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Muscari elmasii sp. nova (Asparagaceae): a new species from western Anatolia, Turkey

Hasan YILDIRIM*
Department of Biology, Faculty of Science, Ege University, Bornova, İzmir, Turkey

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Abstract: *Muscari elmasii* Yıldırım (Asparagaceae) is described as a new species to science. It is endemic to the western Anatolia region of Turkey. *M. elmasii* is known from a single locality in Muğla Province. It is related to *M. weissii* and *M. massayamum* by morphological features and shows some similarities in terms of morphological characters and the same distribution area to *M. mirum*. Diagnostic morphological characters are discussed and compared with those of related taxa. It is easily distinguished from related species by its especially sessile or subsessile and mostly pinkish flowers; relatively longer, cylindrical with sharply-angled shoulder perigon tube; yellowish-green lobes; and relatively bigger fruit.

Key words: Taxonomy, *Muscari*, Muğla, Turkey

1. Introduction

The genus *Muscari* Miller s. lato is represented by about 50 species (Speta, 1998), which are usually distributed in the Caucasus, temperate Europe, Africa, and northwestern and southwestern Asia (Losinskaya, 1935; Davis and Stuart, 1966; Stuart, 1966; Garbari and Greuter, 1970; Davis and Stuart, 1980; Davis, 1984; Feinbrun, 1986; Rechinger, 1990; Jafari and Maassoumi, 2011).

According to the latest checklist for *Muscari* s. str., this genus is represented by 47 taxa distributed worldwide (Govaerts, 2015). The first revision of *Muscari* was carried out by Davis and Stuart (1984) in Turkey. They described 20 species in their study. After this revision, 14 new species were described from Turkey. To date, 36 *Muscari* species have been reported in Turkey, 24 of which are endemic to Anatolia (Karlen, 1987; Tan, 1988; Cowley et al., 1994; Speta, 1998; Güner and Duman, 1999; Yıldırımlı and Selvi, 2002; Uysal et al., 2007; Eker and Koyuncu, 2008; Doğu and Bağcı, 2009; Yıldırımlı, 2011; Demirci et al., 2013, Kaya, 2014; Pirhan et al., 2014; Yıldırım, 2015).

Bülent Elmas, who is an amateur botanist and nature lover, collected an interesting specimen of *Muscari* from Çal Mountain in Muğla Province. He sent some interesting pictures of this specimen to me for identification in 2013. In 2014, we gathered flowering and fruiting material from the natural population of this plant. All samples were compared with many other *Muscari* specimens collected from different localities and deposited in various herbaria such as ANK, EGE, E, GAZI, HUB, ISTE, and K. In addition, relevant literature (Losinskaya, 1935; Davis and Stuart, 1966, 1980, 1984; Stuart, 1966; Garbari and Greuter, 1970; Davis and Stuart, 1980, 1984; Davis, 1984; Feinbrun, 1986; Rechinger, 1990; Jafari and Maassoumi, 2011; Govaerts, 2015) was taken into consideration. After close examination of the specimens, I concluded that the collected specimens belonged to a hitherto undescribed species of *Muscari* and displayed some morphological similarities to *M. weissii* and *M. massayanum*.

2. Materials and methods

The morphology of specimens was examined by stereo binocular microscope. For scanning electron microscopy (SEM), the selected seeds and pollen grains were placed on aluminum stubs using double-sided adhesive tape, sputter coated with gold using a K550 Emitech sputter coater, and then examined using an FEI Quanta 250 field emission gun SEM.

3. Results

Muscari elmasii* Yıldırım, *sp. nov. (Figures 1, 2, 3)

Type: Turkey. C2 Muğla: Fethiye, Çaldağı, açık Serpantin yamaçlar, 1275 m, 19.05.2014, *H.Yıldırım* 2825 (holotype: EGE, isotypes: EGE, ANK, herbarium NGBB).

Paratype: Turkey. C2 Muğla: Fethiye, Çaldağı, açık Serpantin yamaçlar, 1320 m, 15.06.2013, H.Yıldırım 2629.

3.1. Diagnosis

Muscari elmasii is related to *M. weissii* and *M. massayamum*. It differs from both species by dense raceme; sterile flower

* Correspondence: hasanyldrm@gmail.com

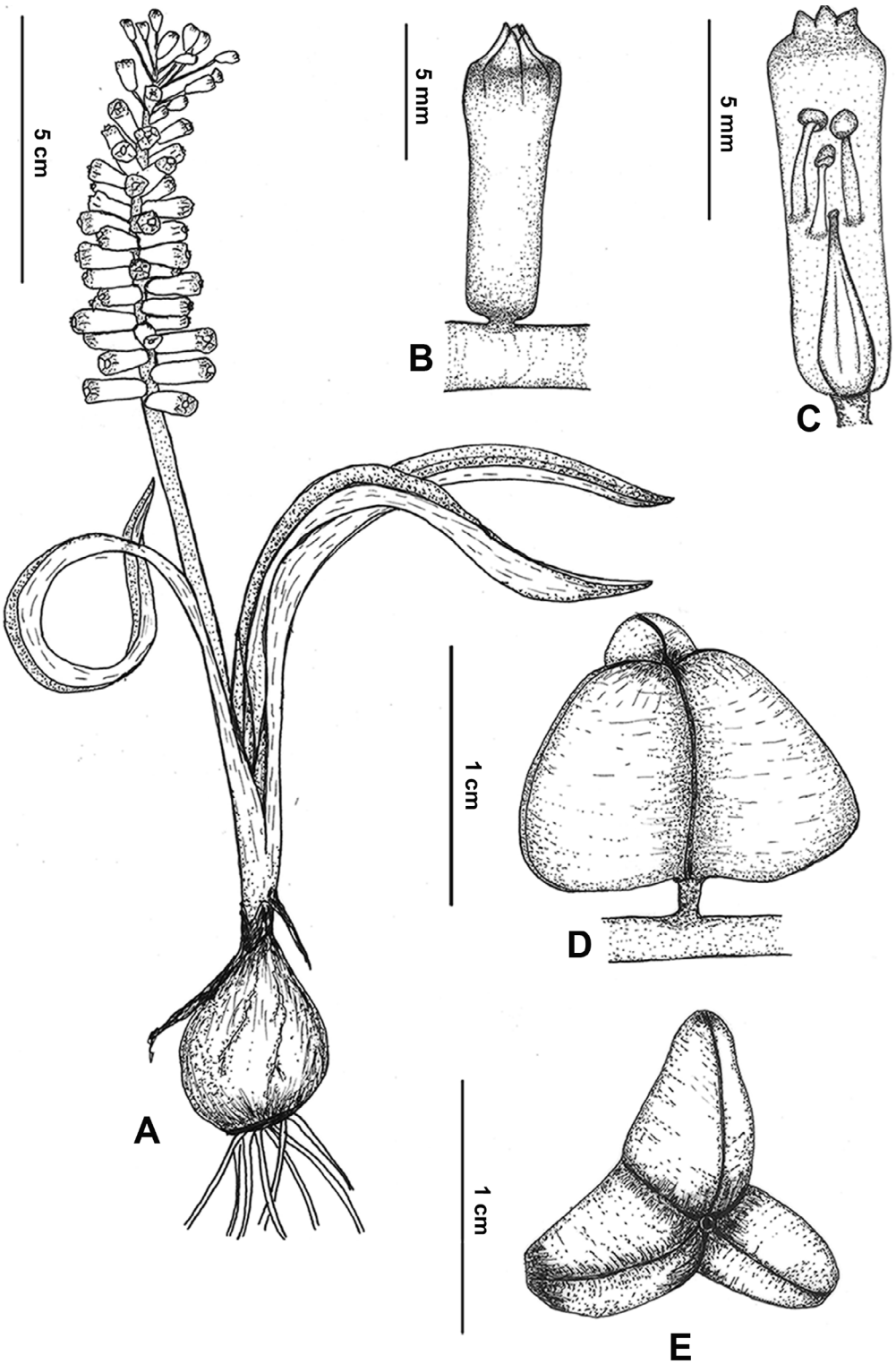

Figure 1. *Muscari elmasii*: A. habit, B. fertile flower, C. detail of fertile flower D. lateral side of capsule, E. upper side of capsule.

pinkish to violaceous, oblong-cylindrical with 3–10 mm long pedicel; fertile flower cylindrical, sharply angled shoulders, sessile; tube of fertile flowers 9–12 × 2–4 mm; buds and early stage of mature fertile flower pinkish; lobes of fertile flowers greenish-yellow; ovary narrowly conical; capsule broadly obconical to slightly orbicular.

Figure 2. *Muscari elmasii*: A, B, C. habit.

3.2. Etymology

This new species is named in honor of Bülent Elmas, who is an amateur botanist and nature lover. The Turkish name of this species is given as "Elmas Müşkürüm", according to the guidelines of Menemen et al. (2013).

3.3. Description

Bulb globose to ovoid, 25–35 × 20–30 mm, without bulblets. Outer tunic membranaceous, very thin textured, pale brown, sometimes pinkish; inner scales fleshy, pinkish. Leaves (2–) 3–4, linear-lanceolate, erecto-patent to patent, 10–22 cm × 6–18 mm, canaliculate, glabrous, apex acute. Scape 1, 7–11 cm. Raceme dense, cylindrical, 4–8 cm × 1.5–2.5 cm; number of fertile flowers 10–35, number of sterile flowers 9–26. Bract minute. Sterile flowers narrowly obconical-cylindrical, 3–6 mm, pinkish to violaceous; pedicels 3–10 mm long, pinkish to violaceous. Fertile flowers cylindrical, shoulders sharply angled; subsessile, rarely with 2–3 mm pedicel in flowers; pedicel very slightly elongate in fruit or stays at same length; tube 9–12 × 2–4 mm, pinkish at buds and early stage of flowering time; change to yellowish brown or yellowish-pink at proximal and dark maroon to brown distally; mostly with 6 purplish-pink prominent main veins; lobes 0.5–1 mm, greenish-yellow, erect to slightly recurved. Stamen biseriate, above middle of tube; filaments 1–1.5 mm, anther dark purple. Pollen grains pale yellow, monosulcate, outline plano-convex in equatorial longitudinal view, circular in equatorial elliptic in polar view; polar axis 23–29 µm longer, equatorial diameter 32–40 µm; shape oblate; exine pattern ornamentation macroreticulate, reticulum heterobrochate. Ovary light green to yellowish green, narrowly conical, 3–3.5 mm; style yellowish-green,

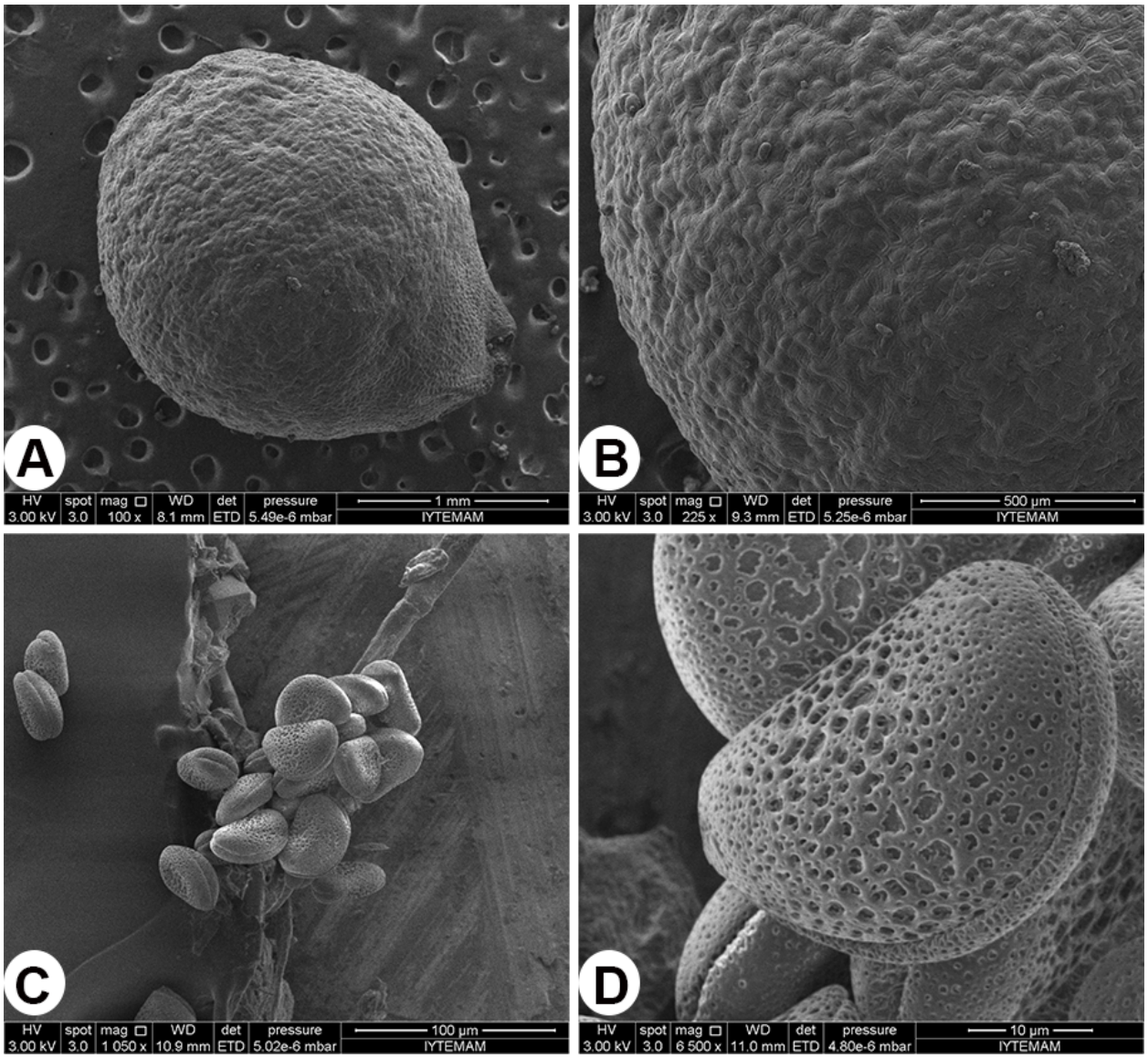

Figure 3. SEM photographs of *Muscari elmasii*: A, B. seed and seed surface, C, D. pollen grain and pollen surface.

c. 2 mm, stigma punctate. Capsule broadly obconical to slightly orbicular, obtuse, or emarginate, 1–1.5 × 1.5–2 cm, valves compressed. Seeds 3–6 per capsule, c. 2 mm wide, subglobose; surface smooth, black. Flowering and fruiting in May–June.

3.4. Suggested conservational status

The population area of *Muscari elmasii* was calculated as 1.42 km^2 and according to my observations and the number of mature individuals is about 650 in total. Following the criteria laid out by the International Union for Conservation of Nature (IUCN Standards and Petitions Working Group, 2013), I suggest that the new species be categorized as 'Vulnerable' (VU) D1, on account of the number of individuals.

3.5. Distribution and ecology

Muscari elmasii is a local endemic species restricted to Çal Mountain in Muğla, southwestern Anatolia. It is an element belonging to the Mediterranean floristic region. The new species colonizes only the serpentine soils, between 1250 and 1350 m. a.s.l. A large part of Çal Mountain is composed of serpentine soil and serpentine rocks. Species growing in the near vicinity include *Acinos troodi* (Post) Leblebici subsp. *vardaranus* Leblebici*, *Eryngium thorifolium* Boiss.*, *Hesperis kuerschneri* G.Parolly & K.Tan*, *Ornithogalum sandrasicum* Yıld.*, *Pilosella sandrasica* Hartvig & Strid*, *Scorzonera ahmet-duranii* S. Makbul & Coskuncelebi*, *Scorzonera pisidica* Hub.-Mor.*, *Teucrium alyssifolium* Stapf*, *Gonocytisus dirmilensis*

Hub.-Mor.*, and *Teucrium sandrasicum* O.Schwarz* (taxa denoted by an asterisk are endemic to Turkey).

4. Discussion

Muscari elmasii morphologically shallowly resembles *M. weissii* and *M. massayamum* in some morphological features (Figure 4).

M. weissii is a close relative of *M. comosum*. The two are often confused in herbarium samples as well as in nature. It is separated from *M. comosum* by its golden yellow lobes (not cream or pale beige). *M. weissii* slightly resembles *M. elmasii* in its general aspects, but is quite a different species. The fertile flowers of *M. weissii* are smaller, oblong to obconical-oblong, slightly shouldered, and pedicellate

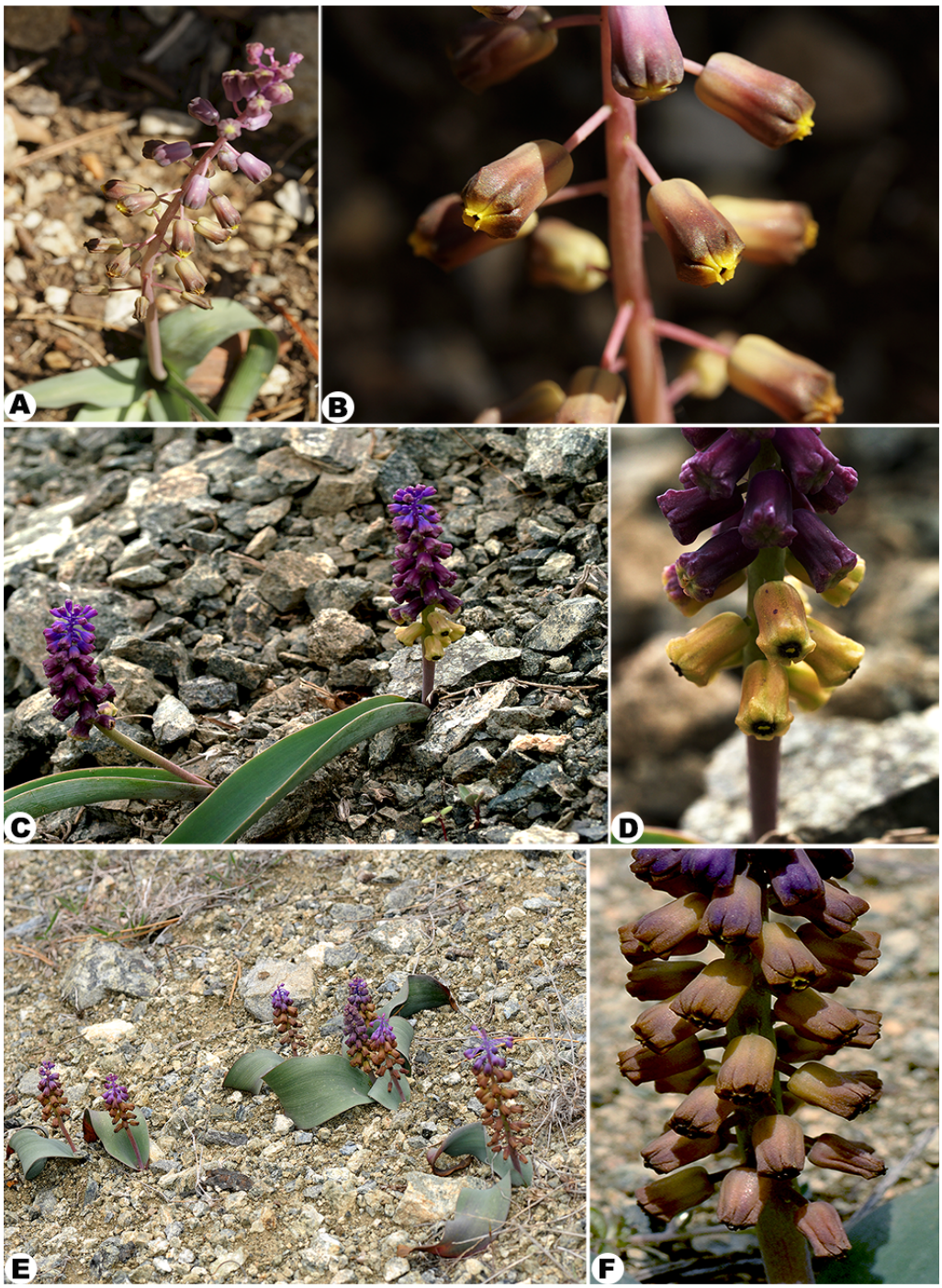

Figure 4. A, B. *Muscari weissii*, C, D. *M. massayamum*, E, F. *M. mirum.*

(not longer, cylindrical, hardly shouldered, and mostly subsessile); fertile flower bud and early stage of mature flower pale violate (not pinkish); lobes golden yellow (not greenish-yellow); the inflorescence lax and longer (dense and relatively short).

M. massayanum is a species related to *M. elmasii* with nearly subsessile mature flowers, dense inflorescence and a dense fruiting stem. However, *M. elmasii* is isolated from *M. massayanum* by its distribution area. *M. massayanum* is distributed from east Anatolia to central Anatolia on serpentine and calcareous substrate but *M. elmasii* is only found in west Anatolia on serpentine substrate. They are morphologically easily distinguished from each other by several features. Although the sterile flowers of *M. massayanum* are dense, dark violate, and short pedicellate, the sterile flowers are lax, pinkish to violaceous, and longer pedicellate in *M. elmasii*. Moreover, the mature fertile flowers are oblong-cylindrical and lobes blackish in *M. massayamum* while mature fertile flowers cylindrical and lobes are greenish-yellow in *M. elmasii*.

The ecological requirements and distribution of *M. elmasii* are very similar to those of *M. mirum*. They are distributed in geographically in very close areas in which both of them grow on serpentine substrate. Morphologically, these two species are easily distinguishable from each other. *M. mirum* mostly has one or sometimes two relatively wider, mostly flattened, glaucose leaves (not 3–4 linear lanceolate, canaliculated). The fertile flowers o*f M. mirum* have brownish buds during the early stage of flowering, oblong-cylindrical with recurved lobes (not pinkish, cylindrical with erect to slightly recurved lobes), and the length of fertile flowers is nearly half that of *M. elmasii*. Moreover, the sterile flower pedicels of *M. mirum* are clearly shorter than those of *M.*

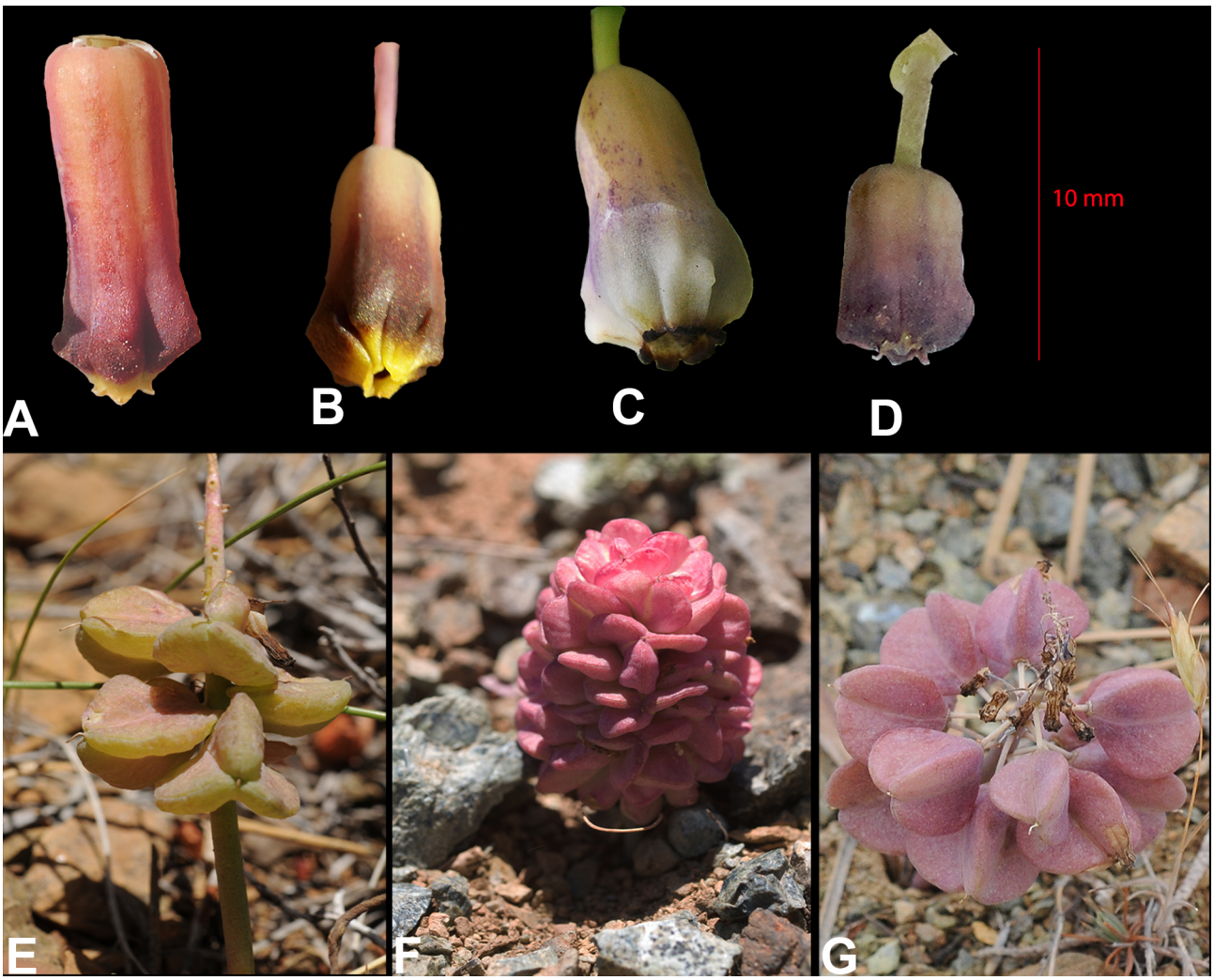

Figure 5. A. flower of *Muscari elmasii* B. flower of *M. weissii*, C. flower of *M. massayamum*, D. flower of *M. mirum,* E. capsule of *Muscari elmasii*, F. capsule of *M. massayamum*, G. capsule of *Muscari mirum.*

elmasii. The fruit of *M. mirum* is also smaller and has a longer pedicel.

Although *M. elmasii* resembles *M. weissii* and *M. massayanum* (Figures 4 and 5), it can easily be distinguished from these species by several noticeable morphological characters (see details in the Table).

Acknowledgments
We are grateful to the curators of the following herbaria for allowing me access to their *Muscari* material for study: ANK, EGE, E, GAZI, HUB, ISTE, and K. Special thanks go to retired Prof Dr Adil Güner for the digital images of *Muscari massayanum*.

Table. Morphological differences between *Muscari elmasii* and its allied species *M. weissii* and *M. massayanum*.

Characters	*Muscari elmasii*	*M. weissii*	*M. massayanum*
Leaves	(2–) 3–4, erecto-patent to patent, 10–22 cm × 6–18 mm, canaliculated, green	(2–)3–6, erect, spreading or sinuate, linear-lanceolate, attenuate, 8–70 cm × 5–15 mm, canaliculated, green	2–4, subpatent, 10–25 cm × 10–25 mm, deeply canaliculated, glaucous
Scape	7–11 cm	8–30 cm	15–22 cm
Raceme	4–8 cm, dense, not elongate in fruit	6–12 cm, lax, elongate in fruit	5–12 cm, dense, not elongate in fruit
Pedicels of fertile flowers of sterile flowers	sessile, rarely with 2–3 mm 3–10 mm long	 1.5–9 mm 5–9 mm	 0.5–4(–6) mm 2–4 mm
Sterile flowers	narrowly obconical-cylindrical, 3–6 mm, pinkish to violaceous	obovoid, 4–8 mm, violaceous	2–4 mm, pink or bright violet-pink
Fertile flower	cylindrical, not waisted, 9–12 × 2–4 mm, pinkish at buds and early stage of flowering time; change to yellowish brown or yellowish-pink at proximal and dark maroon to brown at distally	oblong or obconical-oblong, slightly waisted, 5–9 × 2.5–3.5 mm, distal part of perianth deep brown, proximal part pale brown or dirty greenish	oblong- cylindrical, slightly waisted, 7–11 × 3–5 mm, at first violaceous, at anthesis becoming light greenish or yellowish-brown
Lobes	greenish-yellow, erect to slightly recurved	bright to ocherous yellow, erect to slightly recurved	dark to blackish, recurved
Capsule	dense, subsessile, broadly obconical to slightly orbicular, obtuse or emarginate, 1–1.5 × 1.5–2 cm	very lax, 10-20 mm pedicellate, ovate-orbicular, not or scarcely emarginate, 0.7–1.2 × 0.8–1.3 cm	compact, subsessile, adpressed-orbicular, to 1.2–1.7 × 1.5–2.5 cm, deeply trilobed, apparently shed without dehiscing
Habitat	open stony places. serpentine rocks; between 1250-1350 m a.s.l.	rocky calcareous slopes, phrygana, uncultivated ground, and on fixed dunes in *Pinus pinea* – *Myrtus communis* forest, s.l.–800 m.	calcareous screes and fallow fields, dry *Pinus* forest; between 800 and 2000 m a.s.l.

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