

# Cataloguing Pteridophytes in Girnar Wildlife Sanctuary, Gujarat: An Inaugural Checklist

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## ABSTRACT

Pteridophytes, a group of vascular cryptogams, once reigned supreme on Earth 250 million years ago, ranking as the second most dominant plant category. The primary focus of this study was the pteridophyte population within Girnar Wildlife Sanctuary. A comprehensive study identified a total of 18 pteridophyte species belonging to eight genera and five families in this region. Among these families, Pteridaceae exhibited the highest species richness and contained four genera and seven species, while Ophioglossaceae contained one genus and five species, While Athyriaceae contained one genus and two species. The remaining families, Selaginellaceae, Marsileaceae, and Hypodematiaceae, each contributed a single genus and a solitary species to the sanctuary's pteridophyte diversity. Remarkably, this study marks the first checklist documenting the pteridophyte diversity in Girnar Wildlife Sanctuary. Notably, the findings suggest a relatively limited pteridophytic flora in the Girnar region and the need for more extensive research efforts to unveil a broader spectrum of pteridophyte species beyond the currently identified eighteen species.

**Key Words** - Pteridophyte, Population, Richness, Diversity, Girnar Wildlife Sanctuary

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## INTRODUCTION

The name pteridophytes were derived from the Greek words, *pteron* denoting feather and *phyta* plant, due to feather like leaves. The ferns and fern allies together form the pteridophytes. Pteridophytes are the considered one of the early land dwellers and most primitive group of vascular plants that appeared on this planet in the mid-Palaeozoic era (i.e., approx. 438 million years ago) during the Silurian period (Dudani *et al.*, 2011, 2014). They played a massive role in the establishment of plants on land during these periods. Due to their high reproductive ability and simple genetic makeup, pteridophytes quickly invaded the seashores, riverbanks, and places with very little disturbances (Kenrick and Crane, 1997). In the past, there were large fern trees that showed secondary growth, but at present, the numbers of

tree ferns are very few. Currently, pteridophytes constitute the second largest floral group (Krishnan and Rekha, 2021). This interesting group of plants form an important component of forest ecosystem and act as connecting bridge between the non-vascular cryptogams and the seed plants and occupy various niches on the land, in marshes, swamps and in water bodies (Dudani *et al.* 2011). Generally, the pteridophytes are distributed along a latitudinal gradient, with the highest diversity in the tropics (mainly in mountainous areas) (Kornas, 1993). The maximum diversity was observed at the high-altitude zone, high rainfall zone, high atmospheric humidity and low temperature zone (Patil *et al.*, 2016). The majority of them thrive well in shady and moist places but a few survive in rock crevices and dry places while some of them such

as *Salvinia* and *Azolla* grow in aquatic habitats (Bower, 1923, 1963). They are highly sensitive to microclimatic conditions, thus even small disturbances in the climatic and other environmental factors can cause their extinction from the natural habitats, and hence the existence of pteridophytes is largely dependent on the existence of these forests.

Pteridophytes According to Moran (2008), there are 13,600 species of ferns globally, and of this, approximately 1200 species with 70 families and 192 genera are seen in India (Dixit, 1984; 2000; Patil *et al.*, 2016). In Gujarat, there are 50 species of pteridophytes belonging to 23 genera and 14 families (Rajput *et al.*, 2021). The genus *Ophioglossum* L. is the most specialized in the eusporangiate fern family Ophioglossaceae (Yadav and Goswami, 2010).

The Girnar Wildlife Sanctuary, located in the Western Indian State of Gujarat, is a fascinating natural habitat that is home to a diverse range of flora and fauna, including various species of pteridophytes. Its landscape is characterized by rugged terrain, rocky hills, and several perennial water bodies, making it a suitable habitat for a variety of wildlife species. The Girnar Wildlife Sanctuary primarily consists of dry deciduous forest, with some patches of mixed deciduous forest. To provide an introduction to the pteridophyte diversity within the Girnar Wildlife Sanctuary, we can explore the unique characteristics and significance of these plants within this specific ecosystem.

However, there is no such report on diversity of pteridophyte from the Girnar wildlife Sanctuary. This emphasizes to study the first check list of pteridophyte along with a Girnar wildlife Sanctuary.

## **MATERIALS & METHODS**

### **Study area**

The present study was conducted in Girnar Wildlife Sanctuary. Girnar Wildlife Sanctuary is located in the Junagadh district of the state of Gujarat, India. It is situated near Girnar Hill. The Girnar Hills are famous since ancient times as a place of pilgrimage

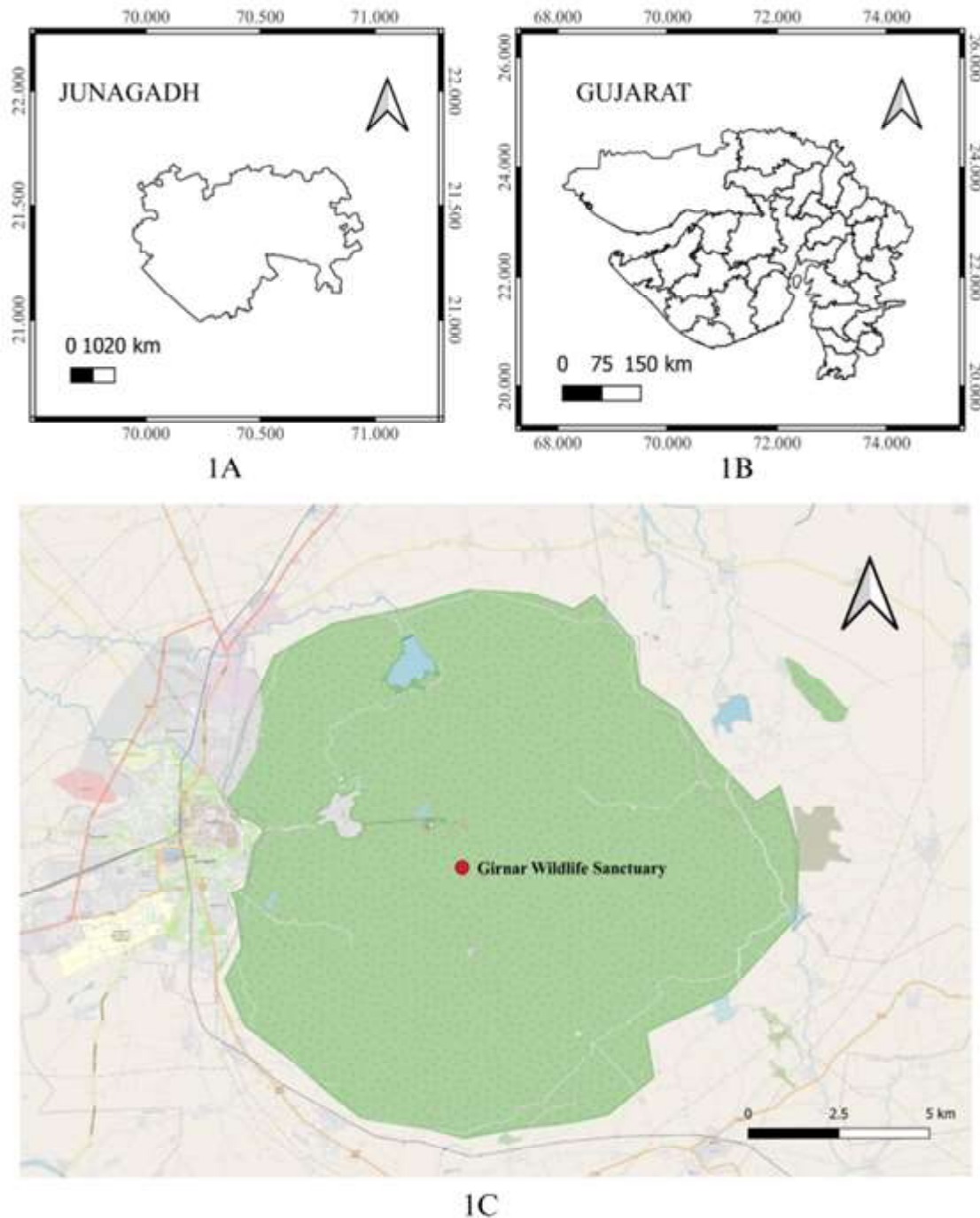
for both Hindus and Jains. Girnar Wildlife Sanctuary covers an area of 178.8 square kilometres. The Girnar Hills are situated between parallels of latitude 21°25' to 21°35' N and meridians of longitude 70°30' to 70°40' E. Looking from above, the forest area looks like a circular disc of about 16 km. in diameter.

### **Field Study**

The present study is the outcome of a critical field study for 15 months in the different parts of Girnar Wildlife Sanctuary. The field study was carried out during June 2022 to August 2023. The field study was made for the entire monsoon and postmonsoon period. All pteridophyte flora encountered were recorded by the visual encounter method. Thus, pteridophytes under various families were recorded, and a checklist was prepared. All pteridophytes were photographed in their natural habitat, and collected specimens were studied in laboratory by using stereo zoom microscope. Identification was done by using identification manuals, reference books, reports, research papers, monographs, and with the help of relevant literature (Bosman, 1991; Manickam and Irudayaraj 1992; Vasudeva and Bir 1993; Nootboom 1997; Khullar 1994, 2000; Ghosh *et al.*, 2004; Fraser-Jenkins 2008; Negi *et al.*, 2009; Kholia *et al.*, 2014). The classification proposed by PPG-I (2016) has been followed for the family and genus-level status of Pteridophytes.

## **RESULTS & DISCUSSION**

The present study of Girnar Wildlife Sanctuary recorded 18 species of pteridophytes belonging to ten genera and seven families of pteridophytes present in wild from in Girnar Region (Table 1). In the present study PPG-I (2016) classification was followed for the pteridophytes. The order Polypodiales is the most species-rich in this region which covers four families, seven genera and eleven taxa, followed by the order Ophioglossales, which covers one family with one genus and five taxa followed by the order Selaginellales and Salviniiales encompassing single family belonging to one genus and one taxon.



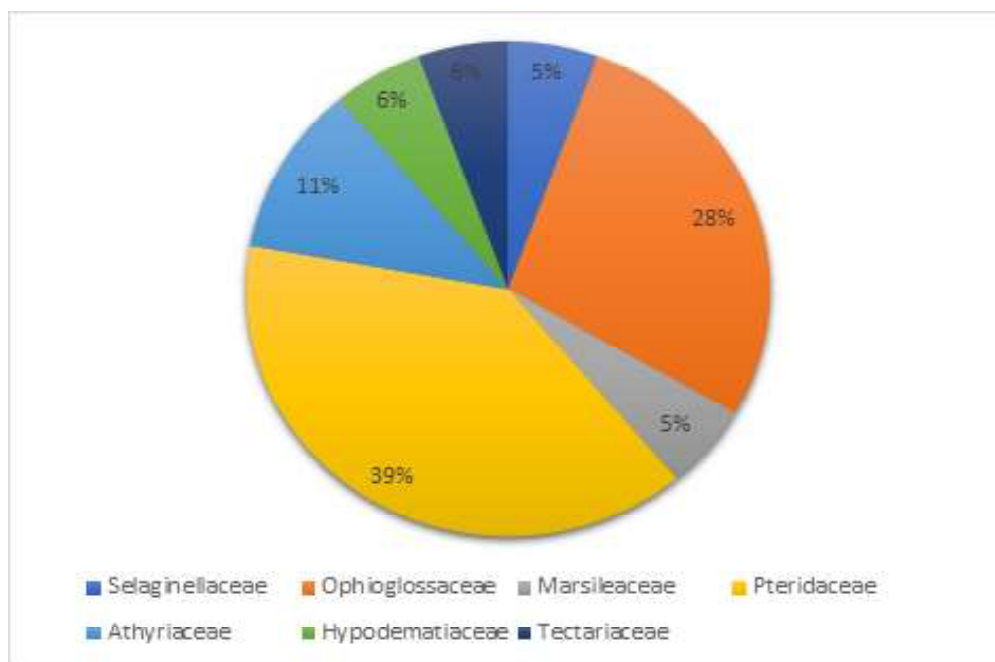
**Figure 1: 1A: Junagadh, (source: QGIS) 1B: Junagadh in Gujarat, (source: QGIS) 1C: Study Area: Girnar Wildlife Sanctuary (Source: QGIS).**

Most number of species were observed in the family Pteridaceae, which comprises four genera and seven species, followed by the family Ophioglossaceae, which comprises one genus and

five species. The remaining families Selaginellaceae, Marsileaceae, Athyriaceae, Hypodematiaceae and Tectariaceae show single genera and single species (Fig. 2).

Table 1- Checklist of Pteridophytes Found in Girnar Wildlife Sanctuary

Class	Order	Family	Genus	Species	
Lycopodiopsida	Selaginellales	Selaginellaceae	<i>Selaginella</i>	<i>Selaginella ciliaris</i> (Retz.) Spring	
Polypodiopsida	Ophioglossales	Ophioglossaceae	<i>Goswamia</i>	<i>Goswamia costata</i> (B. Br.)	
				<i>Goswamia gujratense</i> (S.M. Patil, R.N. Kachhiyapatel, R.S. Patel & K.S. Rajput)	
				<i>Goswamia malaviae</i> (M. Patel & R.M. Reddy)	
				<i>Goswamia polyphyllum</i> (A. Braun apud Seubert)	
				<i>Goswamia nudicaule</i> (Patel & Reddy)	
	Salviniales	Marsileaceae	<i>Marsilea</i>	<i>Marsilea quadrifolia</i> L.	
	Polypodiales	Pteridaceae		<i>Ceratopteris</i>	<i>Ceratopteris</i> spp.
				<i>Actiniopteris</i>	<i>Actiniopteris radiata</i> (Sw.) Link
				<i>Adiantum</i>	<i>Adiantum capillus-veneris</i> L.
					<i>Adiantum philippense</i> L.
				<i>Aleuritopteris</i>	<i>Aleuritopteris albomarginata</i> (C. B. Clarke) Ching
					<i>Aleuritopteris anceps</i> (Blanf.) Panigrahi
					<i>Aleuritopteris bicolor</i> (Roxb.) Fraser-Jenk
		Athyriaceae		<i>Athyrium</i>	<i>Athyrium falcatum</i> Bedd.
					<i>Athyrium hohenackerianum</i> T. Moore
		Hypodematiaceae		<i>Hypodematium</i>	<i>Hypodematium crenatum</i> (Forssk.) Kuhn
	Tectariaceae		<i>Tectaria</i>	<i>Tectaria coadunata</i> (J. Sm.) C. Chr.	



**Figure 2: - Family wise distribution of Pteridophytes**

In my finding, *Adiantum philippense* is cosmopolitan throughout the sanctuary. In contrast, *Adiantum capillus-veneris* L. is seen in only two locations. Which is new record from Gujarat in the study of Kachhiyapatel *et al.*, (2016). Whereas *Aleuritopteris* spp. and *Athyrium* spp. are frequently observed in lithophytic habitats. But in the case of genus *Aleuritopteris*, *Aleuritopteris albomarginata* (C. B. Clarke) Ching is observed only in very high altitude i.e., above 1000 meters. but other species of *Aleuritopteris* viz. *Aleuritopteris anceps* (Blanf.) Panigrahi and *Aleuritopteris bicolor* (Roxb.) Fraser-Jenk. are more common between elevation of 400 to 800 meters. *Hypodematum crenatum* (Forssk.) Kuhn is only found in Girnar Hill, according to comparison with work done in Gujarat. There are only two species of pteridophytes are observe under aquatic habitat, viz. *Marsilea quadrifolia* L. and *Ceratopteris* spp. from the Girnar Wildlife Sanctuary. From which *Marsilea quadrifolia* L. and *Ceratopteris* spp. is newly reported from the Girnar Wildlife Sanctuary. They were not reported in the past from the sanctuary but they were only seen in the Girnar Ecosensitive Zone. Genus *Goswamia* is only found in terrestrial Habitats. We

have observed five species of *Goswamia* from the sanctuary. More ever there are further scope of finding more than five species of *Goswamia*. From the above five species, *Goswamia costatum* is very frequently seen in the field.

A century ago, Saxton and Sedgwick (1918) began studying the pteridophytes of Gujarat by documenting the presence of *Ceratopteris thalictroides* along the Watrak River's bank. After this study numerous other scientists have conducted research on the diversity of pteridophytes in the state of Gujarat. Modi (2015) documented 15 species of pteridophytes from different regions of Gujarat state. According to the survey of Patel and Rajput (2021) in Gujarat State, they recorded 62 species from which 47 were recorded from wild and 15 were under cultivation. They reported three species from Girnar and five species from Junagadh. In my study total of 18 species were recorded from Girnar Wildlife Sanctuary (Fig.3-4). There are high chances of more than 18 species being present in this sanctuary for future study. The compressive work on Pteridophytes diversity of Gujarat state is poorly reflected in botanical literature due to a lack of

enumeration and excursion studies in the state (Rajput *et al.*, 2016a, b) and a relatively minor level of species diversity was reported by GEC (1996). However, the diversity of Girnar forest has been

drastically changed in last three decades. Our several visits in different parts of Girnar forest could not locate the same and need further investigation in this area.

### CONCLUSION

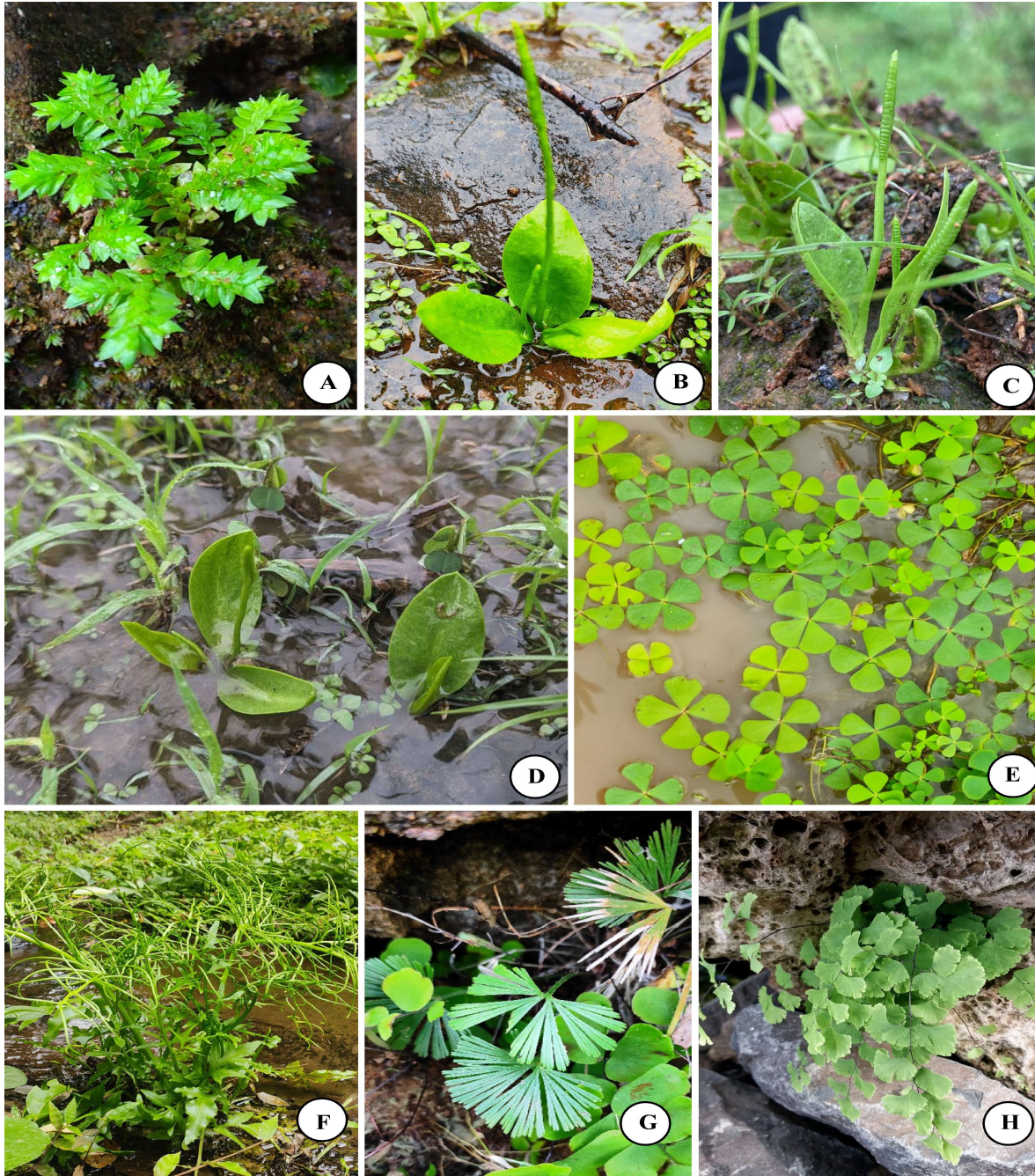
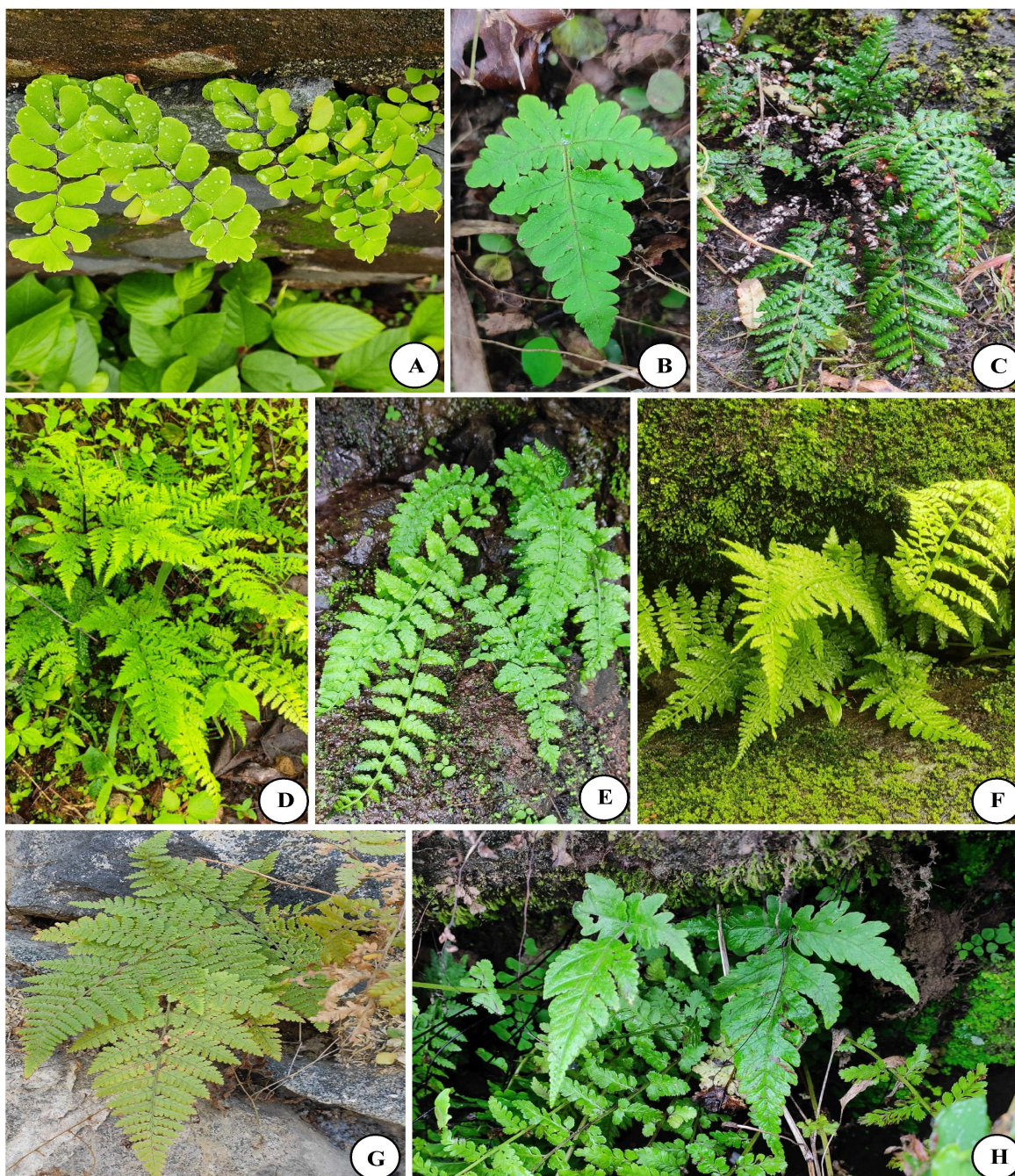


Figure 3. A. *Selaginella ciliaris* (Retz.) Spring B. *Goswamia costata* (B. Br.) C. *Goswamia polyphyllum* (A. Braun apud Seubert) D. *Goswamia gujratense* (S.M. Patil, R.N. Kachhiyapatel, R.S. Patel & K.S. Rajput) E. *Marsilea quadrifolia* L. F. *Ceratopteris* spp. G. *Actiniopteris radiata* (Sw.) Link H. *Adiantum capillus-veneris* L.



**Figure 4.** A. *Adiantum philippense* L. B. *Aleuropteris bicolor* (Roxb.) Fraser-Jenk C. *Aleuropteris albomarginata* (C. B. Clarke) Ching D. *Aleuropteris anceps* (Blanf.) Panigrahi E. *Athyrium falcatum* Bedd. F. *Athyrium hohenackerianum* T. Moore G. *Hypodematium crenatum* (Forsk.) Kuhn H. *Tectaria coadunata* (J. Sm.) C. Chr.

This is the first checklist on the diversity of pteridophytes in Girnar Wildlife Sanctuary. Total of 18 pteridophytic flora are present in the region. This indicates a lower diversity of pteridophytic

flora in the Girnar Region, further more research is needed to explore more than 18 species from this region. This data provides valuable insights into the diversity of pteridophytes in the Girnar region and

highlights the importance of conservation efforts for these species.

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