Vangjeli 2015, Pils 2016, Barina 2017), for the Albanian flora are hitherto known four species of *Limonium*, all occurring along the coastal belt. In particular, they are *L. sinuatum* (Linnaeus 1753: 276) Miller (1768: no.6), *L. narbonense* Miller (1768: no. 2), *L. virgatum* (Willdenow 1809: 336) Fourreau (1869: 141), and *L. himariense* F.K.Meyer (2011: 113). It has to be noted, the last species is quoted in some of the just mentioned floras as *L. anfractum* (C.E.Salmon 1922: 345) C.E.Salmon (1924: 336), which is a synonym of *L. dictyophorum* (Tausch 1824: 254) Degen (1937: 540) endemic to southern Croatia and Montenegro (see Bogdanović & Brullo 2015). The species *L. cancellatum* (Bernhard ex Bertoloni 1837: 525) Kuntze (1891: 395) was also reported for the Albanian flora by Greuter *et al.* (1989) and Domina (2011), but Bogdanović & Brullo (2015) corrected this citation and the occurrence of this species has to be limited only to Croatia.

During a field trip along the Albanian coast, a very peculiar population of *Limonium* was found on the calcareous rocks facing the sea close to the Ksamil village (southern Albania). The habitat is very similar to that one colonized by *L. himariense*, which occurs in northernmost coastal sites. Despite it is morphologically quite related to the individuals of this new population, they differ in significant features chiefly regarding habit, inflorescence and spikelets. Actually, they clearly belong to the group of *L. dictyophorum* carefully investigated by Bogdanović & Brullo (2015), which is represented by several species occurring along the rocky coasts of Croatia, Montenegro, western Greek coast and Ionian Islands. Taxonomical studies on the population from Ksamil revealed that it is morphologically very different from the other allied species of this group and it is attributed to a new species to science, proposed as *L. ksamilum*.

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Material and methods

Morphological analyses were carried out on herbarium materials, that are preserved at CAT, TIR, ZA, and ZAGR (acronyms are according to Thiers 2021), and from ten fresh plants sampled from the type locality in Albania.

Taxonomic treatment

Limonium ksamilum Bogdanović, Shuka, Giusso & Brullo, *sp. nov.* (Fig. 1)

A Limonio dictyophoro internodis saepe longioribus, inflorescentia rigida, leviter contract, spicis brevioribus, spiculis 1–3 floris, ad 4–5 in 1 cm dispositis, bractea inferiore latiore, bractea superiore latiore, acumine breviore, costis calycis pilosis, lobis ovato-triangularis, acutis, longioribus differt.

Type:—ALBANIA. Ksamil, SW promontory, on calcareous rocky coast, 39°46'10.80"N, 19°59'8.90"E, 3 August 2021, *S. Bogdanović s.n.* (holotype ZAGR-73805!, isotypes CAT!, TIR!, ZA!, ZAGR-73806!).

Plant perennial, 15–40 cm tall, glabrous, with robust tap-root. Caudices branched, 1–4 cm long, and covered by leaves in the upper part. Leaves rigid, rugose, glabrous, green, 1–5 cm long, 2–10 mm wide, spathulate to linear-spathulate, revolute at the margin, 1-nerved, tapering into a long petiole, retuse at the apex. Stems numerous, erect, rigid, robust, striate, glabrous, with numerous sterile branches, branched, fragile at nodes, slightly curved, diverging at the angle of 10–25°, internodes 1–5 cm long. Inflorescence erect, slightly contract, rigid, branched; spikes 1–5 cm long, straight to curved. Spikelets 6–6.5 mm long, 1–3-flowered, 4–5 per cm; outer bract 1.2–1.7 mm long, 1.5–1.7 mm wide, ovate, acute, narrowly membranous, glabrous, with central part fleshy, acuminate, with acumen not reaching the apex; middle bract 2–2.2 mm long, 1.6–1.8 mm wide, hemielliptical, rounded at the apex, membranous, glabrous; inner bract 3.6–4.5 mm long, 2.5–3.2 mm wide, ovate-oblong, obtuse to subrounded, with margin membranous, glabrous, 0.3–0.6 mm wide, with central part fleshy, glabrous, 1.7–2 mm wide, long apiculate, forming a triangular tip, 0.6–0.8 mm long, no reaching the upper margin. Calyx 5–5.2 mm long, exserted 2.2–2.7 mm from the inner bract, tube and ribs hairy, ribs reaching the middle part of the lobes; calyx lobes, ovate-triangular, 1–1.3 × 0.8–1 mm, acute. Corolla lilac.

Habitat and Distribution:—*Limonium ksamilum* is localized on rocky stands near the sea, markedly affected by the marine aerosol (Fig. 2). It exclusively grows on the crevices of calcareous outcrops featured by a very feeble accumulation of salty soil. The vegetation colonizing this peculiar habitat shows very poor cover values and is dominated by *L. ksamilum* growing together with few other halophytes, such as *Crithmum maritimum* Linnaeus (1753: 246), *Lotus cytisoides* Linnaeus (1753: 776), *Silene sedoides* Poiret (1789: 164), *Reichardia picroides* (Linnaeus 1753: 792) Roth (1787: 35), *Elymus acutus* (Candolle de 1813: 153) M.-A. Thiébaud (1987: 340), etc. Basing on personal field observations, this species is localized on a narrow coastal area represented by the promontory at southwest of the Ksamil village (southern Albania), as well as on the small islets facing the village (Fig. 3).

Etymology:—The epithet refers to Ksamil, village in southern Albania where the plant was collected.

Phenology:—Flowering from June to September.

Conservation status:—*Limonium ksamilum* is currently known from a single population occurring in the neighbouring of Ksamil village (South Albania) represented by about 1,000 mature individuals scattered over an area of ca. 2 km^2. The habitat of this species, exclusively growing along a narrow coastal belt (wide 8–20 m), is continuously threatened by tourist activities that have already damaged part of it. Therefore, according to the IUCN Red list category (IUCN 2022), this species for its restricted distribution, low number of mature individuals and severe human pressure should be considered as Vulnerable—VU D1+2.

Taxonomic remarks:—*Limonium ksamilum* shows close morphological relationships (Table 1) with some species localized in the calcareous rocky coast of southern Croatia, Montenegro, Albania and Kerkyra island in Greece. Among the allied species can be mentioned *L. dictyophorum* (Tausch) Degen, *L. himariense* F.K.Meyer and *L. arcuatum* Artelari (1984: 20) which are all characterized by a very similar habit, with leaves spathulate, revolute at margin, emarginate at the apex, stems glabrous, erect, fragile at the nodes, with sterile branches in lower part, inflorescence lax, diffuse, spikes with remotely arranged spikelets, calyces long exerted from bracts (Meyer 2011, Bogdanović & Brullo 2015, Brullo & Erben 2016). In particular, *L. ksamilum* differs from *L. dictyophorum* in having inflorescence more rigid and contract (vs. flexuous and lax), spikelets 4–5 per cm, with 1–3 flowers (vs. 2–4 per cm, with 3–7 flowers), inner bract obtuse-subrounded, wider up to 3.2 mm broad (vs. subacute and max. 2.7 mm broad), calyx hairy also in the ribs (vs. ribs glabrous above), calyx lobes acute, ovate-triangular, 1–1.3 mm long (vs. rounded, hemielliptical, 0.6–0.7 mm long)

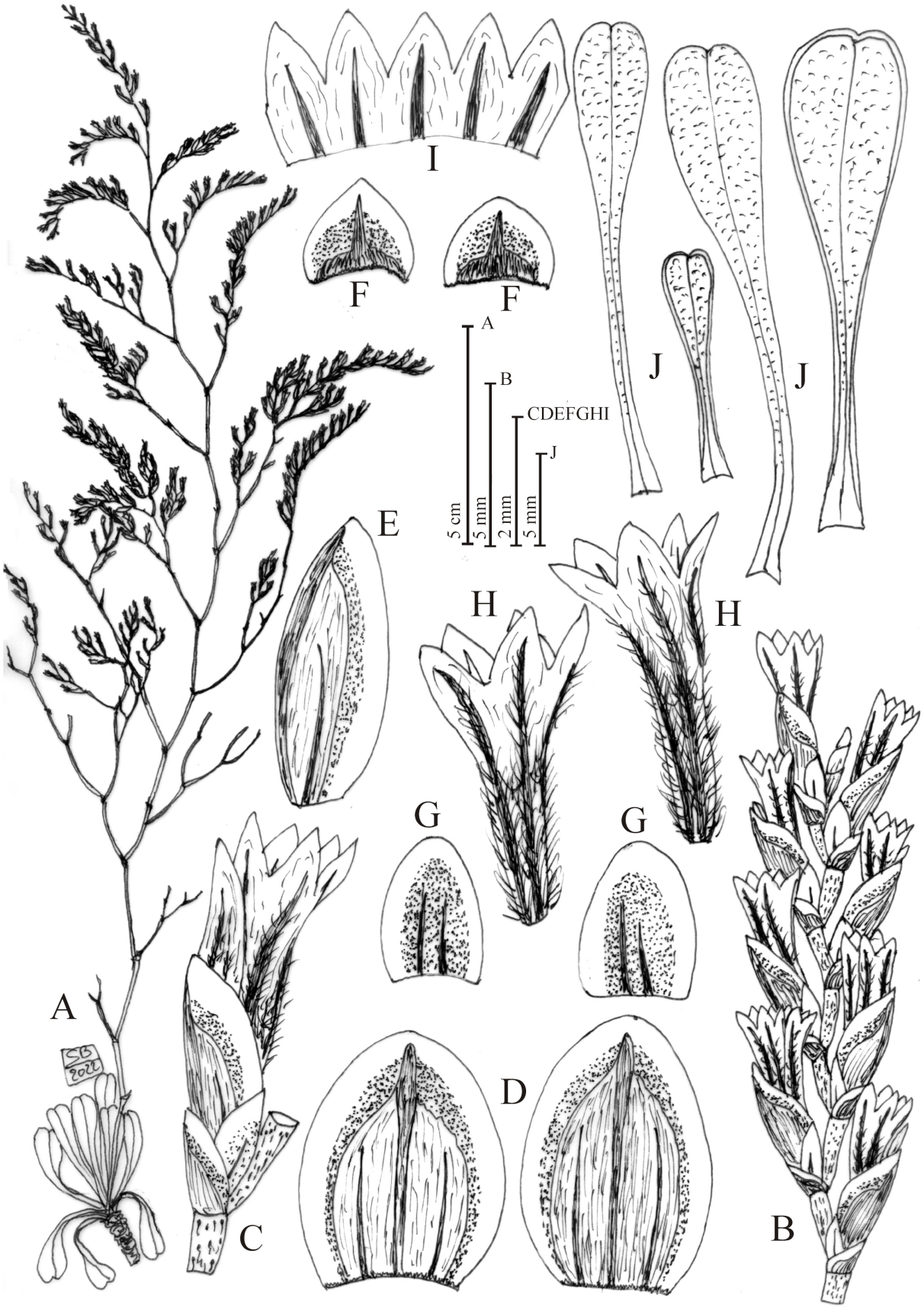

FIGURE 1. Diagnostic features of *Limonium ksamilum*. **A.** Habit. **B.** Inflorescence. **C.** Spikelet. **D.** Inner bracts, dorsal view. **E.** Inner bract, lateral view. **F.** Outer bracts. **G.** Middle bracts. **H**. Calyces. **I.** Calyx lobes. **J.** Leaves. Illustration by S. Brullo based on living material coming from the type locality (CAT!).

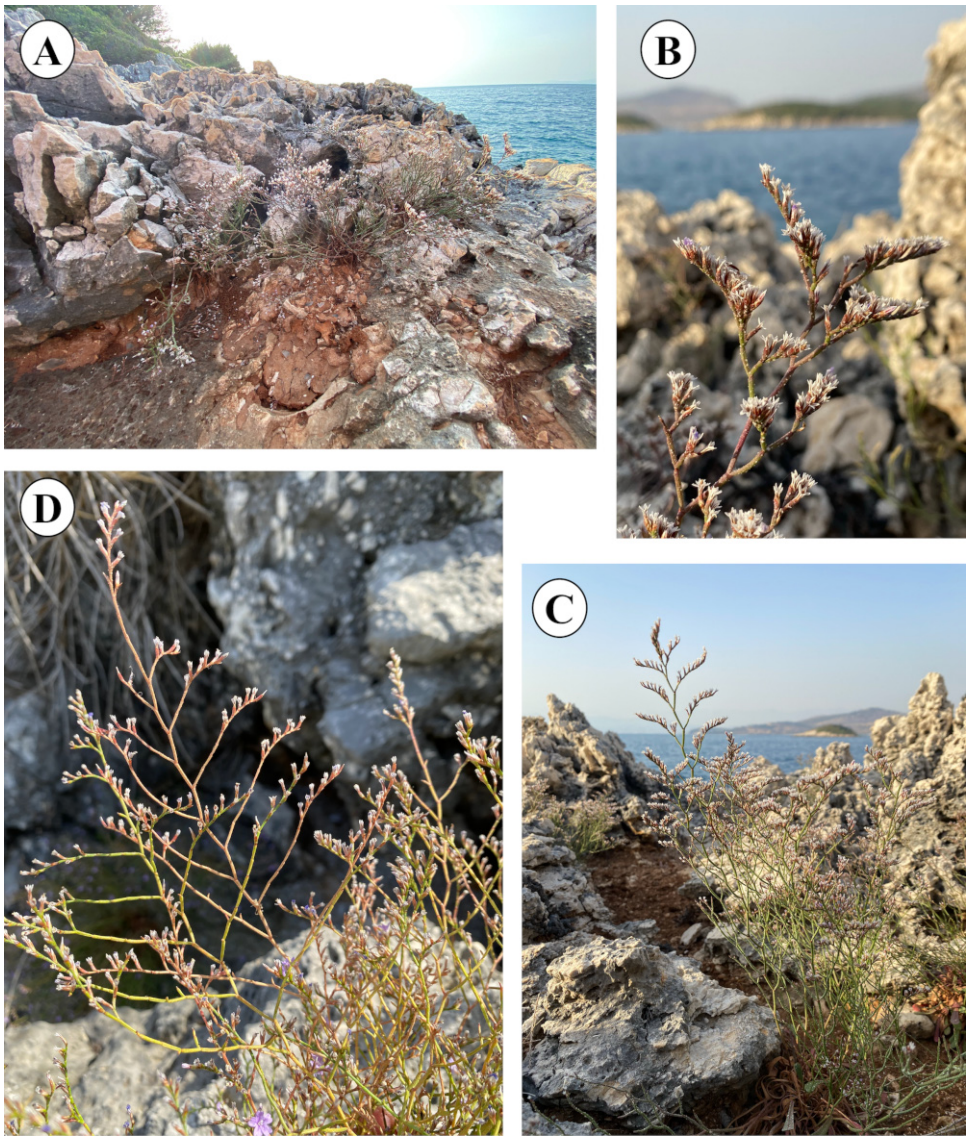

FIGURE 2. *Limonium ksamilum* **A.** Habitat. **B.** Detail of the inflorescence. **C.** Habit. **D**. Detail of the inflorescence of *Limonium himariense.*

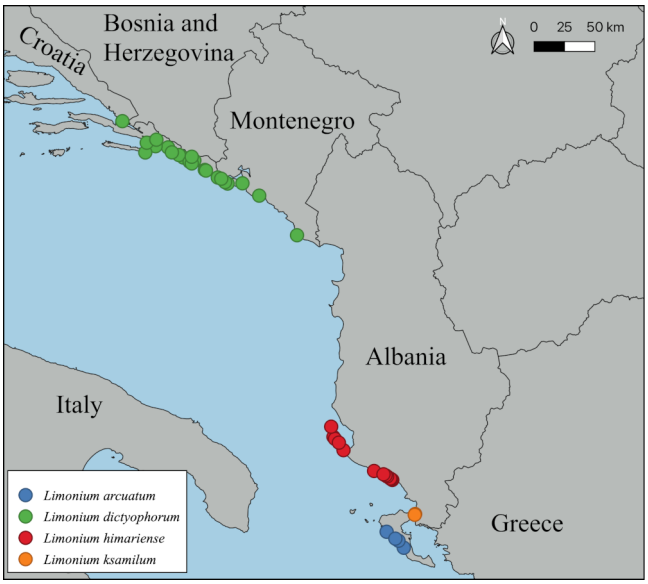

FIGURE 3. Geographical distribution of *Limonium ksamilum* (orange dot), *L. arcuatum* (blue dots), *L. himariense* (red dots) and *L. dictyophorum* (green dots).

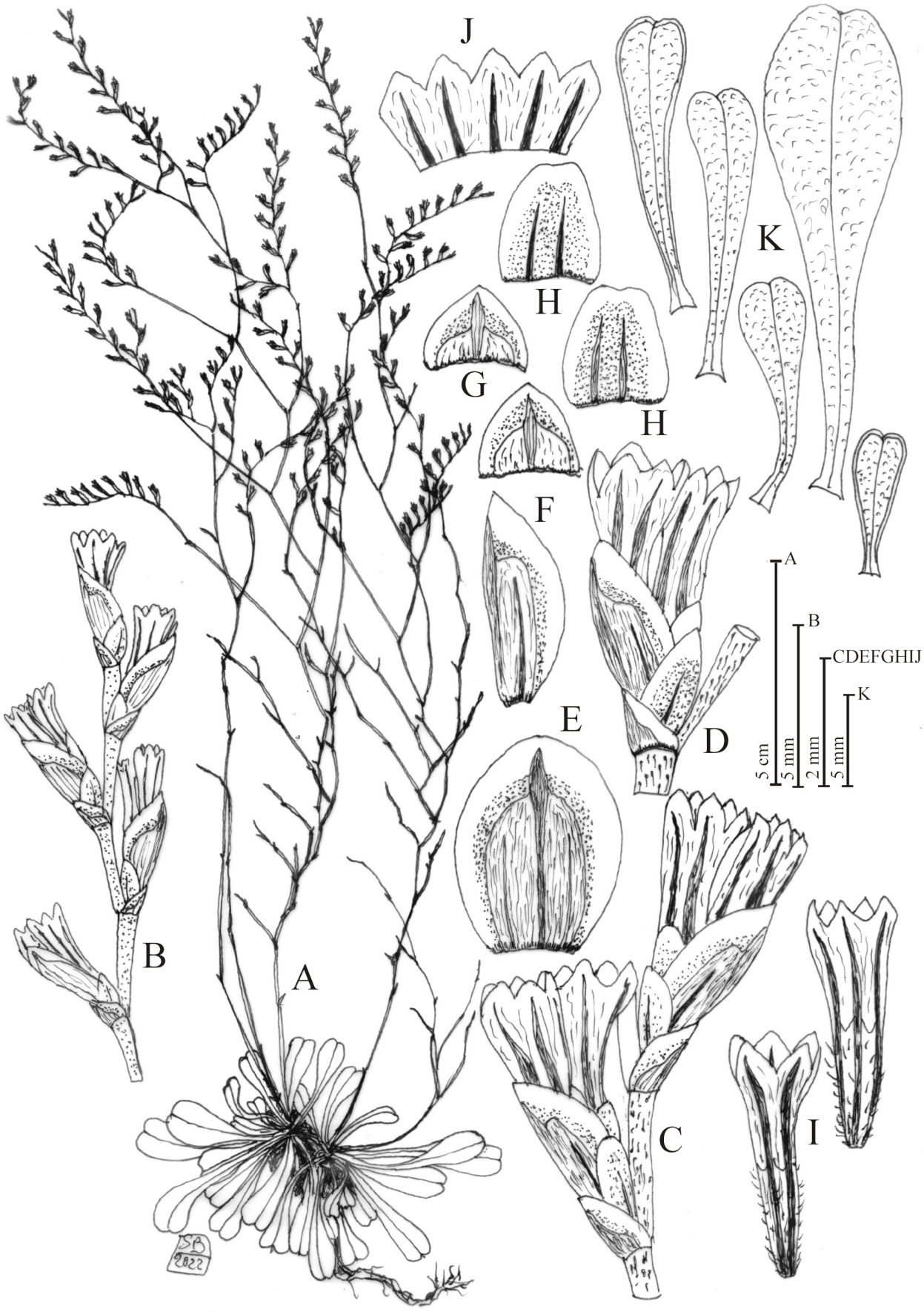

FIGURE 4. Diagnostic features of *Limonium himariense*. **A.** Habit. **B.** Inflorescence. **C.** Detail of inflorescence. **D.** Spikelet. **E.** Inner bract, dorsal view. **F.** Inner bracts, lateral view. **G.** Outer bracts. **H.** Middle bracts. **I.** Calyces. **J.** Calyx lobes. **K.** Leaves. Illustration by S. Brullo based on living material coming from the type locality (CAT!).

(see Bogdanović & Brullo 2015, Figs. 7, 36). Besides, *L. ksamilum* shows some relationships with *L. arcuatum*, but significant features allow to distinguish very well the two species. Actually, according to Brullo & Erben (2016, Fig. 32), *L. ksamilum* differs from the latter for the internodes slightly curved up to 5 cm long (vs. very curved max. 3 cm long), inflorescence slightly contracted, with 4–5 spikelets per cm (vs. lax, with 2–4 spikelets per cm), middle bract 2–2.2 × 1.6–1.8 mm (vs. 1.3–1.8 × 1–1.2 mm), inner bract ovate-oblong (vs. elliptical), calyx exserted 2.2–2.7 mm from the inner bract, densely hairy in the tube and ribs hairy (vs. exerted 1.5–2 mm from the inner bract, sparsely hairy in the tube and ribs glabrous), calyx lobes acute 1–1.3 mm long (vs. rounded, 0.8 mm long). Finally, *L. ksamilum* shows a strong affinity with *L. himariense*, which also grows in Albania but in northern coastal stands. In order to emphasize the morphological features of *L. himariense* a detailed illustration is provided (Fig. 4). The more relevant diagnostic features that allow to differentiate *L. ksamilum* from *L. himariense* are the inflorescence slightly contracted (vs. lax), spikelets 6–6.5 mm long, 4–5 per cm (vs. 4.5–5.2 mm long, 3 per cm), outer bract 1.5–1.7 mm long, acute (vs. 1–1.2 mm long, obtuse), inner bract 3.6–4.5 × 2.5–3.2 mm, ovate-oblong (vs. 3–3.4 × 2.5–2.6 mm, ovate-subrounded), calyx 5–5.2 mm long, exerted 2.2–2.7 mm from the inner bract (vs. 3.8–4 mm long, exerted 1.2–1.8 mm from the inner bract), calyx tube densely hairy and ribs hairy (vs. sparsely hairy and ribs glabrous), calyx lobes acute, 1–1.3 mm long (vs. obtuse, 0.5 mm long).

Basing on literature (Demiri 1983, Meyer 2011, Vangjeli 2015, Pils 2016, Barina 2017), the following analytical key of the *Limonium* species occurring in Albania is provided:

1. Leaves sinuate, stem winged, calyx lobes blue ..... *L. sinuatum*
- Leaves entire, stem not winged, calyx lobes white 2
2. Stems without sterile branches, leaves very large, with pinnately nerves ..... *L. narbonense*
- Stems with sterile branches, leaves linear-spathulate, 1-nerved 3
3. Leaf margin flat, stem rigid not fragile at the nodes, inner bract markedly curved ..... *L. virgatum*
- Leaf margin revolute, stem curved, fragile at the nodes, inner bract straight 4
4. Spikelets 4.5–5.2 mm long, outer bract obtuse 1–1.2 mm long, inner bract 3–3.4 mm long, calyx 3.8–4 mm long, with lobes obtuse 0.5 mm long ..... *L. himariense*
- Spikelets 6–6.5 mm long, outer bract acute 1.2–1.7 mm long, inner bract 3.6–4.5 mm long, calyx 5–5.2 mm long, with lobes acute 1–1.3 mm long ..... *L. ksamilum*

Other specimen examined of *Limonium ksamilum* (paratype):—ALBANIA. Ishujt e Ksamilit, in front of Ksamil village, on calcareous rocky coast, 39°46’31.49”N, 19°59’26.63”E, 3 August 2021, *S. Bogdanović s.n.* (CAT!, ZAGR!).

Specimens examined of *Limonium himariense*:—ALBANIA. Himara, Dhermi, Strand, an Felsen im flachen Meer, 7 September 1961, *F. K. Meyer 5964* (holotype: JE00016701!, isotype: JE00016702!); Porto Palermo, calcareous rocky coast, 1 August 2021, *S. Bogdanović s.n.* (CAT!, ZAGR!); Himare, Spile bay, southern rocky coast, 25 June 2019, *S. Bogdanović s.n* (ZAGR!); Palermo, calcareous rocky coast, 1 August 2021, *S. Bogdanović s.n.* (CAT!, ZAGR!); Himare, Spile, calcareous rocky coast, 6 October 2017, *S. Bogdanović s.n.* (ZAGR!); Qeparo, Grava bay, *S. Bogdanović s.n.* (ZAGR!); Porto Palermo, na stijenama uz obalu mora, 8 July 2010, *C. Gangale & D. Uzunov s.n.* (ZAGR!); Himara, costa rocciosa, 16 June 2018, *S. Cambria s.n.* (CAT!); Vlorë, Dhërmi, 2 m, 21 November 1984, *V. Tartari & A. Mullaj s.n.* (TIR!); Dhërmi, 3-4 m, 26 August 1957, *A. Duka s.n.* (TIR!), sub. *Statice oleifolia*; Ranishtet e Himarës, 3 August 1960, *V. Tartari s.n.* (TIR!), sub *Statice cosyrense*; Ranishtet e Himarës, 3 August 1960, s.l., (TIR!), sub. *Statice oleifolia*; Himara, 13 May 2018, *S. Cambria s.n.* (TIR!); Dhërmi, on the coastal rocky cervices, 2–15 m, 3 July 2018, *L. Shuka s.n.* (private herbarium Shuka!); Himara, on the coastal rocks, 5–10 m, 8 August 2019, *D. Shuka s.n.* (private herbarium Shuka!).

Specimens examined of *Limonium arcuatum*:—GREECE. Corfù a Paleokastritsa, rupi calcaree sul mare, 19 August 1999, *Bartolo, Brullo, Guarino & Signorello s.n.* (CAT!); Isole ioniche, Corfù a Ermones, rupi calcaree sul mare, 19 August 1999, *Bartolo, Brullo, Guarino & Signorello s.n.* (CAT!); Corfù a Glifada, rupi calcarenitiche sul mare, 19 August 1999, *Bartolo, Brullo, Guarino & Signorello s.n.* (CAT!); Ins. Kerkyra: ad loco Agios Gordios, in rupestribus maritimis, 13 August 1978, *R. Artelari 223* (M!).

Specimens examined of *Limonium dictyophorum*:—CROATIA. Dubrovnik, Dalmazia meridionale, sotto albergo Neptun, litorale roccioso, 6 November 2006, *Brullo, Bogdanović & Giusso s.n.* (CAT!, ZAGR!); Trsteno, sotto l’arboreto, Dalmazia meridionale, litorale roccioso, 6 November 2006, *Brullo, Bogdanović & Giusso s.n.* (CAT!, ZAGR!); Prevlaka, Dalmazia meridionale, litorale roccioso, 6 November 2006, *Brullo, Bogdanović & Giusso s.n.* (CAT!, ZAGR!); Isola di Sv. Andrija vicino a Lopud, Sud Dalmazia, 16 June 2005, *Kovačić s.n.* (CAT!, ZAGR!), Vitaljina (selo kod Igala), obalni grebeni uz more, 12 October 1981, *Hećimović s.n.* (ZA!); Duboka (uvala i selo kod Kleka), obalni grebeni uz more, 10 November 1981, *Hećimović s.n.* (ZA!); Mrkan, otočić kod Cavtata, pukotine stijena

uz more, 20 June 1979, *Hećimović s.n.* (ZA!); Lokrum kod Dubrovnika, 26 September 1930, *Lochingg s.n.* (ZA!); Otok Šipan: Kaludrica, uz more, u as. Limonietum anfracti, 25 August 1979, *Hećimović s.n.* (ZA!); Bobara, otočić kod Cavtata, pukotine stijena uz more, 8 August 1979, *Hećimović s.n.* (ZA!); In maritimis Gravosae, 1808, *Vodipić s.n.* (ZA!). MONTENEGRO. Budva, Felsküste, 14 July 1973, *Heinrich s.n.* (M!); An der Bucht südlich Rodovići, 1 September 1977, *Krach s.n.* (M!); In rupestribus maritimis ad Pristan-Bar, July 1890, *Baldacci s.n.* (K!).

TABLE 1. Main diacritic characters of *Limonium ksamilum* and allied species.

Characters	*L. arcuatum*	*L. dictyophorum*	*L. himariense*	*L. ksamilum*
Stem height (cm)	15–45	20–50	20–40	15–40
Stem internodes length (cm)	1–3	1–3.5(4)	1–4	1–5
Sterile branches shape	very curved	curved	slightly curved	slightly curved
Leaf size (cm)	2.5–5 x 0.6–1.6	1.5–3.5(5) x 0.5–1	1–6 x 0.2–1	1–5 x 0.2–1
Inflorescence shape	erect, lax, diffuse	erect, lax, diffuse	erect, lax, diffuse	erect, slightly contract
Spikes length (cm)	1–5.5	2–8	1–6(8)	1–5
Spikelet number per cm	2–4	2–4	3	4–5
Spikelet length (mm)	5–6.5	6–7	4.5–5.2	6–6.5
Spikelet number of flowers	1–2	3–7	1–2	1–3
Outer bract length (mm)	1–1.5	1.4–1.6	1–1.2	1.2–1.7
Outer bract width (mm)	1.6–1.8	1.4.–1.5	1.5–1.7	1.5–1.7
Outer bract shape	triangular-ovate	ovate	triangular-ovate	ovate
Outer bract apex	acute	acute	obtuse	acute
Middle bract length (mm)	1.3–1.8	1.8–2.2	1.7–2	2–2.2
Middle bract width (mm)	1–1.2	1.4–1.7	1.4–1.6	1.6–1.8
Inner bract length (mm)	3.2–4.3	4.2–4.4	3–3.4	3.6–4.5
Inner bract width (mm)	2.3–2.8	2.5–2.7	2.5–2.6	2.5–3.2
Inner bract shape	elliptical	ovate-oblong	ovate-subrounded	ovate-oblong
Inner bract apex	obtuse	subacute	rounded	obtuse-subrounded
Inner bract tip of midrib (mm)	0.7–1	0.8–1	0.6–0.8	0.6–0.8
Calyx length (mm)	4.1–5.2	4.8–5.5	3.8–4	5–5.2
Calyx exserted from inner bract (mm)	1.5–2	2.2–2.5	1.2–1.8	2.2–2.7
Calyx tube indumentum	sparsely hairy	densely hairy	sparsely hairy	densely hairy
Calyx ribs indumentum	glabrous	glabrous	glabrous	hairy
Calyx lobes shape	hemielliptical	hemielliptical	triangular	ovate-triangular
Calyx lobes length (mm)	0.8	0.6-0.7	0.5	1–1.3
Calyx lobes apex	rounded	rounded	obtuse	acute
Calyx lobes midrib	ending abowe the base	reaching the base	reaching the middle part	reaching the middle part

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