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Endmic plants in the Yabraq valley Alwadeea District, Abyan Governorate-Yemen

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A B S T R A C T

Yemen is characterized by its rich plant diversity, featuring endemic plants unique to its environment, as well as near-endemic plants that are restricted to the Arabian Peninsula. This study aimed to inventory the endemic and near-endemic plant species in Yabraq Valley, as these species serve as geographical indicators of their regions and have various uses, including in food and medicine. The study results revealed the presence of six plant species endemic to Yemen alone, 23 species shared between Yemen and the ArabianPeninsula, 21 species endemic at the regional level. The total number of endemic, near-endemic, and regionally endemic species reached 50, belonging to 33 genera distributed across 22 plant families. In this study, the plant family with the highest number of endemic species was Apocynaceaea, comprising eight species (16%), followed by Euphorbiaceae with five species (10%). The families Asphodelaceaea, Mimosaceae, and Acanthaceae each contained four species, representing (8%) each, while Asteraceae and Lamiaceae had three species each, accounting for (6%).

1 Introduction

Yemen is located between latitudes 19° and 12° north and longitudes 41° and 53° eastIn the southwestern Kingdom of Saudi Arabia borders it on the north, and the Sultanate of Oman borders it on the east. Yemen's varied geography results in a wide range of soil types and climatic conditions, which in turn produce a vast diversity of plants. The nation boasts a significant array of plant species, including both endemic and semi-endemic varieties, with estimates indicating over 608 species, of which 457 are unique to Yemen and 307 are found exclusively on Socotra Island, as noted by Al-Khalidi (2013). Endemice plants are those that are specific to a certain geographic area and do not occur elsewhere. This region is home to Yemen's endemic vegetation. Conversely, plants whose distribution extends into nearby countries, like the Kingdom of Saudi Arabia and the Sultanate of Oman, are categorized as semi-endemice. (Al-Khulaidi *et al*., 2010). Plants are vital to the continuation of life on Earth and are an integral part of every ecosystem. Nevertheless, despite their importance, plant biodiversity is becoming more and more threatened worldwide, as the number of endangered species increases significantly every year (Fao, 2019). In addition to more recent factors like pollution and spring experiences significant wind speeds, peaking in March at 1.79 m/s (Nasser, 2009).

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Annual rainfall varies between 140 and 190 mm, with the majority of precipitation in the medium and high-altitude regions occurring from June to September, attributed to the influence of the southwest monsoon winds (Al-Mansiri, 2002). Figure (1). Research into endemic plants aims to protect biodiversity, understand their roles in various ecosystems, and prevent their extinction. Examining these plants is also crucial for conserving natural heritage and promoting sustainable development.

region of the Arabian Peninsula, the country is bordered by the Red Sea to the west the Arabian Sea and the Gulf of Aden border it on the south, the climate change that contribute to the erosion of genetic diversity, habitat destruction and alteration—mainly from human overexploitation—are frequently linked to the decline of natural populations or the extinction of entire species (Corlett& Bigger 2017; Reed et al., 2011). Since many of these species are endemic—that is, exclusive to particular areas—only a few tiny wild populations are frequently left (Reed *et al*., 2011; Sarasan et al., 2006). The definition of an indigenous species as one with a high degree of environmental adaption that only exists naturally in a certain geographic place (Işik, 2011). These species can be classified as "local endemic" (confined to a small area), "provincial endemice" (limited to a province), "national endemica" (restricted to a nation), "regional endemic" (bound to a geographical region), and "continental endemic" (limited to a continent) based on the size and boundaries of their habitat (Işik, 2011; Ladle & Whittaker, 2011). The majority of endemic species have a number of traits, such as their limited range, that make them more vulnerable to both natural and man-made threats.

2 Materials and Methods

It is located in the Yabrai qvalleye in the district of Al-Wade'e, Abyani Governorate, Yemeni and cover about 2785 Km^2 (Figure 1), at latitude between 13.920573 and 13.517228, and longitude between 46.047728 and 46.684208, The elevation varies from 70 to 1250 meters above sea level, with the southern mountain ranges in the area providing a view of the Gulf of Aden. Temperatures fluctuate between 18.2 and -52.7 °C (Al-Najashi, 2019). The predominant wind direction shifts from northeast to east during the winter and spring months, while it transitions to south and southwest in the summer and autumn. The highest wind speed occurs in winter (January) at 1.92 m/s, whereas.

Specimen Collection and Identification:

Between March 2020 and June 2022, a number of field works were completed. The plant sample was collected in the village of Farida, near Wadi Yabraq in the Al-Wadaya district of Abyan .

The following references were used to define plants and identify endemic plants. Abdullah & Al-Dosari ,2022; Al -Gifri,& Hussein,1993; Al-Gifri&Al-Subai,1994;Al-Gifri etal,2019; Al-Hawshabi etal,2017;, Al-Khulaidi ,2013; Beier,2005; Boulos& Al-Dosari,1994; Dahmash, 2015; Kilian et al. ,2004 , 2006); Boulos (1988, 1994) ; Giesen etal.2007; Thulin2004, -Gifri et al.2024; Mazen etal.2024; Azmi etal 2024; Al-Khulaidi etal,2020;Alsuper,2023; Alhood 2020)classification. Phytogeographical cate- gories were distinguished based on World Online(https://powo.science.kew).

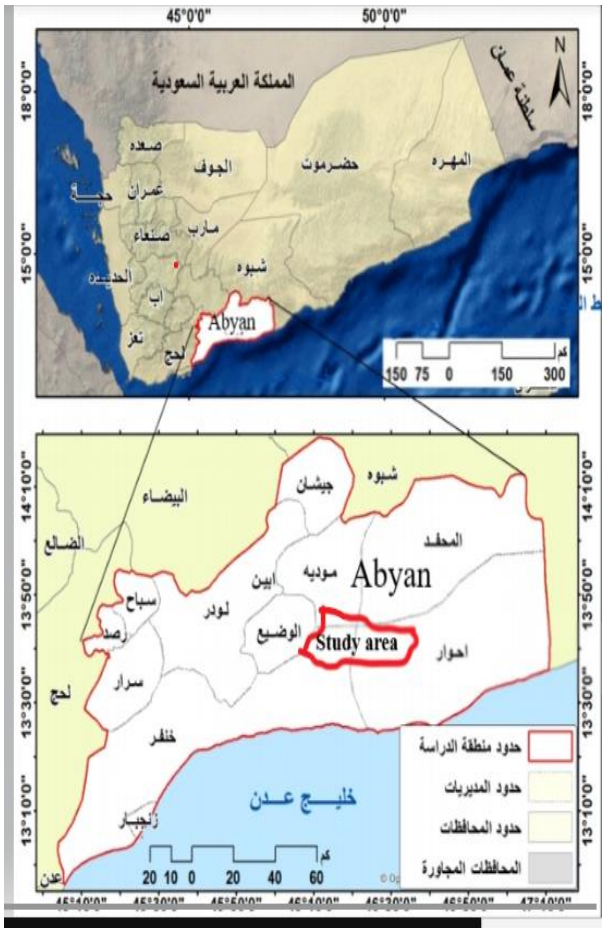

Figure (1): The location of the study areaAl-(Najashi,2019).

3 Results and Discussion

The results were analyzed and endemic, near-endemic, and regional endemic plants were identified. Table (1) shows the most important families containing the largest number of endemic plants were determined and represented graphically.

R.E-regional endemici (such as Sudan, Somalia, Ethiopia, Eritrea, and Kenya) examples are: Arab- Pen-Arabian Peninsulae. The number of endemic, Near-endemic and regionally endemic species was 50 species and 33genera within 23 plant families, while the families containing the most endemic species Apocynaceaee (8 species 16%.) and Euphoriacea 5species 10%, (Aloeaceaee and Mimosaceae and Acanthaceae. represented by 4species and a percentage of 8% and the plant family Asteraceae and , Lamiaceae represented by 3 species and a percentage of 6%. The dominant genera were Euphorbia. and Aloe These results differ from the results of (Mazen *et al*.,2024) (Figure 2).

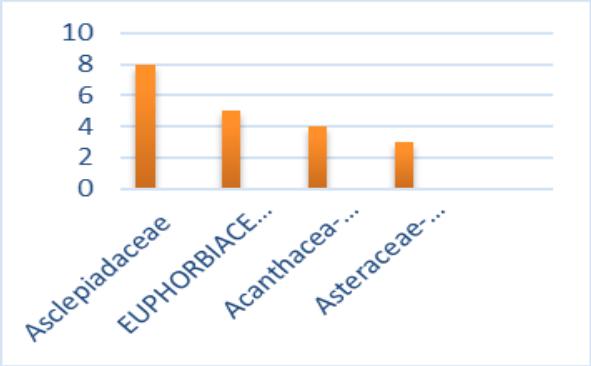

Figure (2): List of the recorded families.

Table (2) shows the endemics species in Yemen in the study area were represented by 6 species and a percentage of 12%. Near-endemic species are represented by 23 species, representing 83.48%.

Table (3) displays the comparison of many studies conducted in various Yaemeni locations. The study by Al-Super indicates that the number of endemic and near endemic plants was the largest. This study ranks second for near endemic plants, followed by Ahood for endemics and near endemici species, (Azmi *et al*.,2024) for near endemic plants, and (Mazen, *et al*.,2024) for regional endemic.

The majority of the plant species in the study area are unique to the region. This is because the majority of Yaemen's flora belongs to the Sudanian area, which is a biogeographic zone that spans eastern Africa. Eastern and southern Ethiopia, southeastern Sudan, northeastern or southeastern Uganda, the majority belonging to Kenya, central Tanzania, Somalia, and the southern, figure3. (Al-Khalidi, 2013). (Al-hood, 2024), (ALSobeai,2024), (Hamood,2012.) found in the study area were also recorded such as *Euphorbia greuteri*this plant species has been recorded only from Jabal Al-Arais. (Gabali, 1995) observed that endemic and near-endemic plant species are abundant in this area. Because the research region is located on the same latitude and longitude as Jabal Al Arays, where 23 endemic and near-endemic species are found, this species is present there. (Al-Khalidi, 2013). Additionally, several endemic species, including *Fagonia hadramautica*, have only been found in the Hadhramaut Governorate

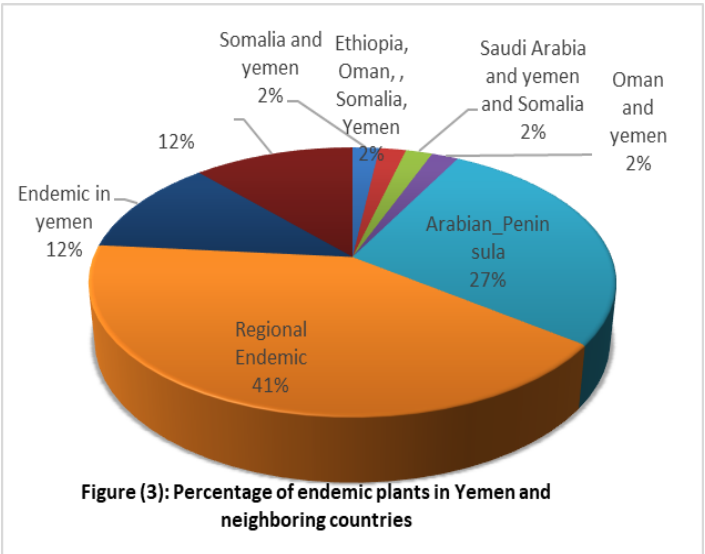

Figure (3): Percentage of endemic plants in Yemen and neighboring countries

Table (1): List of plant species in the study area

Family	Scientific names	Endemic	near Endemic	Regional endemic
Acanthaceae	*Anisotes trisulcus* (Forssk). Nees			Rg
	Barleria. proxima Lindau.			Rg
	Barleria prionitis subsp. appressa (Forssk.) Brummitt & J.R.I.Wood		Yemenand Saudi Arabia	
	*Ruellia discifolia*oliv.			Rg
Aizoaceae	*Trianthemacrystallina*(Forssk.) Vahl			Rg
	Trianthema. Portulacastrum. L			Rg
Asphodelaceae	*Aloe splendens* lavranos	Yemen		
	*Aloe inermis*Forssk			Rg
	*Aloe vacillans*Forssk		Yemen and Saudi Arabia	
	Aloe lanata T.A.McCoy & Lavranos.	Yemen		
Apocynaceae				
	Ceropegia awdeliana (Deflers) Bruyns		Oman and Yemen	
	Ceropegia deflersiana (Lavranos) Bruyns		Yemen and Saudi Arabia	
	Cynanchum forskaolianum (Schult.) Meve&Liede		Yemenand Saudi Arabia	
	Cynanchum radians (Forssk.) Lam.		Yemen and Somalia	
	Desmidorchis adenensis (Deflers) Meve & Liede	Yemen		
	Rhytidocaulon macrolobum Lavranos		Arab.-Pen.	
	Monolluma hexagona (Lavranos) Meve & Liede		Arab- Pen.	
	Monolluma.quadrangula (Forssk.) Plowes		Arab-Pen	
Asteraceae	*Kleinia odora. (*Forssk.) A. Berger.			Rg
	Pulicara jauberti. Gamal-Eldin			Rg
	Pulicaria somalensis. O. Hoffm. subsp. schweinfurthii Gamal-Eldin		Arab- Pen	
Boraginaceae	*Heliotropium longiflorum* (A.DC.) Jaub. & Spach		Arab- Pen.	
Brassicaceae	*Farsetia linearis* Dene ex Boiss		Arab- Pen	
Buraceraceae	*Commiphora kataf*(Forssk.) Engl.		Arab- Pen	
	Commiphora myrrha(Nees) Engl.			Rg
Chenopodiaceae	Halothamnus bottae Jaub. & Spach		Arab- Pen.	
Crassulaceae	*Kalanchoebentii*Hook. f.subsp. bentii		Yemenand Somalia	

Dracaenaceae Asparagaceae	*Dracaena hanningtonii* Baker .			Rg
Euphorbiaceae	*Euphorbia inarticulata*Schweinf.		Yemen and Saudi Arabia.	
	Euphorbia balsamifera Ait. subsp. *adenensis*(Defl.) Bally			Rg
	Euphorbia hadramautica E.G.Baker		Ethiopia,Oman, Somalia, Yemen	
	Euphorbia greuteri N. Kilian, Kürschner& P. He	Yemen		Rg
	Jatropha spinosa Vahl			Rg
Fabaceae	*Indigofera spinosa* Forssk.			Rg
	Zygocarpum yemenense (J.B.Gillett) Thulin & Lavin	Yemen		
Lamiaceae	*Leucas alba* (Forssk.) Sebald		Yemen and Saudi Arabia	
	*Ocimum forsskaolii*Benth.		Arab- Pen	
	*Teucrium yemense*Defl.		Arab- Pen.	
Mimosaceae	*Vachellia etbaica subsp. uncin*ata (Brenan) Kyal. & Boatwr			Rg
	Acacia hamulosa. Benth.			Rg
	Acacia nilotica (L.) Willd. ex Delile subsp.*indica*(Benth.) Brenan			Rg
	Acacia tortilis (Forssk.) Hayne subsp. *tortilis*			Rg
Moraceae	*Ficus vasta* (Forssk.)Thunb.			Rg
Orobanchaceae	*Cistamche rosea.* E.G.Baker		Arab- Pen.	
Plantaginaceae	*Campylanthu. spungens* .Schwart)		Arab -Pen.	
Resedaceae	*Reseda sphenocleoides.* Defl.		Arab- Pen.	
Rubiaceae	*Pavetta longiflora* Vahl subsp. *longiflora*		Arab- Pen.	
Salvadoraceae	*Dobera glabra* (Forssk.) Poir			Rg
Tiliaceae Malvaceae	*Grewia. erythraeae* Schweinf.			Rg
Zygophyllaceae	*Fagonia hadramautica* Beier&Thulin	Yemen		
	R.E-regional endemic (such as Sudan, Somalia, Ethiopia, Eritrea, and Kenya) examples are: Arab- Pen-Arabian Peninsula.			

Table (2) List of endemic and near endemic in study area

Near Endemic	Number of species	Percentage
Yemen and Saudi Arabia	**6**	**12**
Somalia and yemen	**1**	**2**
Ethiopia, Oman, , Somalia, Yemen	**1**	**2**
Saudi Arabia and yemen and Somalia	**1**	**2**
Oman and yemen	**1**	**2**
Arabian_Peninsula	**13**	**28**
Total	**23**	**48**
Regional Endemic	**21**	**42**
Endemic in yemen	**6**	**12**

Table (3) comparison between Endemic and near endemic species in the study area and other studies in Yemen

regional Endmic	Near Endemic	Endmic	Comparison
-	**20**	**8**	**Azmi et al.2024**
-	**11**	**5**	**Mazen etal.2024**
21	**23**	**6**	**Study area**
	20	**21**	**Alhoodetal 2020**
	37	**23**	**2023,Al-Super**

Conclusions

The study records: 6species were found to be endemic to Yemen only 23 plant species were endemic to both Yemen and the Arabian Peninsula 21 species were found to be endemic to the region. The quantity of species that are classified as endemic, near-endemic, and regionally endemic. were 50 plant species and 33genera within 22 plant families,

The WadiYabrig region and the Mahwari villages are home to a rich diversity of endemic, near-endemic, and regional endemic plants, indicating a high level of biodiversity in the area.

Indigenous plants in Yemen are natural treasures that must be protected and preserved for future generations. Through collective efforts, we can ensure the survival of these unique plants and continue to enjoy their beauty

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

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