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Noccaea anatolica SP. NOV. (BRASSICACEAE): A NEW SPECIES FROM EASTERN ANATOLIA, TÜRKİYE

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ABSTRACT

Noccaea anatolica sp. nov. (Brassicaceae) is described and illustrated as a new species from Van Province in eastern Anatolia, Türkiye. Diagnostic morphological characteristics, a full description, detailed illustrations, and a distribution map are provided. It is morphologically similar to *Noccaea sintenisii* and *Noccaea valerianoides* but easily differs from these species by its fruit shape, seed characters, basal leaf shape, and also general habit.

1 INTRODUCTION

Although *Thlaspi* L. was first used by Linnaeus [1], Moench [2] first discussed the *Noccaea* Moench under the *Thlaspi*. After that, Meyer [3, 4] revised, based mostly on seed coat anatomy and embryonic aspect, and placed most of the older *Thlaspi* species in the genus *Noccaea*. Molecular evidence confirming Meyer's finding phylogenetically has been published [5, 6]. Since Meyer [3] began working on the genus *Thlaspi* in the early 1970s, he has consistently published a number of monographs on all his new genera (*Microthlaspi* Meyer, *Thlaspiceras* Meyer, *Noccidium* Meyer, *Kotschyella* Meyer, *Callothlaspi* Meyer, *Raparia* Meyer, *Atropatenia* Meyer, *Vania* Meyer, and *Masmenia* Meyer). A comprehensive volume focusing on *Noccaea* has been presented [7]. Recent floristic studies [8, 9, 10] have accepted that *Noccaea* is different from *Thlaspi*. Meyer [7] defined *Noccaea* as having 4 sections and 67 species. Although various improvements have been made to solve the taxonomic problems of *Noccaea*, complexity remains [11].

With the first revision of *Thlaspi* in Türkiye, 25 species and 2 subsp. records identified for Türkiye [12]. Since then, 26 new *Thlaspi* taxa, including subspecies, have been added [13, 14, 15, 16, 17]. Additionally, some anatomy and pollen morphology studies have been conducted on the genus [18, 19]. According to the study conducted by Al-Shehbaz [20], 51 *Noccaea* species grow naturally in Türkiye, and Mutlu [21] reported that there were 16 species according to the study [22].

The authors observed an interesting *Noccaea* population during a botanical trip in July 2021 to the Ispiriz Mountain, located in the Van-Başkale district. The authors noticed that this population has wide and semitriangular basal leaves. All examinations show that this population is distinct from all known species distributed in Türkiye and the neighboring countries (especially Iranian species).

2 MATERIAL AND METHODS

The material for the new species collected in Van province in the Eastern Anatolia region in 2022. Plants deposited at the Bingöl University Herbarium (BIN). We compared these specimens with relevant taxonomic literature [20, 16, 12, 14, 7, 17, 23] and with specimens held in the herbaria of E, B, and K (acronyms according

to Thiers [24]. Detailed morphological measurements performed using a stereo microscope (Leica EZ4). And the new species compared to the features of the closely related *Noccaea sintenisii* and *N. valerianoides*. During field studies, photographs of the living material of the new species and its related taxa taken with a Canon 60D digital camera. The general terminology used by Baytop [25].

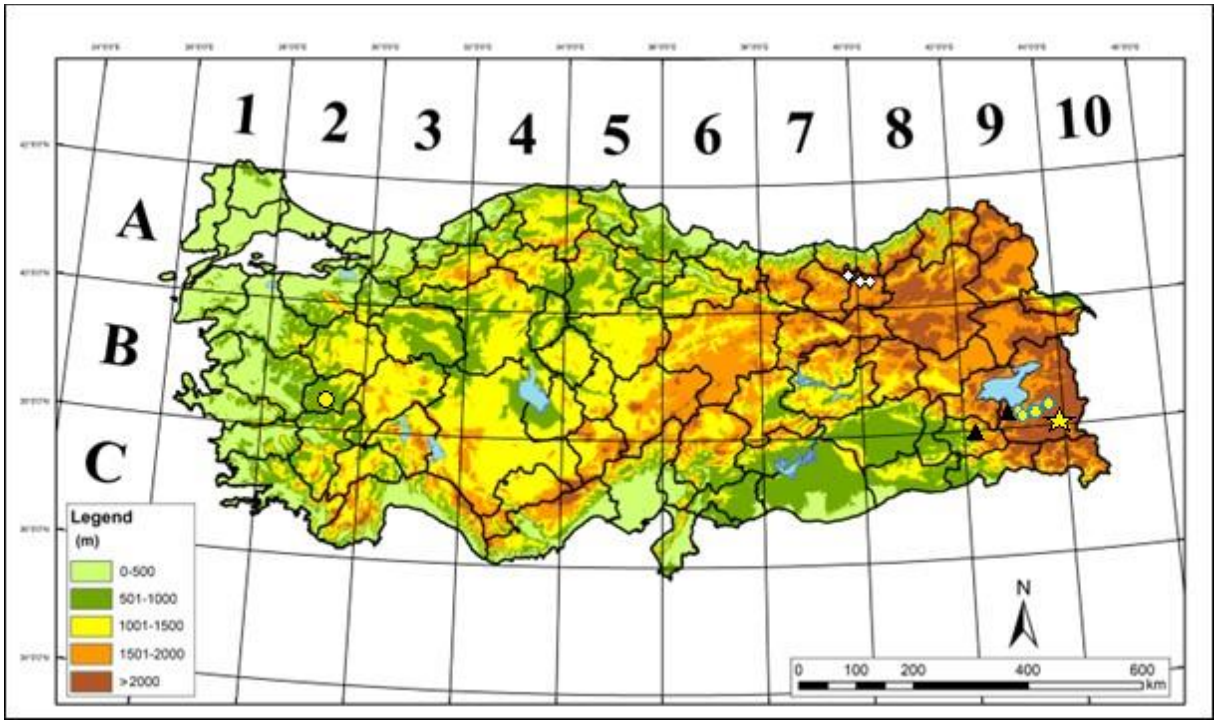

***Figure 1**. Distribution map of Noccaea anatolica (★), N. sintenisii (◇), N. valerianoides (▲), N. papillosa (●) and N. kurdica (●).*

3 RESULTS AND DISCUSSION

Noccaea anatolica Sefalı, Yapar & Demir sp. nova (Figures 2–4).

Type:—TÜRKİYE. Van: Başkale, Southern slopes of Ispiriz Mountain, stony places, 3500 m a.s.l., 13.07.2021, *A. Sefalı, Y. Yapar and İ. Demir* 13 (holotype: Bingöl University Herbarium (BIN))

Affinis: — *Noccaea anatolica* is characterized by its wider and semi-triangular basal leaves and wider stem leaves.

3.1 Description

Perennial, woody at base, c. 3 cm tall, glaucous, glabrous throughout. Stems erect, simple with sterile shoots. Basal leaves rosulate; sessile; spathulate or spathulate to elliptic. Margin entire sometimes with two angles near apex or semi triangular, 6–13×3–5 mm. Cauline leaves, sessile, a few, oblong, shortly auriculate, 6-10×c. 5 mm. Racemes ebracteate, lax 5–15 flowered, sterile fruit present, in fruit to 1.5 cm long. Fruiting pedicels 8 mm long (the bottom), slender, divaricate, straight, horizontal. Flowers unknown, probably white. When looking some dried flowers. Fruit slightly compressed, ovate, apex obtuse, basal truncate to obtuse, widest slightly basal, 7–8×3–4 mm, wingless, apical notch absent, style filiform, c. 1 mm long. Seeds yellowish brown, narrowly ovate, 2.5–3×1.4 mm, 1 in each loculus.

Flowering time:— June

Fruiting time:— July

Etymology:— The new species epithet is anatolica (in Turkish, Anadolu), refers to Anatolia, the Asian part of Türkiye.

3.2 Distribution and Ecology

Noccaea anatolica grows in stony and mobile slopes of the Ispiriz Mountain (Başkale, Van province), at 3500–3700 m (summit) a.s.l., together with *Allium oreophilum* C.A. Mey., *Androsace caduca* Ovcz., *Centaurea poluninii* Wagenitz, *Chondrilla spinosa* Lamond & V.A. Matthews, *Pastinaca vanensis* Demir, Sefalı & Yapar, *Didymophysa aucheri* Boiss., *Euprasia* sp., *Noccaea kurdica* (Hedge) Al-Shehbaz, *Draba* sp., *Vavilovia formosa* (Steven) Al. Fed. etc.

3.3 Conservation Status

According to IUCN [26] criteria, *Noccaea anatolica* should be labeled as “Critically Endangered” [CR B2ab(i, ii, iii)]. The area of occupancy estimated to be less than 10 km^2, and the number of mature individuals was about 50 in total.

3.4 Taxonomic Relationships

Noccaea anatolica is closely related to *N. sintenisii* and *N. valerianoides* about the general habit. It differs from the *N. sintenisii* and *N. valerianoides* basal leaves in shape, cauline leaf number, inflorescence density, fruit shape and length, and seed color and shape.

In the Flora of Turkey [12], *N. sintenisii* and *N. valerianoides* belong to the *Thlaspi* genus, sect. *Apterygium* Ledeb. This section had four species (*T. papillosum* Boiss., *T. sintenisii* Hausskn. Ex Bornm., *T. kurdicum* Hedge, and *T. valerianoides* Rech.) in Türkiye. These species have general fruit futures such as silicula, entire, acute at apex, not or slightly winged, and high alpine perennials. Therefore, the new species comprises not only *N. sintenisii* and *N. valerianoides* but also *N. papillosa* and *Noccaea kurdica*. *N. papillosa* has papillose on some leaf margins. *N. anatolica* throughoutly glabrose. *N. kurdica* has narrowly linear basal leaves, even though the new species has spathulate or spathulate to elliptic basal leaves. In addition, the fruit shape is quite different from this species.

Noccaea rubescens (Schott & Kotschy ex Boiss.) F.K.Mey. seems in a doctoral dissertation, “Revision of *Noccaea* Sensu Meyer Taxa Growing in Turkey” [23]. This species clearly differs from the new species in the petiolate basal leaves, elongating fruit, and cuneate base of fruit futures. *N. sintenisii* and *N. valerianoides* are closely related species and evaluated in the genus *Noccaea* in the last study [11]. Therefore, the new species (*N. anatolica*) described here appears to belong to the genus *Noccaea*.

In general, it can be seen that *N. anatolica* is more dwarf than related species and has more succulent rosette basal leaves. Considering the geographical distribution, it has been determined that *N. sintenisii* spreads in the northeastern and western regions, but *N. anatolica* is located in the eastern part of Türkiye.

Table 1*. Morphological and habitat differences between Noccaea anatolica, N. sintenisii and N. valerianoides.*

Characters	*Noccaea anatolica*	*N. sintenisii*	*N. valerianoides*
Plant height	c. 3 cm	c. 9 cm	c. 5 cm
Basal leaves size	6–13×3–5 mm.	10–22×4–6 mm.	4–15×c. 1–1.5 mm,
Basal leaves shape	Sessile, spathulate or spathulate to elliptic. Margin entire sometimes with two angles near apex or semi triangular.	Petiolate (c. 8 mm), oblanceolate, oblong-spathulate or obovate,	Petiolate (c. 12 mm), spatulate, apex obtuse. Margin entire.
Stem leaves	6–10×c. 5 mm. Sessile, a few, oblong, shortly auriculate.	3.5–12×1.5–7 mm. Sessile, a few, not or scarcely auriculate.	6–13×c. 5 mm. Sessile, dense, oblong, shortly auriculate.
Inflorescence	Lax, 5–15 flowered. Sterile fruit present.	Dense, 8–25 flowered. Sterile fruit absent.	Capitate, 8–15 flowered.
Pedicel length (the bottom)	8 mm	10 mm	6 mm
Fruit length	7–8×3–4 mm	5–9×c.5 mm	7–13.5×2–3 mm
Fruit shape	Slightly compressed, ovate, apex obtuse, basal truncate to obtuse.	Slightly compressed, oblong, attenuate at both ends.	Slightly compressed, linear-lanceolate to oblong, cuneate at both ends.
Stylus length	c. 1 mm	c. 2 mm	c. 1.5 mm
Seed characteristics	2.5–3×1.4 mm. Yellowish brown, narrowly ovate. 1 in each loculus.	2.2–2.7×1.5–1.8 mm. Reddish brown, ovate or ovate to elliptic. 2 in each loculus	2–2.5×1.25–1.5 mm. Greenish brown, ovate. 2 in each loculus

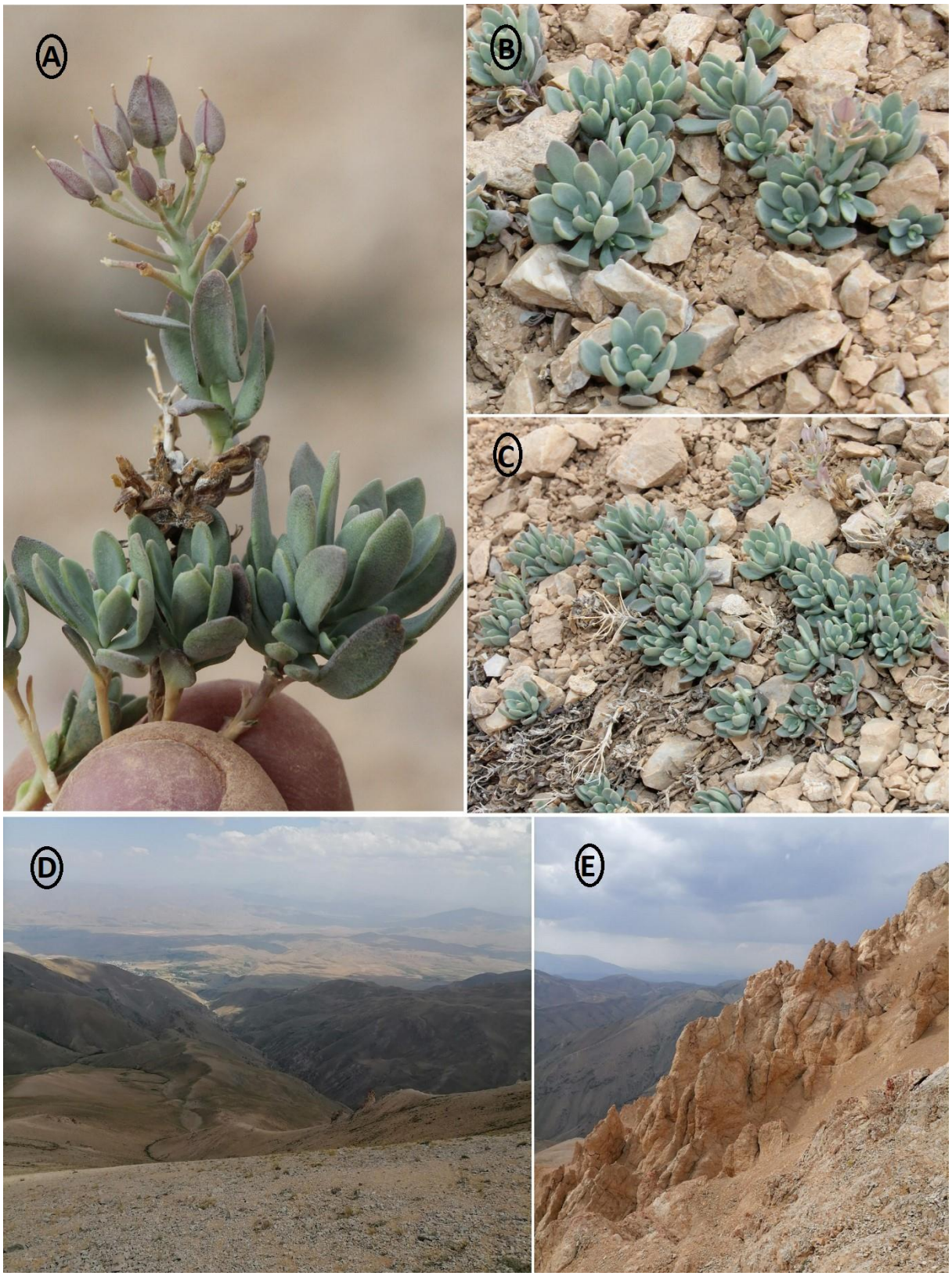

Figure 2. *Noccaea anatolica:* A.-C. habitus, D. habitat and E. Summit of Ispiriz Mountain.

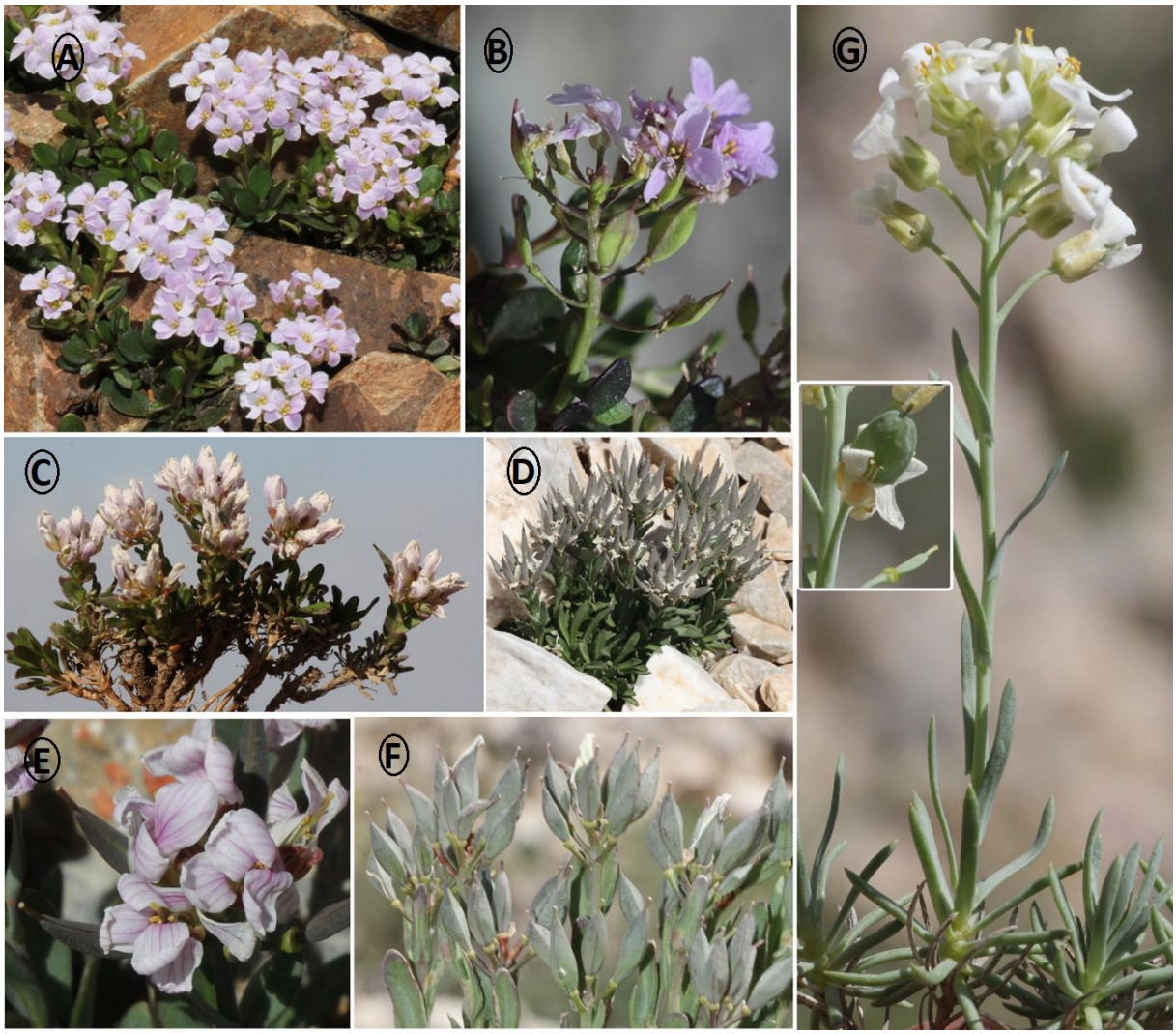

Figure 3. Compared related species in their habitat: A-B. *Noccaea sintenisii*, C-F. *N. valerianoides* and G. *N. kurdica*.

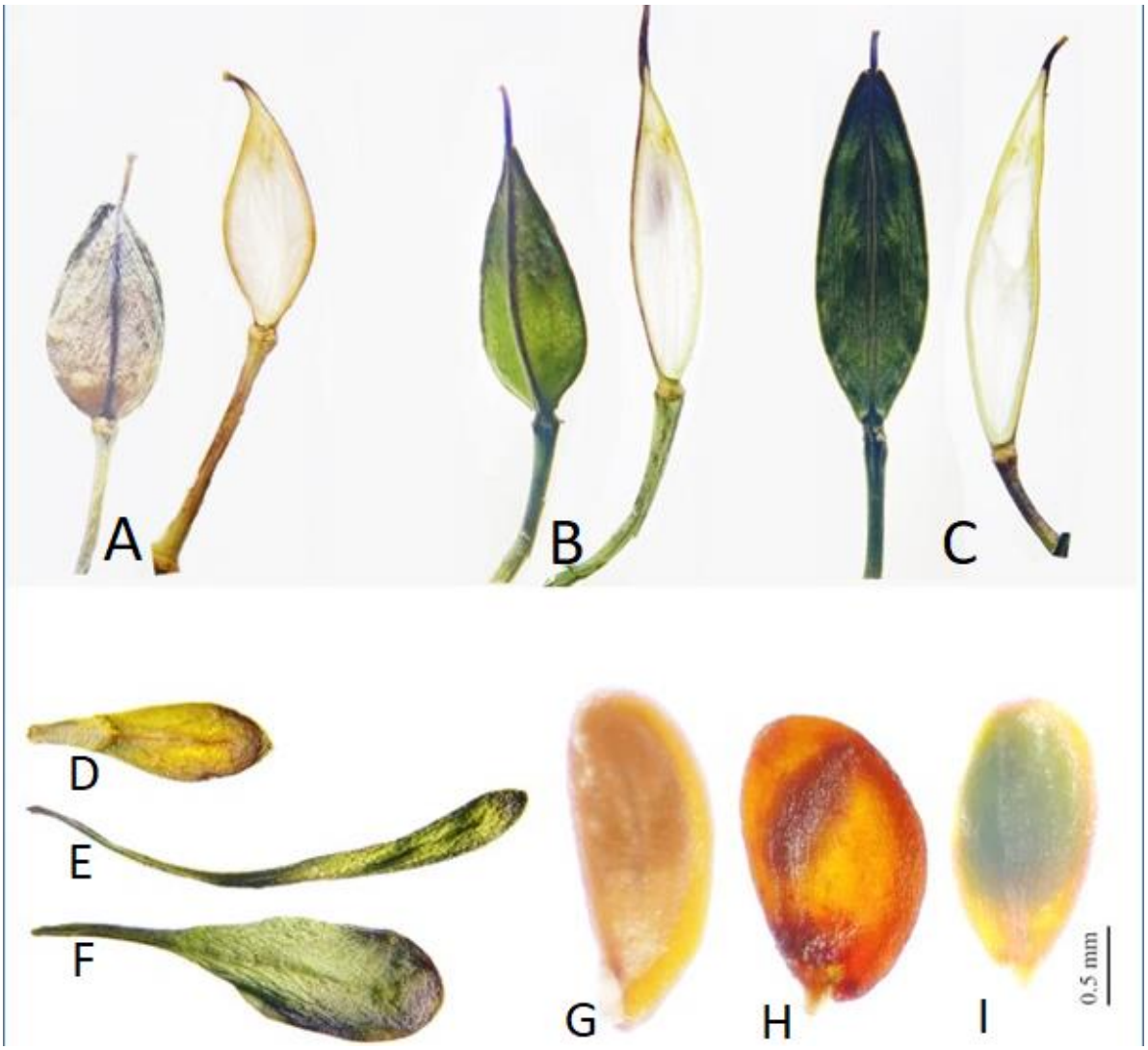

Figure 4. Fruit, seed and basal leaves: **A.** Fruit and septum of *N. anatolica*, **B.** Fruit and septum of *N. sintenisii* and **C.** Fruit and septum of *N. valerianoides*: Basal leaves **D**. *N. anatolica*, **E.** *N. sintenisii*, **F.** *N. valerianoides*; Seeds **G.** *N. anatolica*, **H.** *N. valerianoides*, **I.** *N. sintenisii*.

3.5 Selected Specimens Examined

Noccaea anatolica –TÜRKİYE. Van: Başkale, Southern slopes of Ispiriz Mountain, stony places, 3500 m a.s.l., 13.07.2021, *A. Sefalı*, *Y. Yapar* and *İ. Demir* 13 (holotype: Bingöl University Herbarium (BIN)).

Noccaea sintenisii –TÜRKİYE. Gümüşhane, Karagöl Mountain, E00376257, B 10 0249982, K000484322; Bayburt: Anzer Mountain, near the summit, stony and mobile slopes, 3100 m of elevation, 10 July 2023, *A. Sefalı*, *Y. Yapar* and *İ. Demir* 51 (BIN).

Noccaea valerianoides –TÜRKİYE. Van, Artos Dağı, E00059923 (as Vania kurdica (Hedge) F.K. Mey.): Artos Mountain, near the summit, 3250 m of elevation, 03 July 2023, *A. Sefalı*, *Y. Yapar* and *İ. Demir* 32 (BIN).

Noccaea kurdica –TÜRKİYE. Van, Artos Mountain, near the summit, 3250 m of elevation, 03 July 2023, *A. Sefalı*, *Y. Yapar* and *İ. Demir* 29 (BIN).

Conflict of Interest

There is no conflict of interest between the authors.

Authors contributions

All authors contributed equally.

Statement of Research and Publication Ethics

The study is complied with research and publication ethics.

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