

## A new species of *Bellevalia* (Hyacinthaceae) from Turkey

Mehmet Erkan UZUNHİSARCIKLİ<sup>1\*</sup>, Hayri DUMAN<sup>1</sup>, Serkan YILMAZ<sup>2</sup>

<sup>1</sup>Department of Biology, Faculty of Science, Gazi University, 06500 Teknikokullar, Ankara, Turkey

<sup>2</sup>Department of Midwifery, Faculty of Health Science, Ankara University, 06590 Altındağ, Ankara, Turkey

Received: 18.09.2012 • Accepted: 10.01.2013 • Published Online: 02.07.2013 • Printed: 02.08.2013

**Abstract:** *Bellevalia malatyaensis* Uzunh. & H.Duman is described and illustrated as a new species from East Anatolia. The distribution area of this species is restricted to Erkenek (Malatya)–Gölbaşı (Adıyaman). It grows in open areas of *Pinus brutia* Ten. forest. It resembles *Bellevalia gracilis* Feinbrun, but differs in scapose habitus, leaves, and characters of the capsule. The morphological diagnostic characters and karyological features are discussed.

**Key words:** *Bellevalia*, taxonomy, karyotype, Turkey

### 1. Introduction

*Bellevalia* Lapeyr. comprises nearly 50 species in the world. The members of this genus mostly occur in the Mediterranean region, from Morocco and Algeria eastwards to the Caucasus and Iran. *Bellevalia* is taxonomically assigned to Hyacinthaceae. It is closely related to *Muscari* Mill., *Hyacinthus* L., and *Hyacinthella* Schur (Persson & Wendelbo, 1979). Various methods such as karyological and embryological investigations are applied to solve the taxonomic problems within members of Monocotyledones (Mutlu & Karakuş, 2012; Vardar et al., 2012). The karyological features, consisting of  $x = 4$  with long chromosomes (7.2–15.8 mm), make it distinctive from others (von Bothmer & Wendelbo, 1981).

According to a monograph, *Bellevalia* includes 44 species, 8 of which are recorded from Asiatic Turkey. Two of the Asiatic species [i.e. *Bellevalia trifoliata* (Ten.) Kunth and *Bellevalia ciliata* (Cyr.) Nees] also occur in European Turkey (Feinbrun, 1940). Wendelbo (1984) listed 18 species from Turkey, 7 of which are endemic. In subsequent studies, Wendelbo (1985) reduced *Bellevalia latifolia* Feinbrun to a synonymy of *Bellevalia olivieri* (Baker) Wendelbo. Moreover, 3 species were added in the second supplement of *Flora of Turkey*: *Bellevalia mathewii* Özhatay & Koçak, *B. anatolica* B.Mathew & Özhatay, and *Bellevalia edirnensis* Özhatay & B.Mathew (Özhatay et al., 2000). In a different study by Johnson (2003), *Bellevalia pycnantha* (K.Koch) Losinsk. was reduced to a synonymy of *Bellevalia paradoxa* (Fisch. & C.A.Mey.) Boiss. *Bellevalia*

*leucantha* K.Pers. was added as a new species by Persson (2006). At present, the total number of *Bellevalia* taxa, including our new species, has been raised to 21, 11 of which are endemic to Turkey.

The index of chromosome numbers of 6 species was published in the first supplement of the *Flora of Turkey* (Davis et al., 1988), 5 by von Bothmer and Wendelbo (1981) and 1 by Wendelbo (1984). The second supplement is composed of another index with 17 species (Özhatay et al., 2000). The chromosome numbers of most *Bellevalia* species (80%) have been identified (Özhatay et al., 1991a, 1991b; Johnson, 1994; Özhatay & Johnson, 1996; Johnson & Brandham, 1997; Dane, 1999). In some species of *Bellevalia* which show polyploidy, the basic chromosome number is  $x = 4$  (Özhatay et al., 1991a). The polyploids are tetraploid ( $2n = 16$ ), hexaploid ( $2n = 24$ ), and octoploid ( $2n = 32$ ) (Özhatay et al., 1991a). Triploidy ( $2n = 12$ ) and pentaploidy ( $2n = 20$ ) are also reported in some members of *Bellevalia* (Özhatay et al., 1991a).

### 2. Materials and methods

The materials were collected between Malatya (Erkenek) and Adıyaman (Gölbaşı) in 2002. Voucher specimens are deposited in the herbarium of Gazi University (GAZI). They were compared with allied taxa deposited in herbaria HUB, ANK, and GAZI. The authors of plant names were checked using Brummitt and Powell (1992).

The root tips were used for karyological study. The roots were pretreated with a saturated solution of alpha-monobromonaphthalene (ABN) for 3 h at room

\* Correspondence: merkan@gazi.edu.tr

temperature (20 °C) and fixed in 3:1 absolute alcohol and acetic acid. They were then hydrolyzed with 1 N HCl at 60 °C for 12 min and transferred to fresh 70% ethanol. For preparation of slides, the standard Feulgen squash method was used (Johnson, 1994). Permanent slides were made in Depex. Measurements were based on 6 metaphase plates. Chromosomes were classified according to the nomenclature of Levan et al. (1964). The satellites of nucleolar chromosomes were also measured and considered in the total length and arm ratios. Idiograms were arranged in order of decreasing length.

### 3. Results

*Bellevalia malatyaensis* Uzunh. & H.Duman **sp. nov.** (Figures 1–2).

Type: Turkey, C6 Malatya: From Erkenek to Gölbaşı, 15 km, 800–1000 m, under the fairly open canopy of a *Pinus brutia* forest, 17.04.2005, 37°54'006"N, 37°48'406"E, M.E.Uzunh. 2019 (holotype: GAZI; isotypes: ANK, HUB).

**Diagnosis:** Affinis *Bellevalia gracilis* sed foliis plerumque 1–2, raro 3 et 1–2.5 cm latis (non 3–6 et ad 4 cm latis exterior uno), pedicellis fructiferis 0.8–3.5 cm longis et horizontalibus (non 2.5–4.5 cm longis et saepe deflexis), corollae lobis 1–1.5 longis (non 1.5–3 mm longis), capsulae valvis 3–7 mm longis, lanceolatae-orbicularibus (non 10 mm et cordatis) differt.

Bulb globose-ovoid, 1.5–2 cm diam., outer tunic coriaceous, dark brownish; inner tunic papery, whitish. Leaves 1–2 (-3), lanceolate-elliptic, shorter than scape, 6–10 × 1–2.5 cm, with margin membranaceous and distinctly ciliate, apex cucullate. Scape single, 2.5–7 cm long, greenish, pale brown when dry. Raceme cylindrical, laxly flowered, rachis bluish, 3.5–7 cm long. Bracts minute, bluish, bilobed. Pedicels distinctly longer than flowers, horizontally ascending or erect, sometimes slightly deflexed; 0.8–3 cm long in flowering time, becoming slightly longer in fruiting time to 3.5 cm and distinctly horizontal, violet to greenish. Flowers 10–22, perianth

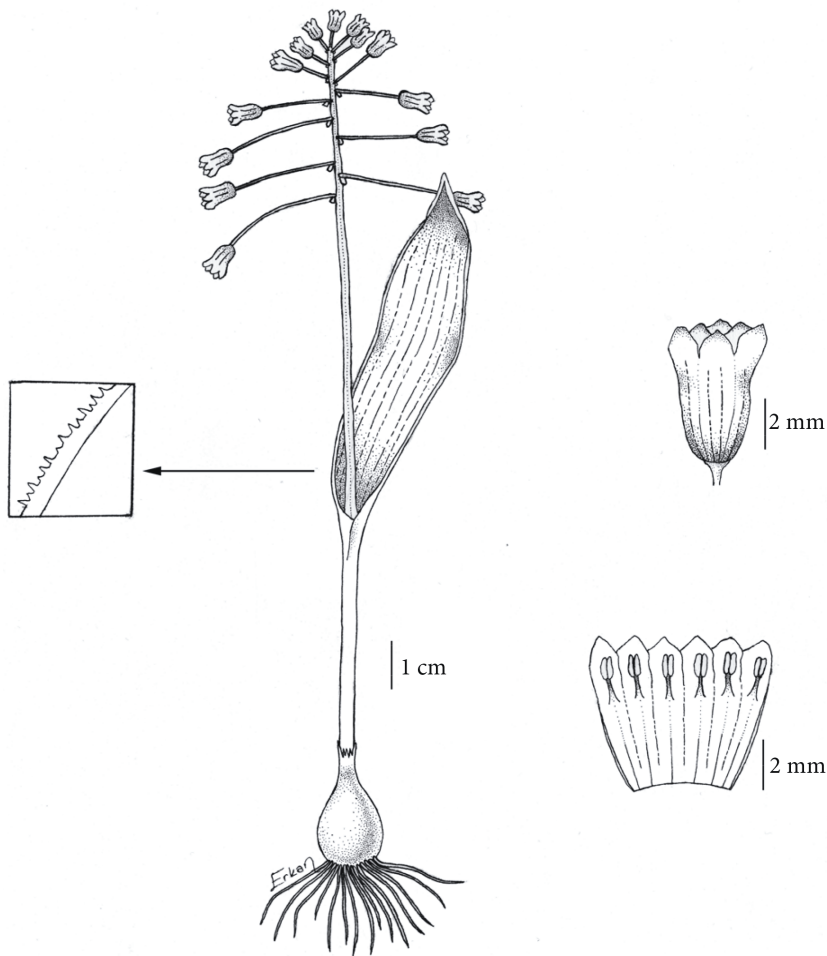


Figure 1. Habitus of *Bellevalia malatyaensis*.

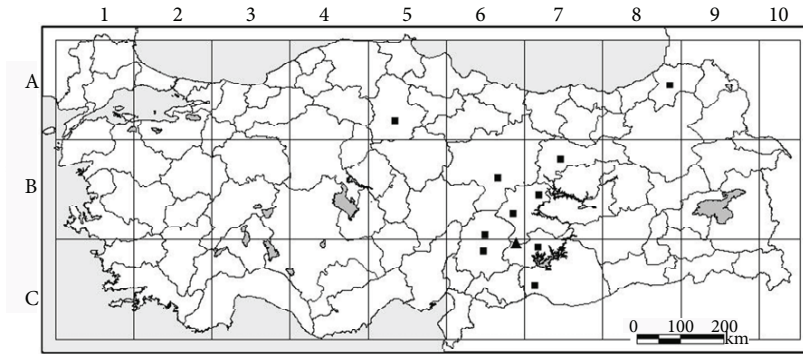


Figure 2. Distribution map of *Bellevalia malatyaensis* (▲) and *Bellevalia gracilis* (■).

white to greenish in bud, later pale brown on tube, 4.5–6 mm long, tubular-campanulate; tube 3.5–4.5 mm long, white, pale brownish at the base of tube, lobes 1–1.5 mm long, subequal, ovate-lanceolate, whitish, distinctly shorter than tube. Stamens flattened, narrowly triangular, filaments connate towards the base of perianth lobes, anthers violet, 0.1–0.3 mm long, reaching at least to the middle of the lobes and visible in the mouth of the flower. Capsules triquetrous, valves of capsule c. 3–7 mm long, slightly thin, lanceolate-orbicular, retuse at the apex, dehiscent, persistent. Seeds broadly ellipsoid, 1.5–2 × 1.3–2.2 mm, blackish, shiny.

Fl. 4–5.

**Conservation status:** This species is known only from one locality (criterion B2a), with an area of occupancy estimated to be less than 10 km<sup>2</sup> (criterion B2), and so it should be classified as “Critically Endangered (CR)” (IUCN, 2010). The population consists of at least 1000 individuals growing under the fairly open canopy of a *Pinus brutia* forest.

**Distribution and ecology:** *Bellevalia malatyaensis* grows in the east of Turkey at 800–1000 m elevation, under the fairly open canopy of a *Pinus brutia* forest. The most important associated species are *Clypeola jonthlaspi* L., *Erysimum kotschyannum* Gay., *Tripleurospermum oreades* (Boiss.) Rech.f. var. *tchihatchewii* (Boiss.) E.Hossain, *Linaria chalepensis* (L.) Mill. var. *chalepensis*, *Muscari neglectum* Guss., *M. comosum* (L.) Mill., *Ornithogalum alpigenum* Stapf., *Isatis candolleana* Boiss., and *Ziziphora capitata* L.

**Examined *Bellevalia gracilis* specimens:** C6 Maraş: Süleymanlı, Okkayası, 1200 m, 17.05.1978, *B. Yıldız* 1882; B6 Maraş: Göksun, Çardak, Fındık village, Bostandere, open area of *Cedrus* forest, 1800 m, 14.05.1978, calcareous slopes, *B. Yıldız* 1731; Göksun, Kaman Da., 1800 m, 20.06.1981, calcareous fields, *B. Yıldız* 3027; B7 Tunceli: Ovacık, Munzur Da., Karagöl valley, 1400 m, 05.05.1979, Ş.Yıldırım 1330; Ovacık, beside Munzur Stream, 1200 m,

05.05.1979, Ş.Yıldırım 1313; ibid., Ş.Yıldırım 1332; A8 Artvin: around Yusufeli, 850 m, 03.04.1996, rocky slopes, A.A.Dönmez 5158 (HUB).

**Etymology:** Named for distribution area (Malatya Province).

**Cytology:** Cytological analysis reveals that *Bellevalia malatyaensis* contains 8 pairs of chromosomes (Figure 3). Karyotypic data are presented in Table 1. The set consists of 2 pairs of metacentric, 1 pair of submetacentric, and 1 pair of subtelocentric chromosomes. The total length of chromosomes in this taxon varies from 13.40 to 24.01 µm. Chromosome 2 has the highest L/S arm ratio. Total haploid length of *B. malatyaensis* is 70.22 µm. Nucleolar chromosomes are detected on chromosomes 1 and 3. In both chromosomes, satellites are determined on the long arms.

#### 4. Discussion

*Bellevalia malatyaensis* closely resembles *B. gracilis*. It differs by having a stem 1.5–2 cm long (not 1.8–3 cm), scape single and 2.5–7 cm long (not 1–2, 3.5–10.5 cm), leaves 1–2 (-3), 1–2.2 cm broad, apex cucullate (not 3–6, outer apex up to 4 cm broad, apex mucronate), pedicels



Figure 3. Somatic chromosomes of *Bellevalia malatyaensis* (scale bar = 5 µm).

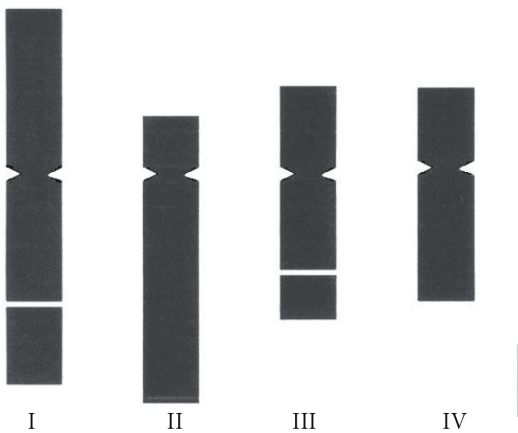
**Table 1.** Measurements of somatic chromosomes of *Bellevalia malatyaensis*.

Chromosome pair no.	Chromosome arms ( $\mu\text{m}$ )		Total length ( $\mu\text{m}$ )	Arm ratio ( $r = L/S$ )	Relative length (%)	Centromeric position
	Long arm (L)	Short arm (S)				
1	8.11 + 5.20	10.70	24.01	1.24	34.19	M
2	15.10	3.41	18.51	4.43	26.36	St
3	6.01 + 2.87	5.42	14.30	1.64	20.37	M
4	8.47	4.93	13.40	1.72	1.72	Sm

Total length of haploid complement: 70.22  $\mu\text{m}$ .

**Table 2.** Comparison of the morphological characters of *Bellevalia malatyaensis* and *Bellevalia gracilis*.

Characters	<i>Bellevalia malatyaensis</i>	<i>Bellevalia gracilis</i>
Bulb (diam.)	1.5–2 cm	1.8–3.5 cm
Leaves	1–2 (rarely 3), 1–2.2 cm broad, apex cucullate	3–6, outer one to 4 cm broad, apex mucronate
Scape	single, 2.5–7 cm	1–2, 3.5–10.5 cm
Pedicle	0.8–3.5 cm in fruit, distinctly horizontal	2.5–3.5 (-4.5) cm in fruit, often deflexed
Flower		
Buds	white with greenish tinge	whitish
Lobes	1–1.5 mm long	1.5–3 mm long
Valves of capsule	3–7 mm, lanceolate-orbicular	10 mm, more cordate

**Figure 4.** Idiograms of the haploid chromosome set in *Bellevalia malatyaensis* (scale bar = 5  $\mu\text{m}$ ).

0.8–3.5 cm in fruiting time, distinctly horizontal (not 2.5–3.5 (-4.5) cm in fruiting time, often deflexed), lobes of flower 1–1.5 mm long (not 1.5–3 mm), valves of capsule 3–7 mm (not 10 mm), lanceolate-orbicular (not more cordate). A more detailed comparison is given in Table 2.

The chromosome numbers of examined cells of *B. malatyaensis* are the same as those of most other species (Figure 4). The karyotype in most *Bellevalia* species includes 2 pairs of metacentric ( $r = 1.24$  and  $1.64$ ), 1 pair of submetacentric ( $r = 1.72$ ), and 1 pair of subtelocentric ( $r = 4.43$ ) chromosomes. Two metacentric chromosomes are provided with large satellites on the long arms. The chromosome numbers of *B. gracilis* vary from  $2n = 8 + 0 - 3$  meta Bs to  $2n = 16$  (Özhatay et al., 1991a; Johnson & Brandham, 1997). Moreover, polyploidy and B chromosomes are present, which is not observed in *B. malatyaensis*.

## References

- Brummitt RK & Powell CE (1992). *Authors of Plant Names*. Kew: Royal Botanic Gardens.
- Dane F (1999). Hekzaploid ( $2n = 24$ ) *Bellevalia edirnensis* N. Özhatay & Mathew'in pollen mitozu ve polen morfolojisinin incelenmesi. *Turkish Journal of Biology* 23: 357–368.
- Davis PH, Mill RR & Tan K (1988). *Bellevalia* Lapeyr. In: Davis PH, Mill RR & Tan K (eds.) *Flora of Turkey and the East Aegean Islands* (Suppl. 1), Vol. 10, pp. 226. Edinburgh: Edinburgh University Press.
- Feinbrun N (1940). A monographic study on the genus *Bellevalia* Lapeyr. *Palestine Journal of Botany* 1: 336–409.
- IUCN Species Survival Commission (2010). *IUCN Red List Categories: Version 8.1*. Gland, Switzerland: IUCN.
- Johnson MAT (1994). Cytology of three new geophytes from Turkey. *Kew Bulletin* 49: 491–498.
- Johnson MAT (2003). Polyploidy and karyotype variation in Turkish *Bellevalia* (Hyacinthaceae). *Botanical Journal of the Linnean Society* 143: 87–98.
- Johnson MAT & Brandham PE (1997). New chromosome numbers in petaloid monocotyledons and in other miscellaneous angiosperms. *Kew Bulletin* 52: 121–138.
- Levan A, Fredga K, Sandberg A (1964). Nomenclature of centromeric position of chromosomes. *Hereditas* 52: 201–220.
- Mutlu B & Karakuş Ş (2012). A new species of *Ornithogalum* (Hyacinthaceae) from East Anatolia, Turkey. *Turkish Journal of Biology* 36: 125–133.
- Özhatay N (2000). *Bellevalia* Lapeyr. In: Güner A, Özhatay N, Ekim T, Başer KHC (eds.) *Flora of Turkey and the East Aegean Islands* (Suppl. 2), Vol. 11, pp. 240–241. Edinburgh: Edinburgh University Press.
- Özhatay N & Johnson MAT (1996). Some karyological remarks on Turkish *Allium* sect. *Allium*, *Bellevalia*, *Muscari*, and *Ornithogalum* subg. *Ornithogalum*. *Bocconeia* 5: 239–249.
- Özhatay N, Johnson MAT & Mathew B (1991a). Chromosome numbers of Turkish *Bellevalia* L. species including a new hexaploid from European Turkey. *Botanika Chronika* 10: 813–818.
- Özhatay N, Johnson MAT, Mathew B & Dalgıç G (1991b). A new hexaploid *Bellevalia* (Hyacinthaceae) from European Turkey. *Botanical Journal of the Linnean Society* 107: 89–99.
- Özhatay N, Sadıkoğlu N & Johnson MAT (2000). Index to Turkish plant chromosome numbers. In: Güner A, Özhatay N, Ekim T, Başer KHC (eds.) *Flora of Turkey and the East Aegean Islands* (Suppl. 2), Vol. 11, pp. 407–512. Edinburgh: Edinburgh University Press.
- Persson K (2006). One new and one emended species of *Bellevalia* (Hyacinthaceae) from Turkey. *Botanical Journal of the Linnean Society* 150: 253–260.
- Persson K & Wendelbo P (1979). *Bellevalia hyacinthoides*, a new name for *Strangweija spicata* (Liliaceae). *Botaniska Notiser* 132: 65–70.
- Vardar F, İsmailoğlu I & Ünal M (2012). Embryological and cytological features of *Gagea bohemica* (Liliaceae). *Turkish Journal of Biology* 36: 462–472.
- von Bothmer R & Wendelbo P (1981). Cytological and morphological variation in *Bellevalia*. *Nordic Journal of Botany* 1: 4–11.
- Wendelbo P (1984). *Bellevalia* Lapeyr. In: Davis PH, Mill RR & Tan K (eds.) *Flora of Turkey and the East Aegean Islands*, Vol. 8, pp. 264–274. Edinburgh: Edinburgh University Press.
- Wendelbo P (1985). *Bellevalia* Lapeyr. In: Townsend CC, Guest E (eds.) *Flora of Iraq*, Vol. 8, pp. 113–127. Baghdad: Ministry of Agriculture.