

Dionysia × *mallahiae* (Primulaceae): a new natural hybrid between *D. iranshahrii* and *D. zagrica*

AMIN ZERAATKAR, HAMZEHALI SHIRMARDI & TOURAJ
MOKHTARPOUR

Research Division of Natural Resources, Chaharmahal and Bakhtiari Agricultural and Natural Resources Research and Education Center (AREEO), Shahrekord, Iran

ORCID iD. A. ZERAATKAR: <https://orcid.org/0000-0002-6085-0096>,

H. SHIRMARDI: <https://orcid.org/0000-0002-2554-1909>,

T. MOKHTARPOUR: <https://orcid.org/0009-0007-9708-1431>

Author for correspondence: A. Zeraatkar (a.zeraatkar@areeo.ac.ir)

Editor: Neus Ibáñez

Received: 11 March 2024; accepted 26 October 2024; published online 27 January 2025

Abstract

DIONYSIA × *MALLAHIAE* (PRIMULACEAE): A NEW NATURAL HYBRID BETWEEN *D. IRANSHAHRII* AND *D. ZAGRICA*.— Here we introduce one more hybrid in the section *Dionysia*, *D. × mallahiae*, formed via hybridization between parents with different corolla colors, i.e. *D. iranshahrii* and *D. zagrica*. The morphological characters of the hybrids are frequently found to be intermediate to those of the two parental species. On the other hand, only two slight morphological novelties were recorded in the hybrids, with having considerably short trichomes and slightly longer glands in all individuals.

Key words: alpine; Chaharmahal and Bakhtiari; hybridization; Iran; subalpine; Zagros.

Resumen

DIONYSIA × *MALLAHIAE* (PRIMULACEAE): UN NUEVO HÍBRIDO NATURAL ENTRE *D. IRANSHAHRII* Y *D. ZAGRICA*.— Presentamos aquí un híbrido más en la sección *Dionysia*, *D. × mallahiae*, formado mediante la hibridación entre progenitores con diferentes colores de corola, es decir, *D. iranshahrii* y *D. zagrica*. Los caracteres morfológicos de los híbridos se encuentran con frecuencia como intermedios entre los de las dos especies parentales. Por otro lado, solo se registraron dos ligeras novedades morfológicas en los híbridos, los cuales presentaron tricomas considerablemente cortos y glándulas ligeramente más largas en todos los individuos.

Palabras clave: alpino; Chaharmahal y Bakhtiari; hibridación; Irán; subalpino; Zagros.

Cómo citar este artículo / Citation

Zeraatkar, A., Shirmardi, H. & Mokhtarpour, T. 2024. *Dionysia* × *mallahiae* (Primulaceae): a new natural hybrid between *D. iranshahrii* and *D. zagrica*. *Collectanea Botanica* 43: e0006. <https://doi.org/10.3989/collectbot.2024.v43.0006>

Copyright

© 2024 CSIC. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International (CC BY 4.0) License.

INTRODUCTION

Dionysias possess unique qualities that make them fascinating to both naturalists and botanists. They captivate us with their lovely appearance and amazing habitats, diverse range of species, considerable ornamental value, and remarkable capacity for producing new and cute varieties through cross-breeding (Zeraatkar *et al.*, 2022; Lidén & Mehregan, 2023; Zeraatkar *et al.*, 2023).

Many previous studies have shown that when two species of the genus are in sympatry and have overlapping flowering time, they often interbreed and create hybrids. This results in the formation of natural hybridization zones (Zeraatkar & Khajoei Nasab, 2022).

The occurrence of hybridization in *Dionysia* has been known for less than half of a century. To this point, only a small number of natural hybrids within the genus have been reported. In contrast, many artificially produced hybrids are commonly found in cultures (Lidén & Mehregan, 2023). The lack of natural hybrids produced within the genus is more likely because of strong pre-zygotic barriers to reproduction. Several species of the genus have restricted distributions, occupying only specific geographical locations. The distribution of suitable localities for many species is similar to that of islands, even occurring within a single mountain (Grey-Wilson, 1969).

In August 2021, during investigation on the genus *Dionysia* specimens kept at D herbarium, the first author came across specimens of *D. iran-shahrii* Wendelbo and *D. zagrica* Grey-Wilson that have been collected from the same locality and attracted his attention. He speculated that the populations of these species might create another undescribed hybrid between purple and yellow-flowered species. Following our careful examination field in spring 2022–2024, we observed the two mentioned species occur side-by-side in nature and sometimes utilize the same habitats (under overhangs or on vertical faces and slopes), where diffuse hybridization zones with hybrid swarms can occasionally be witnessed between *D. iran-shahrii* and *D. zagrica*.

RESULTS AND DISCUSSION

Dionysia × *mallahiae* Zeraatkar **nothosp. nov.** (= *D. iran-shahrii* × *D. zagrica*) (Figs. 1–3)

Description: Cushions very dense green to bluish green, 5–10 cm across. Branches closely packed, densely clad with imbricate leaves. Yearly growth 2–4 mm, with contiguous leaf generations. Marcescent leaves brownish, brownish black, whitish, long persistent, eventually disintegrating and shed. Defoliated stems up to 1.5–2 mm in diameter, with a dark wine-red bark. **Leaves** green to bluish green, unnoticeably involute, slightly thick or papery, non-hyaline or hyaline at margin, lateral veins obscure or slightly raised, sclereids slightly significant or insignificant, conspicuously ciliate throughout with up to 0.2 mm long trichomes and short-stalked (0.05–0.1 mm long) and medium-sized (*ca.* 0.15 mm) glands; lanceolate, oblong-spathulate, oblanceolate, oblong, spathulate-lanceolate, elliptic-spathulate, spathulate or elliptic, 1.5–2.7(3) × 0.3–0.8(0.9) mm, abaxially and adaxially pubescent, glabrescent or glabrous, with trichomes to 0.2 mm long, short-stalked and medium-sized glands, apex acute, subacute, obtuse or sometimes rounded. **Bracts** 1(0?), narrow, narrowly oblong to lanceolate, apex acute to obtuse, shorter than calyx, 1.5–2.5 mm long, pubescent like the calyx teeth. **Flowers** single, sessile. **Calyx** (2)2.5–3(3.5) mm long, divided for slightly more 1/2 to 4/5 of its length into oblong to lanceolate entire or with 1–2 fine teeth lobes, apex acute, ciliate along the margin, abaxially sparsely pubescent or glabrescent, adaxially glabrous sometimes with a few trichomes and glands at some teeth apex. **Corolla** pale/dark violet with a distinct yellowish eye; tube violet or pale yellow, 7–15 mm long, sparsely with trichomes to 0.2 mm long and short-stalked and medium-sized glands; limb (4)5–7(7.5) mm across, lobes elliptic, widely obovate, elliptic-obovate, suborbicular, apex entire (sometimes slightly emarginate), with a few trichomes and glands at the distal part of the lamina. **Style** of short-styled flowers up to 4–5 mm long, reaching about halfway through the tube; that of long-styled flowers 11–12 mm long, exserted or as long as the corolla tube. **Anthers** *ca.* 0.9 mm, inserted in the throat or just below the middle of the corolla tube. **Ovary** small, sub-spheric, with three

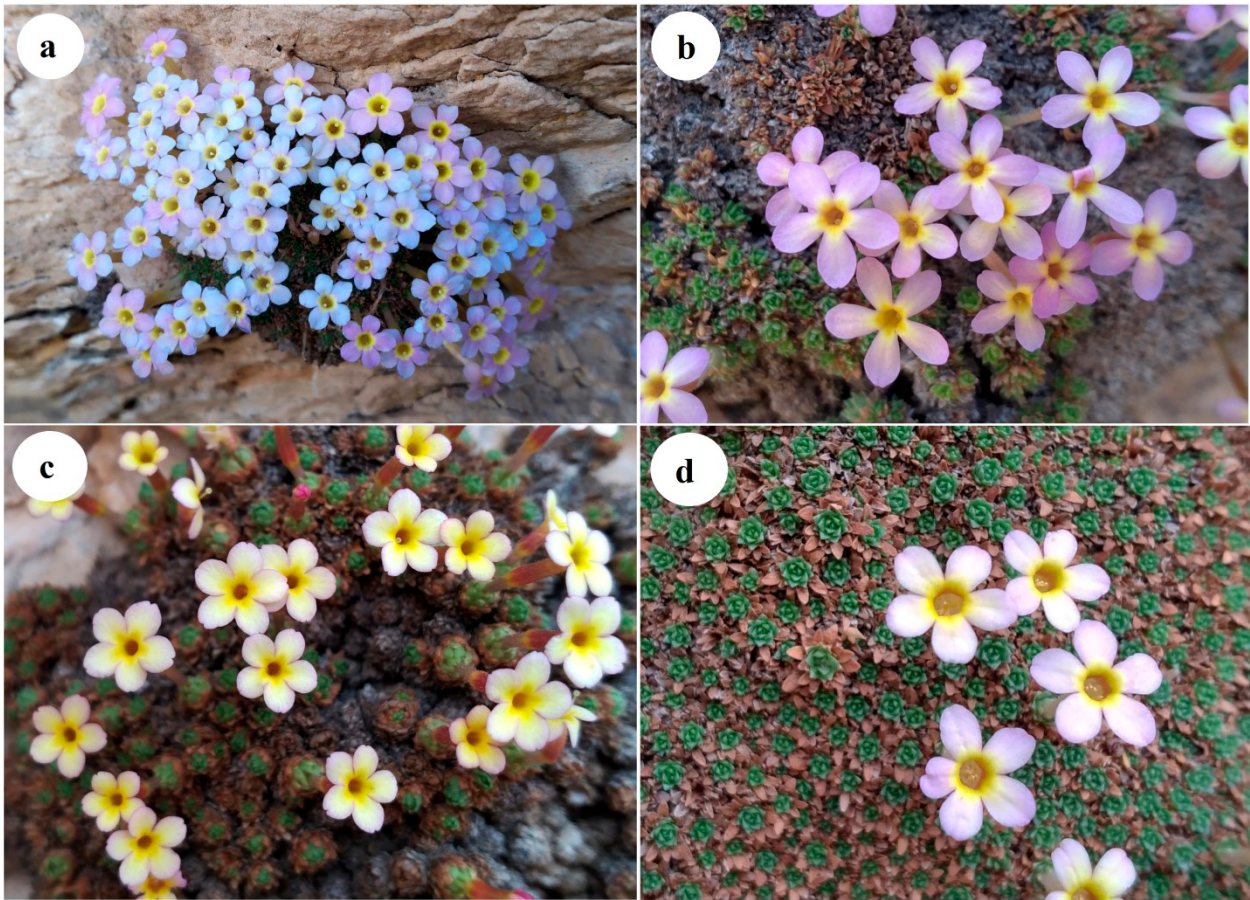


Figure 1. Flowers variation in *Dionysia* × *mallahiae* (photographs: Amin Zeraatkar).

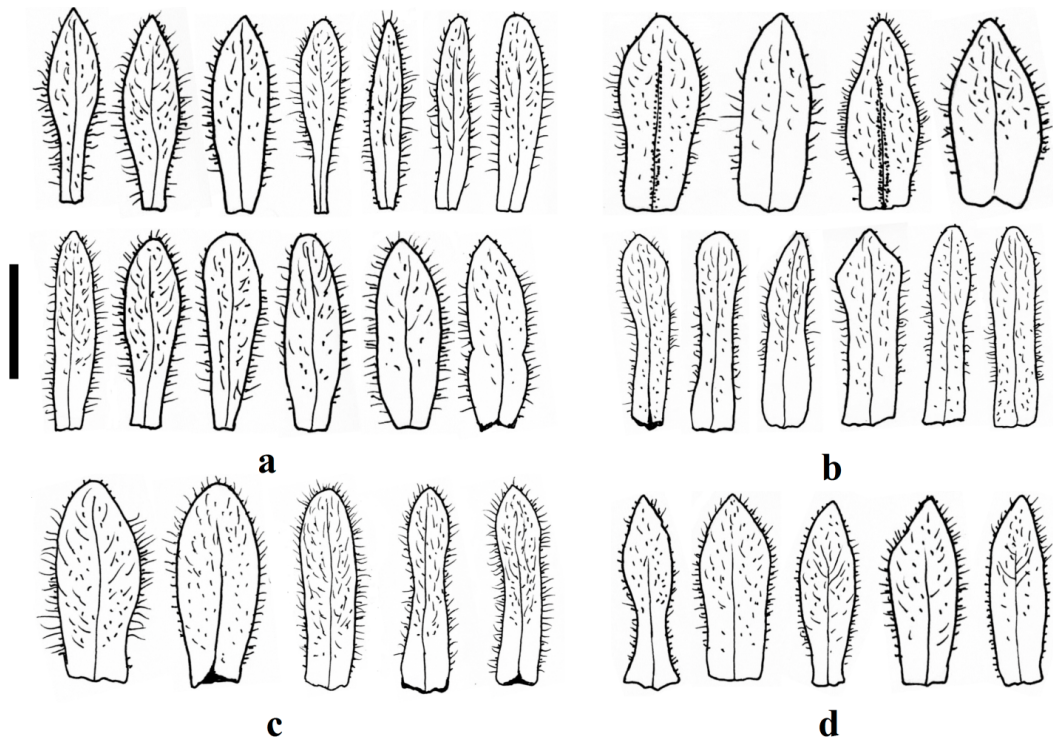


Figure 2. Leaf variation in *Dionysia* × *mallahiae*. Scale bar: 1 mm (drawings: Amin Zeraatkar).

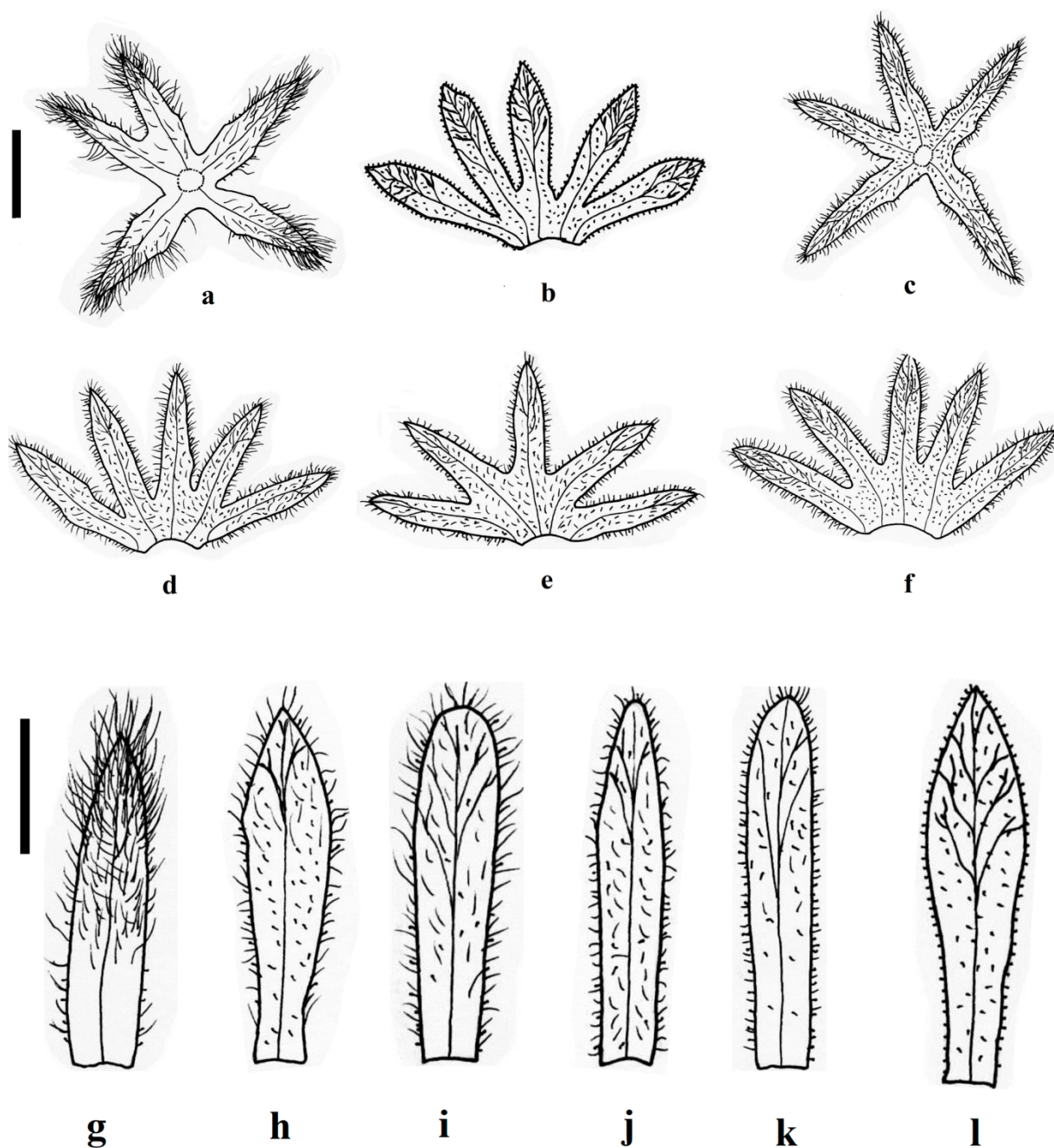


Figure 3. Calyx in: (A), *Dionysia iranshahrii*; (B), *D. zagrica*; (C–F), *D. xmallahiae*. Bract in: (G), *D. iranshahrii*; (H–K), *D. xmallahiae*; (L), *D. zagrica*. Scale bars: 0.75 mm (drawings: Amin Zeraatkar).

ovules. **Capsule** narrowly ovate, valves spiraling after dehiscence, ca. 2.5 mm long, with seeds that lack embryos.

Type. Iran. Chaharmahal and Bakhtiari province. Felard district, near mount Dalankuh, 2810 m a.s.l., 24.IV.2022, Zeraatkar 7193 (holotype: D7193).

The specific epithet is chosen in honor of Dr. Mahlagha Mallah, an Iranian environmentalist and

researcher who has made significant contributions to reduce environmental pollution in Iran. She is known as the founder of “Women’s Society Against Environmental Pollution”.

In the locality type, *D. iranshahrii* and *D. zagrica* start to flower at the beginning of middle of April and continues until the late of May. The flowering period of hybrid plants occur late of April to middle

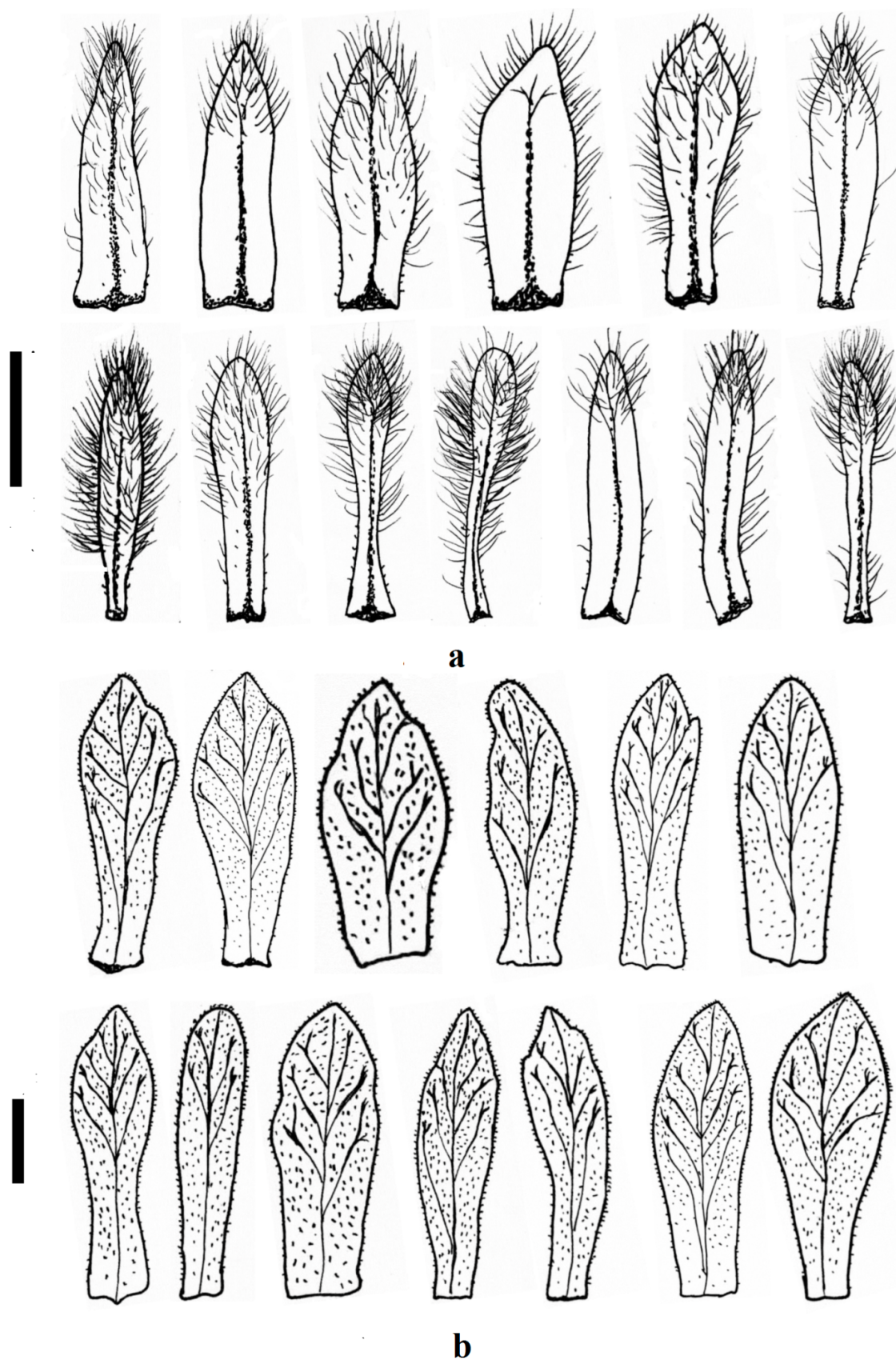


Figure 4. Leaf variation in: (A), *Dionysia iranshahrii*; (B), *D. zagrica*. Scale bars: (A), 0.75 mm; (B), 1 mm (drawings: Amin Zeraatkar).

of May. The species are mainly pollinated by hawk moths such as *Macroglossum stellatarum*. It seems the hybrid is without seed production.

Dionysia iranshahrii with a very restricted distribution had been previously reported from two closely populations in Isfahan province at altitude 2400–2590 m a.s.l. (Lidén & Mehregan, 2023). In the framework of this paper, this species was collected for the first time from Chaharmahal and Bakhtiari province at 2810–2915 m a.s.l. (see Appendix 1). In contrast, *D. zagrica* is relatively widely distributed in the Chaharmahal and Bakhtiari province and south Isfahan at altitude 1850–2850 m a.s.l. (Lidén & Mehregan, 2023). Regarding pre-zygotic barriers (ecological isolation), there are only a few overlapping areas between *D. iranshahrii* and *D. zagrica* exist in the north of Felard district, at altitudes of 2810–2850 m a.s.l. (see Appendix 1). The hybridization between *D. iranshahrii* and *D. zagrica* do occur where the both species meet each other at their highest altitude (2800–3000 m a.s.l.).

Despite the differences in the niches of these species, their populations occasionally come into contact, which may result in interspecific hybridization (Table 1). One or two swarms of *Dionysia* × *mallahiae* grow at the hybridization zones where populations of *D. iranshahrii* and *D. zagrica* oc-

cur together. In agreement with previous studies in Primulaceae (Jacquemyn *et al.*, 2009; Zeraatkar & Khajoei Nasab, 2022), the current results indicate such hybrid plants are in fact rare in nature and distributed within a narrow range between the parental habitats and do not spread further.

The parental plants remain morphologically distinct and pure in their hybridization zones. Previous studies in the genus demonstrate postzygotic isolation mechanisms still maintain parental species in the genus (Zeraatkar & Khajoei Nasab, 2022). Our observation shows that the following traits are variable among the hybrids: corolla color, corolla limb outline, leaf and calyx size, gland and trichome size, degree of prominence of lateral veins, thickness of leaf and calyx margin (Figs. 1–3, Table 1). Trichomes are totally absent in *D. zagrica*. In contrast, *D. iranshahrii* is densely covered by trichomes. The trichomes are present in the hybrid plants; however, they are considerably shorter in the hybrid plants than that of *D. iranshahrii* (Figs. 2–4, Table 1). *D. zagrica* is glandular pubescent all over while the glands are insignificant in *D. iranshahrii*. In our study, glands were present in the all hybrid plants but slightly longer compared with parental species (Figs. 2–4, Table 1). Across most of the investigated leaves, hybrids express patterns similar to *D. zagrica*.

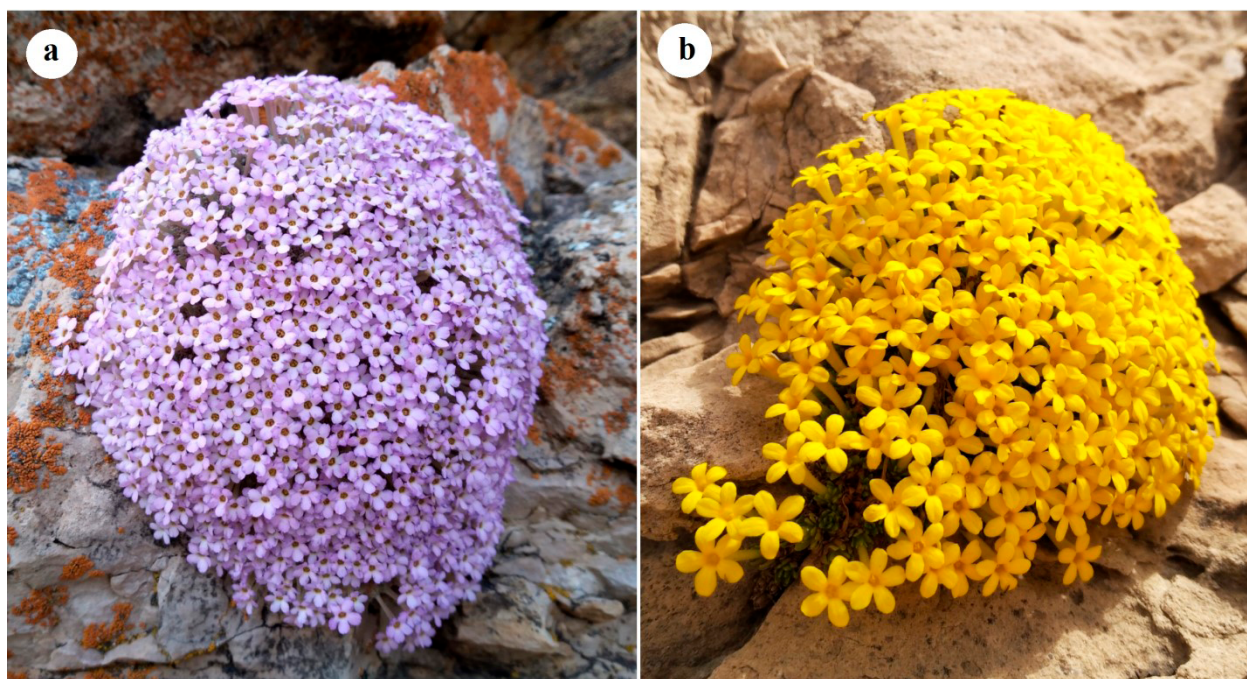


Figure 5. Flowered plants of: (A), *Dionysia iranshahrii*; (B), *D. zagrica* (photographs: Amin Zeraatkar).

Table 1. Diagnostic characters of *Dionysia ×mallahiae* and its parent species.

	<i>Dionysia iranshahrui</i>	<i>Dionysia ×mallahiae</i>	<i>Dionysia zagrica</i>
Leaf size (mm)	1.5–3 × 0.5–1	1.5–2.7(3) × 0.3–0.8(0.9)	(2.5)3–4.5 × 0.7–1.5
Leaf outline	narrowly oblong, lanceolate, oblanceolate, narrowly elliptic-ovate, oblong-spathulate	lanceolate, oblong-spathulate, oblanceolate, oblong, spathulate-lanceolate, elliptic-spathulate, spathulate, elliptic	oblong-spathulate, obovate, oblong, oblanceolate
Leaf direction/position	flat	unnoticeably involute	slightly involute
Leaf and calyx thickness	papery	slightly thick or papery	thick
Leaf margin	hyaline	non-hyaline or hyaline	non-hyaline
Lateral veins of leaf and calyx	obscure and sclereids insignificant	obscure or slightly raised, sclereids slightly significant or insignificant	raised and sclereids significant
Bract outline	lanceolate to narrowly oblong	narrowly oblong, oblong-linear to lanceolate	lanceolate, oblong-linear
Bract length (mm)	ca. 2	1.5–2.5	2–3
Calyx length (mm)	2–2.5	(2)2.5–3(3.5)	3–4
Calyx lobes margin	mostly with 1–2 fine teeth lobes	entire or with 1–2 fine teeth lobes	entire
Calyx incision length	1/2 to 2/3(4/5)	slightly more 1/2 to 4/5	3/4 to 4/5
Corolla tube length (mm)	8–12	7–15	10–17
Corolla limb diam. (mm)	4–6	(4)5–7(7.5)	5–8
Corolla indumentum	glabrous	sparsely with short trichomes, subsessile and short-stalked glands	finely glandular
Corolla lobes	slightly emarginate (rarely entire or lobules sometimes again divided)	slightly emarginate or entire	entire (sometimes slightly emarginate)
Corolla lobes outline	widely obovate	elliptic, widely obovate, elliptic-obovate, suborbicular	elliptic, suborbicular
Corolla colour	violet	pale/dark violet with a distinct yellowish eye	yellow
Ovules number	2–4	3	4–5
Glands type	short-stalked	short-stalked and medium-sized	short-stalked
Trichomes type	long (up to 0.9 mm long)	short (up to 0.2 mm long)	absent
Habitat	steep limestone cliffs, usually under overhangs, in shade or deep shade	intermediate between those of the parents: limestone cliffs, in partial shade with some bright sunlight	limestone cliffs, on vertical faces and slopes, in full sun

The leaves of *D. zagrica* were described and illustrated as entire in previous research (Grey-Wilson, 1974; Lidén & Mehregan, 2023). More materials from broad geographic range demonstrate the leaves are entire and very rarely with 1–2 fine teeth in upper part or slightly lobed (Fig. 3B).

In contrast, in case of the reproductive traits, hybrids express patterns similar to the parents (Fig. 2 and 4, Table 1). The calyx lobes of *D. iranshahrui* are treated as entire in the original description and

consequent studies (Wendelbo, 1975; Lidén & Mehregan, 2023). However, our materials show that the calyx lobes are mostly with 1–2 fine teeth (Fig. 3A). The ovule numbers are variable and range from 2–4 per ovary in the species.

ACKNOWLEDGEMENTS

This study was funded by project of “Preparing an atlas of *Dionysia* species in Chaharmahal and Bakhtiari province” (no. 24-42-09-005-030047).

AUTHORSHIP CONTRIBUTION STATEMENT

Amin Zeraatkar: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing, **Hamzehali Shirmardi:** Data curation, Investigation, Funding acquisition, Methodology. **Touraj Mokhtarpour:** Data curation, Funding acquisition, Methodology.

REFERENCES

- Grey-Wilson, C. 1969. *Dionysias: The Genus Dionysia in the Wild and in Cultivation*. Alpine Garden Society, Woking.
- Grey-Wilson, C. 1974. Some notes on Iranian *Dionysias* (Primulaceae). *Kew Bulletin* 29(4): 687–694. <https://doi.org/10.2307/4108134>
- Jacquemyn, H., Endels, P., Brys, R., Hermy, M. & Woodell, S. R. 2009. Biological flora of the British Isles: *Primula vulgaris* Huds. (*P. acaulis* (L.) Hill). *Journal of Ecology* 97(4): 812–833. <https://doi.org/10.1111/j.1365-2745.2009.01513.x>
- Lidén, M. & Mehregan, I. 2023. *Dionysia* (Primulaceae) – the cushion primroses (Symbolae Botanicae Upsalienses, 41). Uppsala University, Uppsala.
- Wendelbo, P. 1975. Another new *Dionysia* (Primulaceae) from the Bakhtiari Mts. of Iran. *The Iranian Journal of Botany* 1: 71–73.
- Zeraatkar, A., Jamzad, Z., Jalili, A. & Khajoei Nasab, F. 2022. The conservation status of endemic SW Iranian *Dionysia* species. *Iran Nature* 7(2): 143–155 [in Persian]. <https://doi.org/10.22092/irn.2022.357964.1450>
- Zeraatkar, A. & Khajoei Nasab, F. 2022. A new natural hybrid in *Dionysia* (Primulaceae). *Phytotaxa* 559(1): 64–72. <https://doi.org/10.11646/phytotaxa.559.1.7>
- Zeraatkar, A., Lidén, M., Mokhtarpour, T. & Shirmardi, H. A. 2023. Rediscovery of *Dionysia bachtiarica* (Primulaceae) in kuh-e kallar after 119 years. *The Iranian Journal of Botany* 29(1): 21–28. <https://doi.org/10.22092/ijb.2023.129423>