



## Taxonomic Note on *Fagonia isotricha* Murb. (*Zygophyllum mayanum* (Schltdl.) Christenh. and Byng) from Libya.

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This study presents a taxonomic note on *Fagonia isotricha* Murb. (Zygophyllaceae), a species recorded in Libya and currently treated as a taxonomic synonym of *Zygophyllum mayanum*. Global taxonomic databases, such as those curated by the Royal Botanic Gardens, Kew and World Flora Online, recognize this taxon as part of the Libyan flora under its currently accepted nomenclature.

This study provides field-based and morphological documentation of populations observed in the Ariggiba region (southern Libya), and discusses their taxonomic placement within the *Fagonia-Zygophyllum* complex. Herbarium specimens were collected, examined, and deposited, supporting the occurrence of this taxon in the Libyan flora.

### Introduction

*Zygophyllum mayanum* (Schltdl.) Christenh. & Byng (*Fagonia isotricha* Murb). Acta Univ. Lund. 33(12): 54 (1897), is a spiny, herbaceous plant species belonging to the family Zygophyllaceae, a family well-known for its adaptability to arid and semi-arid climates. This species is part of the genus *Zygophyllum* which comprises approximately 100 species distributed across arid and subtropical regions of the Old World and the New World (Mashaly, 2019).

*Zygophyllum mayanum* is considered to have originated in southwestern Asia, particularly within arid regions of Iran, Pakistan, and Afghanistan., where it thrives in desert plains, rocky slopes, and dry wadis. Its westward expansion is likely linked to historical climatic shifts, geological processes, and natural dispersal mechanisms. (Al-Wakeel,1992). From its center of origin, *Zygophyllum mayanum* gradually expanded its range across the Arabian Peninsula and entered Northeast

Africa. Its introduction into North Africa, including Egypt, Algeria, and Tunisia, is likely associated with historical trade routes, nomadic pastoralism, and the natural dispersal via wind and animals. Today, it is recorded in the Sahara Desert and semi-desert ecosystems, where it has adapted to the extreme temperatures and limited water availability. The species contributes to desert ecosystem stability by enhancing soil structure and providing resources for insect communities. Its resilience to drought makes it an indicator of arid land flora.

Medicinally, the genus *Zygophyllum* has a long history of ethnobotanical use in traditional medicine across Asia and Africa. Several species within the genus are traditionally utilized in herbal preparations for the management of: Fever and malaria, Skin disorders and infections, Inflammatory conditions, Liver disorders

Previous investigations have reported the presence of bioactive constituents such as flavonoids, alkaloids, and

terpenoids in *Zygophyllum* species, which exhibit antioxidant, anti-inflammatory, and anticancer properties (Bhojani et al., 2020; Ali et al., 2013). However, specific phytochemical and pharmacological studies on *Zygophyllum mayanum* remain limited, indicating the need for further research to confirm and standardize its medicinal uses.

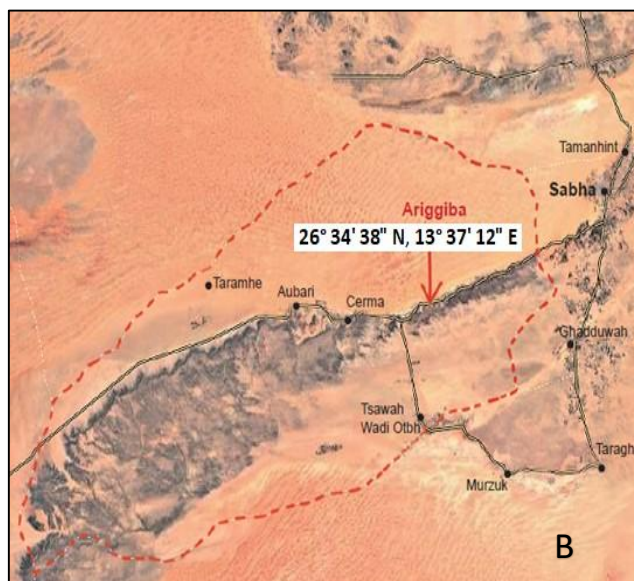
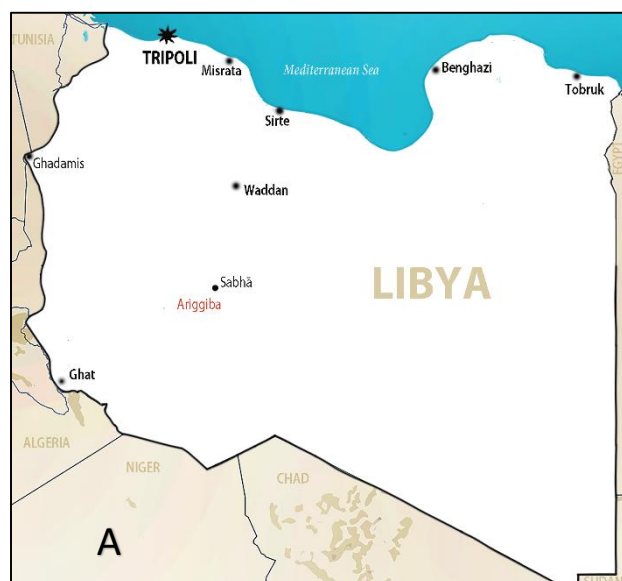
This study presents the taxonomic note occurrence of *Fagonia isotricha* (*Zygophyllum mayanum* (Schltdl.) Christenh. & Byngin) Libya. It offers a comprehensive examination of its ecological adaptability, and potential impacts. By contributing new taxonomic and ecological insights,. This study aims to document field populations in Libya and clarify their taxonomic status.

### Materials and Methods:

Observation and Identification of *Zygophyllum mayanum* (Schltdl.) Christenh. & Byng (*Fagonia isotricha* Murb). Field observations were conducted across multiple developmental stages, including flowering, fruiting, and seedling phases. (2024-2025), from various localities in the Ariggiba Region, 110 Km Southwest Sabha city about 1000 Km south of Tripoli

(26° 34' 38" N, 13° 37' 12" E) (Fig1). The collected specimens were meticulously photographed, collected, and identified as *F. isotricha* Murb (Figure 2).

Standard herbarium techniques were employed for specimen preparation, including pressing, drying, mounting, and labeling. Following rigorous examination, the plant was confirmed as *Zygophyllum mayanum* (Schltdl.) Christenh. & Byng using data from multiple references (Cooke,1903., Boulos,2000.,Govaerts, 2001., Setshogo, 2005., Dobignard & Chatelain,2013., Govaerts, 2021., Govaerts et al, 2021., World Flora Online, 2024., Hyde, et al 2025). These references supported accurate taxonomic identification and contextualized the species within regional flora of *Fagonia isotricha* (*Zygophyllum mayanum* (Schltdl.) Christenh. & Byngin) Libya. The voucher specimens have been deposited in the Herbarium of the Botany Department at the University of Sabha (ULS), Faculty of Science, under voucher number 0238613N (Figure 3). A duplicate set of the specimens has also been sent to the Herbarium of the Botany Department at Gharyan University, Gharyan, Libya, ensuring accessibility for further research.



**Figure 1.** Map of Libya (A) and detailed map of the Sabha District (B), showing the locality where *Zygophyllum mayanum* (*Fagonia isotricha*) was collected, with its longitude and latitude in the decimal system.

### Morphological Description

**Accepted name:** *Zygophyllum mayanum* (Schltdl.) Christenh. & Byng

**Synonym:** *Fagonia isotricha* Murb.

*Zygophyllum mayanum* is a small perennial shrublet, reaching up to 30 cm in height. The plant exhibits a greyish to bright green coloration and is characterized by glandular pubescence composed of uniform trichomes,

each consisting of a basal cell topped with a club-shaped glandular cell. The branches are generally erect, with internodes that are angular to cylindrical, measuring 2–4 cm in length and 1–3 mm in diameter. The leaves are petiolate and typically trifoliate, with petioles ranging from 7 to 15 mm in length. The median leaflet is broader than the lateral ones, reaching up to 2 cm long and 1 cm wide. Stipules are modified into spines, up to 15 mm long (Fig. 2). Flowers are small, less than 10 mm in diameter, borne on short peduncles measuring 3–5 mm.

Sepals are ovate, approximately 2.5 mm long and 1.5 mm wide, with glandular surfaces. Petals are rose-colored, about  $4.5 \times 2.5$  mm. The flower contains ten stamens arranged in two whorls; filaments reach up to 6 mm in length, while anthers are about 0.8 mm long and 0.5 mm wide.

The fruit is a tomentose capsule, approximately 5 mm wide and 4 mm long, with a style up to 2 mm in length. The calyx is deciduous and falls off at fruit maturity.

Note: The observed morphological characters, particularly the trifoliolate leaves and spiny stipules, are consistent with the diagnostic features historically attributed to *F. isotricha*, supporting its treatment as a synonym of *Z. mayanum*.

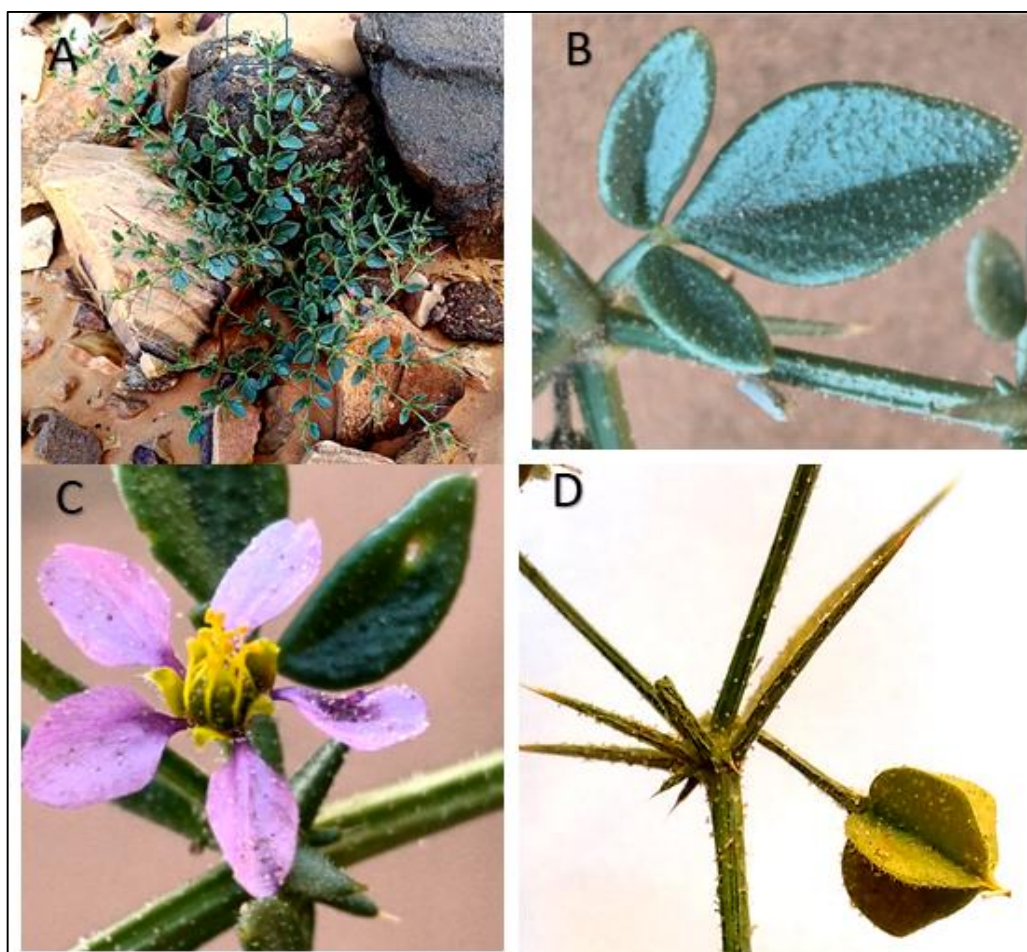


Figure 2. (A) Habit of *Zygophyllum mayanum*, (B) petiolate and trifoliolate leaf with **glandular-pubescent** (C) flower on short peduncles (D) tomentose capsule and **Spiny stipules**.

### Habitat

*Z. mayanum* is typically found in arid and semi-arid environments, thriving in desert plains, rocky slopes, dry wadis, and gravelly or sandy soils. It is well-adapted to regions with extreme temperatures, intense sunlight, and low annual rainfall. The species often occurs in open, sparsely vegetated landscapes, where competition with other plant species is minimal (Gomes et al,2023). In North Africa, *F. isotricha* is commonly recorded in the Saharan ecozones, particularly in Libya, Algeria, and parts of Egypt, where it grows at low to moderate elevations. It can also be found along the fringes of

desert mountains and calcareous or gypsum-rich substrates, which provide good drainage—an essential factor for its survival. This species is part of the xerophytic flora, and its morphological adaptations, such as spiny stipules, small glandular leaves, and trichome-covered surfaces, enable it to conserve water and resist herbivory. *Z. mayanum* is often associated with other drought-tolerant shrubs and herbs, including members of the genera *Zygophyllum*, *Haloxylon*, and *Anabasis* (Gomes et al,2023)..

**Chromosome number:**  $2n=28$ , indicating its diploid status (Kumar, & Sharma, 1986).

**Voucher Specimen**

This plant were observed near roadsides, alluvial plains, and borders of fields, wastelands and dried water bodies

of Ariggiba region (Figure 1) located at Sabha, Libya, and Tripoli (Figure 3).

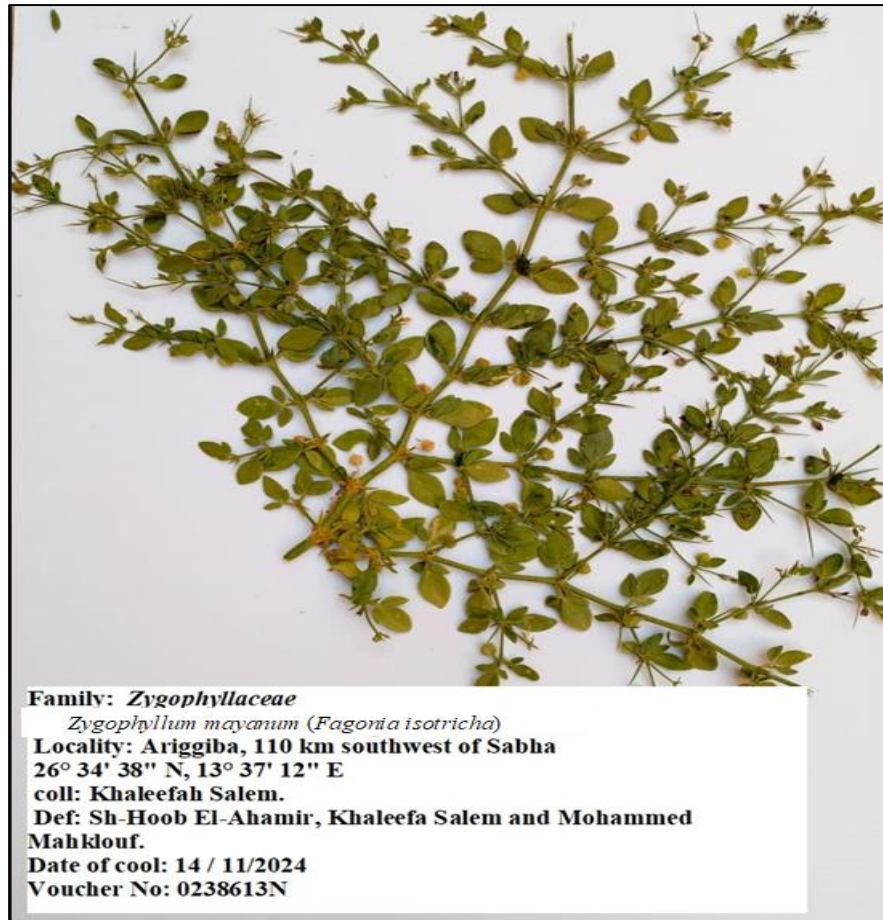


Figure 3: Herbarium specimen of *Zygothymus mayanum* (*Fagonia isotricha*) collected from Ariggiba regions.

**Results and discussion**

The present study confirms the occurrence of populations identifiable as *Zygothymus mayanum* (Schltdl.) Christenh. & Byng (*Fagonia isotricha*) in southern Libya. However, based on current taxonomic consensus, these populations should be referred to *Zygothymus mayanum*, reporting the inaugural documentation of *Fagonia isotricha* within the Libyan flora, specifically identified in the Sabha region (Ariggiba). Previous comprehensive floristic surveys and botanical compilations for Libya, such as those by Keith (1965) and Jafri (1977) do not include any mention of *Fagonia isotricha*, thereby substantiating its status as the taxonomic note occurrence of *Fagonia isotricha* (*Zygothymus mayanum* (Schltdl.) Christenh. & Byng) in Libya.

*Zygothymus mayanum* is inherently distributed across the arid and semi-arid landscapes of Southwest and Central Asia, with its primary center of origin and diversification located in countries such as Iran, Afghanistan, and Pakistan (Zohary, 1973). From these core regions, the species has successfully expanded its range westward and southward, establishing populations in various parts of the Middle East, including the Arabian Peninsula. Notably, *Zygothymus mayanum* has also been recorded across several North African nations, including Algeria, Egypt, Libya, Mauritania, Morocco, Niger, Tunisia, and Western Sahara (Govaerts, 2021).

The wide distribution of *Z. mayanum* can be explained by several adaptive traits that enhance its survival and dispersal in arid environments. Firstly, its remarkable adaptation to extreme desert and semi-desert conditions is paramount. The species thrives in environments characterized by high temperatures, erratic and low

rainfall, and nutrient-poor, often sandy or rocky, soils (Al-Qurainy, et al, 2012). Its xerophytic adaptations including reduced leaf size, spiny structures, and dense trichomes, help minimize water loss and deter herbivory, enabling its survival in niches where most other plant species cannot persist (Sher & Hussain, 2009).

Secondly, *Zygophyllum mayanum* employs highly efficient reproductive strategies that facilitate its dispersal. Its small, desiccation-tolerant seeds are readily dispersed by abiotic factors such as wind and water runoff, particularly within ephemeral wadi systems. Furthermore, biotic dispersal mechanisms play a crucial role; seeds may be transported externally by attaching to animal fur or internally through ingestion and later excretion, a common occurrence in desert ecosystems.

This animal-mediated dispersal is particularly effective in facilitating long-distance seed dissemination, especially through grazing and migratory patterns of livestock (Tielbörger & Prasse, 2009., El-ahmir, 2015). Beyond natural dispersal, unintentional anthropogenic pathways, such as contamination of agricultural products within global trade networks, have also contributed to the introduction of *F. isotricha* into new geographical areas (Mack, & Lonsdale, 2001). The cumulative effect of these adaptive traits and dispersal mechanisms, coupled with its inherent ability to colonize diverse habitats, has significantly contributed to its widespread establishment globally (Fig 4).

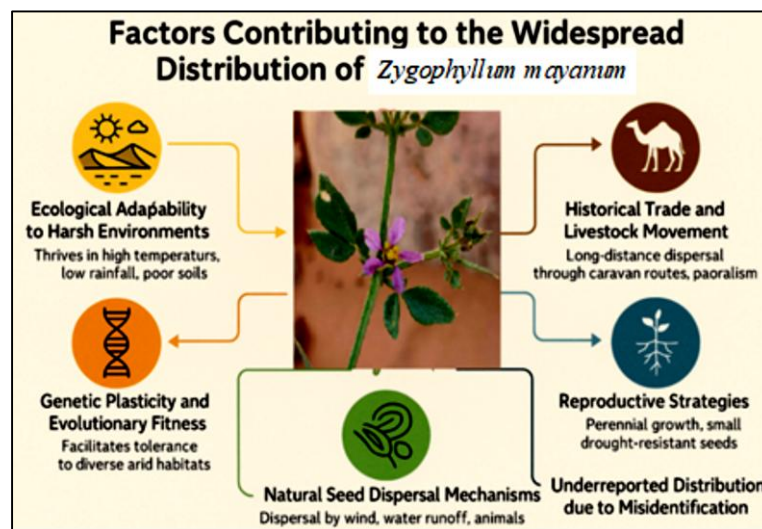


Figure 4: Factors of *Zygophyllum mayanum* distribution .

The initial record of *Zygophyllum mayanum* (Schltdl.) Christenh. & Byng (*Fagonia isotricha*) in the Sabha region of Libya, approximately 700 km south of Tripoli, prompts critical questions regarding its mode and timing of introduction into the Libyan ecosystem. While the precise mechanisms of its arrival remain to be definitively determined, plausible hypotheses include natural dispersal events or its introduction as a seed contaminant, given its observed presence in both undisturbed natural vegetation and cultivated agricultural fields within the region. The species is readily identifiable by its distinctive morphological characteristics, including glandular pubescence, spiny stipules, and small, rose-colored flowers, which serve as key diagnostic features for distinguishing *Z. mayanum* from other closely related species inhabiting arid and semi-arid environments (Mack & Lonsdale, 2001).

This discovery underscores the critical need for ongoing research to comprehensively elucidate the ecological role of *Z. mayanum* and to assess its potential impacts on indigenous ecosystems and the vital agricultural sector across North Africa. A deeper understanding of these

ecological dynamics is indispensable for developing and implementing effective management strategies for this species. Such strategies are crucial for mitigating any potential negative repercussions on regional biodiversity and sustaining agricultural productivity. Ultimately, this comprehensive ecological insight will empower informed decision-making, ensuring the preservation of ecological balance and fostering agricultural sustainability throughout the region.

## Conclusions

This study provides a taxonomic note on *Fagonia isotricha* Murb. from Libya, clarifying its status as a synonym of *Zygophyllum mayanum*. While the species is not newly recorded for the country, the present work contributes valuable field and morphological documentation supporting its occurrence.

This work highlights the value of combining field observations, herbarium analysis, and global taxonomic

databases to ensure accurate and up-to-date floristic knowledge.

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**Conflict of interest:** The authors declare that there are no conflicts of interest

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