Research Article



# Morphological Characteristics of Endemic Species of Araceae to Al-Jabal Al-Akhdar, Libya (Field Simulation)

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*Abstract*—Flora of Libya database includes about 168 plant families that need to be updated periodically. This review is submitted as a modern field simulation of Araceae species endemic herbaceous to Libya. This study included field visits to ten sites in Al-Jabal Akhdar region, an inventory of species belonging to Araceae, a comparison was made between our study's morphological measurements and those found in flora of Libya. This Study revealed a distribution of three herbaceous species belonging to Araceae in Al-Jabal Al-Akhdar represented by (*Arisarum vulgare, Arum cyrenaicum* and *Biarum bovei*). *Biarum bovei* was the least found species by 40%. The results of the morphological study also showed some discrepancies, especially in morphological measurements such as plant height, number of leaves and some floral characteristics (length of spathe and spadix), which may have high taxonomic values in identification and classification of the members of Araceae.

Keywords—Araceae, Flora of Libya, Morphogical Characterization, Field simulation.

# 1. Introduction

Flora of Libya must be re-evaluated using contemporary methods because the last published records describing native flora were issued in 1989 [1]. Libya covers an area of roughly 1.7 million km<sup>2</sup>; this does not correspond to the number of recorded Libyan plant species, which indicates that this environment is still a raw environment for many studies; although the vegetation of Libya has been the subject of much investigation, many families lack sufficient documentation [2]. For example, if we search for the taxonomic keys for plant species in Libya, we will return to old keys created by Renato Pampanini in 1931, and this was applied in 2015 when the first part of the Libyan Flora collection was published as an attempt to reconstruct contemporary plant types, which suggested several taxonomic updates. However, some errors were discovered after the results of the first part were released, which led to the release of the second part [3]. The number of Libyan plants is estimated at 2103 species belonging to 856 genera and 155 families, the families Lamiaceae, Asteraceae and Apiaceae dominate the most important sites of vegetation gatherings [4,5].

Araceae family ranks as the third largest among monocot families, several of which are significant to agriculture and horticulture worldwide. It is widely distributed in humid tropical regions, especially in South and Central America, Southeast Asia, and North Africa. A family with 3,645 documented species and 144 genera [6,7,8]. Araceae also has an amazing fossil record that dates back to the early Cretaceous, containing some of the earliest known examples of monocots [9,10]. Some studies have indicated the presence of herbaceous genera from the Araceae family among the endemic plants in Libya, based on ancient volumes of Libyan flora for their definition and diagnosis [11,12].

# 2. Related Work

The period between 1977 and 1989 is considered the peak period for flora of Libya. A series of volumes were published to describe the latest Libyan plants and place them within specific families and genera [13,14]. After that, most previous studies were limited to what was related to the vegetation in Libya, especially the Al-Jabal Al-Akhdar region, by relying on survey studies (inventory and registration) and issuing checklists of endemic plants without paying attention to the taxonomic aspect. Agiel & Mericli (2017) presented a list of Aromatic Plants of Libya [15] The plant diversity of invasive plants in Libya was also analyzed and a list of about 13 families was issued [16]. Additionally, it was discovered that roughly 145 species of Libya's indigenous flora are edible [17]. A few studies have focused on plant families, where [18] A description including a comprehensive list of Asteraceae family was made in the Jufra Oasis in Libya, Libya. The Fabaceae family has received wide attention from an analytical and reference point of view by researchers in

Libya [19,20]. Also, distribution of the study of species floristic of family Poaceae in Libya[21].

Therefore, this study was conducted as a modern field simulation to confirm the morphological characteristics of Araceae species endemic to Libya.

# 3. Experimental Method

#### 3.1. Study area:

Al-Jabal Al-Akhdar in the eastern region of Libya (Figure 1). has a climate that is hot-dry in the summer and cold-rainy in the winter.. The summer extends from May to August, and the winter extends from December to March, and the highest rates are Rainfall falls in December and January, and the average annual temperature is about 16°C. Its lowest rates are in February and its highest rates are in June. This region is characterized by the dominance of northern and northwestern winds in winter, and southern and southwestern winds in summer, the region consists of soils of calcareous origin, the most common type of which is shallow red soil [22,23].

#### 3.2. Field study:

Araceae, naturally distributed in Al-Jabal Al-Akhdar region-Libya. A field survey was conducted during the 2023-2024 AD seasons to follow up and inventory varieties belonging to the botanical family in ten locations of Al-Jabal Al-Akhdar, which included (Al-Bayda, Al-Wasita, Qaser Libya, Al-quba, Sidi Al-humray, Shahat, Aslanta, Omar Al-Mukhtar, Qandula, Marawah). Important measurements were taken and documented from within the study sites with photographs using mobile. Samples were collected and transferred to the Biology Laboratory/College of Education/Omar Al-Mukhtar University, for classification and preservation.

#### 3.3. Morphological and taxonomic study:

Taxonomic descriptors for Araceae Characters have been identified. Tuber shape, plant height, Leaf shape, leaf blade length, leaf Type of venation, petiole length and surface Features. Spathe; Shape, Color and Length. Spadix; Shape, Color, Length, length of the male and female area, sterile area Length. Classify descriptions based on [13,24,25].

#### 4. Results

#### 4.1. Field Study:

The field study's findings for ten locations in the Al-Jabal Al Akhdar region for the 2023–2024 AD seasons (Table .1). After investigation and investigation, the presence of species belonging to the Araceae family was documented in all sites of the studied regions (Figure .1), at a minimum of two types per site. The most abundant species that appeared in all the studied regions were *Arum cyrenaicum* and *Arisarum vulgare* at 100%. In contrast, the least abundant species was *Biarum bovei*, which was recorded in four areas south of Al-Bydea city (Aslanta, Omar Al-Mukhtar, Qandula, Marawah) at 40%.

**Table.1.** Distribution of endemic species from Araceae in the study locations.

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Location Specis	Al- Bayda	Al- Wasita	Qaser Libya	Al- quba	Sidi Al- humray	Shahat	Aslanta	Omar Al- Mukhtar	Qandula	Marawah	Total (%)
Arum cyrenaicum	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	100%
Arisarum vulgare	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	100%
Biarum bovei	×	×	×	×	×	×	$\checkmark$	$\checkmark$			40%



Figure. 1. Endemic herbaceous species of Araceae in Libya. A: Arisarum vulgare; B: Arum cyrenaicum; C: Biarum bovei

# 4.2 Morphogical study:

# 1-Arisarum vulgae:

An annual herbaceous with a maximum height of approximately 45cm, with irregular disc tubers or underground rhizomes, it is found at a depth of up to 20 cm under the soil, extending to create huge colonies covering the ground.Petioles emerge from the Rhizomes or tubers, have a sheath short, green with a white upper end or spotted with purple or dark green; leaves 1-3 and often 2 with blade hastate, sagittate, cordate or acute-ovate-shaped green  $5-13 \times 3-9$  cm, a smooth surface, dark on the upper side, and pale on the lower side, pinnate veins. Inflorescence; an erect single-

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tubular (spathe, spadix), bisexual, monoecious, Spathe up 7cm long, shape hood-like, purplish-brown or purple-green striped, smells of dung, spadix up 8cm long, a thin green strip shape resembling a sparrow's tongue, emerges from the spathe. Male and female flowers are located at the bottom of a spadix, male flowers are always higher than the female flowers, extending for more than a third of a spadix tube length. Male flowers; stamens yellow with short filaments, a single anther, theca, opens by an apical slit. Female flowers; a few 2–5, ovary 1-locular, depressed-globose, style base persistent, stigma hemispherical. Seeds; small ovoid irregular pale white 2mm. Fruits; 4-5 berries, irregular with acut corners 1.2 cm (Figure .2).



Figure 2. Morphological structure of Ariarum vulgare parts.

#### 2- Arum cyreniacum:

An annual herbaceous with roots; discoid tubers  $3-5\times1-3$ cm. leaves usually 4 leaves, individual simple, with blade Hastate or sagittate, with a sharp apex of 7-22×5-13cm, reticulatepinnate veins with vein central clear. Petioles; dark green 6a tubular bract, bisexual, 30cm long. Inflorescence; monoecious. Spathe up 26cm long, coiled at the bottom, widening in the middle, and sharp at the top, an erect hang sail shape, smells of dung, with a dark purple at the edges with green, pale in the middle. Spadix; a cylindrical structure, slender at the bottom and swollen at the top, dark purple 6-12 long 6-11 cm. The female flowers are below the male flowers on the lower spadix part, the distance between them is usually 4-8 mm. Male flowers 4 or 5 purple circular rows, stamens with short filaments bearing a pale purple anther, with flexible top filamentous hairs of yellow to cream color (Staminodes). Female flowers 6 or 7 yellow circular rows, ovary 1-locular, 4 ovules usually, style absent, stigma hemispherical, parietal placentation topped with creamy vellow flexible filamentous hairs (pseudocarpels Pistillodes). Fruits; green berries, when they mature orange and then red. seeds; oval (Figure .3).



Figure 3. Morphological structure of Arum cyrenaicum parts

#### 3- Biarum bovei:

An annual herbaceous with a maximum height of approximately 25cm, with Tuber globose. Leaves 3-9 Hysteranthous with blade ovate, oblong-shaped green 7.5×4cm, a skin surface, pinnate veins. Petioles; white adaxial 7cm. Inflorescence; a cylindric tube, base globose, bisexual, monoecious. Spathe up 13cm long, channeled at the back usually, an erect hang Borage shape, smells of horse dung, exterior white-green at the base, heavily stained purple at the top, pale green-purple inside, green outside. Spadix, a cylindrical structure, dark green-brown up to 14cm long. The female flowers are below the male flowers on the lower spadix part, the distance between them is usually 8-13mm. male flowers in a cylindrical zone, a dark purple anther; sterile flower zone (staminodes) flexible top filamentous hairs of purple 11mm. Female flowers in a globose cluster, ovary 1-locular, ovules oblong, pale cream usually, style absent, stigma hemispherical, parietal placentation. Fruits; purple berries when ripe; head pyriform consisting of 8-12 berries. Seeds; globose to oval  $2-4 \times 1.5-2$  mm (Figure .4).



Figure 4. Morphological structure of Biarum bovei parts.

**Table 2.** Morphological characteristics of endemic species in Libya.

Spcies charachtes	Arisarum vulgare	Arum cyrenaicum	Biarum bovei	
Plant height	45cm	40cm	25cm	
Roots	Tubers or rhizomes	Discoid tubers	Globose tubers	
Petioles	Spotted with purple or dark green+ sheath short	Dark green+ sheath short	White adaxial	
Leaves	1-3+ hastate, sagittate, cordate or ovate	4 + hastate or sagittate	3–9+ Hysteranthous: ovate or oblong	
Spathe	Hood-like shape +striped+purplish- brown or purple- green	An erect sail shape+dark purple with green+up 26cm long	An erect borage shape+green outside+purple inside	
Spadix	A thin sparrow's tongue+ up 8cm long	Cylindrical+dark purple+up12cm long	Cylindrical+dark green-brown+up to 14cm long	
Fruit	4+berries+acut corners	65+pyriform berries: green, orange or red.	12+pyriform berries: purple	
Flowering date	February-March	March-April	October - December	

## 5. Discussion

Al-Jabal Al-Akhdar region-Libva is characterized Despite its small area with a great diversity of plant cover, as it constitutes about 80% of the plants recorded in Libya, which belong to many plant families [26]. In line with the continuous changes in updating of Matrix-based computer interactive keys for the Araceae family that are connected to pictures, lexicons, and additional resources to ensure accurate identification. Three endemic herbaceous species of this family from Libya were presented in this study, with a more accurate description and accompanying photos, compared to the information provided by [14,27]. The field study results indicate that this family is one of the small families present within the Libyan plant life compared to the dominant biggest families mentioned by some old and modern survey studies, which have been restricted to inventory and recording, they did not address the morphological description and precise documentation attached to photos from within the study sites [5,19]. The field study reflects an adaptation of Araceae to environmental conditions, the presence of two spices, Arisaum vulgare and Arum cyrenaicum prevails in all areas of Al-Jabal Al-Akhdar, while Biarum bovei is found in the southern regions only of Al-Jabal Al-Akhdar. This may be due to the latter species' tendency to flower in dry conditions so that the inflorescences appear early on the bare ground before the leaves in late autumn, this was confirmed by [28]. While Arisaum vulgare and Arum cyrenaicum are adapted plants that like shady places under trees, shrubs, rocky slopes, and a high level of humidity [29]. The results of the morphological study came with an accurate description of three species in their original environment, and when this description was compared with the taxonomic keys and the description of [14,27], Some differences were observed in many measurements, such as plant height, length of spathe,

spadix, petioles, tubers, and leaf blades (Table .2), which are considered to have high taxonomic value at the species level.

### 6. Conclusion

This study presented three Endemic herbaceous species of Araceae family in Al-Jabal Al-Akhdar- Libya region, as a field-morphological simulation. The present study focused on the Morophical description of the native Family Araceae of Libya. This description includes Some measurements that may have high taxonomic values in the identification and classification of the genera Araceae, In addition to distribution areas. In conclusion, this work may encourage many Libyan researchers and botanists to take serious steps to rebuild and restructure the Flora of Libya database, so that it is available on its website in a more advanced form so that it is a field guide accompanied by a documented morphological description of plant species and genera from within the original environment.

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#### **Data Availability**

Data can be obtained from the appropriate author upon request.

#### **Conflict of Interest**

There is no conflict of interest, according to the authors.

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#### **Authors' Contributions**

The idea of the article and field and morphological study was equally between researchers

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