

FLORISTIC ANALYSIS OF FERN AND FERN-ALLIES FROM TODGARH-RAOLI WILD LIFE SANCTUARY RAJASTHAN, INDIA

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Fern and fern-allies of Todgarh-Raoli Wild Life Sanctuary is very limited due to the extreme and largely arid and dry climate, which is characteristic feature of the Rajasthan. Fern and fern-allies are small but significant element occurring quite frequent in this Sanctuary. Systematic survey from all localities of fern and fern-allies in this sanctuary has revealed the occurrence of 09 taxa belonging to 06 genera and 05 families. *Actiniopteris radiata* (Sw.) Link, *Marsilea minuta* L., *Azolla pinnata* R. Br. subsp. *Asiatica* and *Adiantum incisum* Forssk. are widely distributed throughout the sanctuary. This sanctuary is also represented by *Adiantum capillus-veneris* L., *Adiantum hilippense* L., *Marsilea aegyptiaca* Willd. and *Cheilanthes farinose* (Forssk.) Kaulf. in scattered habitat under shaded moisture and in rock crevices. A check list of fern and fern-allies along with its distributions in the Todgarh-Raoli Wild Life Sanctuary and its adjoining area has been investigated in this paper. Increasing exploitation of natural resources resulted in depletion of these important Pteridophytes. RET, species were discussed and common household conservational techniques adapted by tribals and rural peoples of this region have also been discussed in this paper.

Key words: Fern and fern-allies, Local conservational strategies, Todgarh-Raoli Wild Life Sanctuary.

Introduction

The Aravalli ranges which is one of the oldest mountain range of the world, divides the Rajasthan into two vegetational segments like xerophytic and mesic. Todgarh Raoli Wildlife Sanctuary located in central position of Aravalli range. The sanctuary is also an ecotone of both vegetational segments. Despite the quite hostile climatic condition of this region ferns and fern-allies form a small but significant component of the vegetation. According to earlier pteridologist Mount Abu was regarded to be the only fern and fern-allies locality in Rajasthan^{6,29}. The Pteridophytic flora of various localities of Rajasthan has been studied and published by many workers^{1-10,15-16,21-26,30-31}. As current known this

group whose members are predominant, though not all shade and moisture loving plants is represented in the state by 21 genera and 42 species in Rajasthan^{9,13,16,19,31}. So far as Pteridophytic flora of Todgarh-Raoli wild life sanctuary is concerned, no work has been taken up by any of the earlier workers except a brief report of *Cheilanthes farinosa*²⁸, Pteridophytes of Todgarh-Raoli wildlife sanctuary, Pteridophytic flora and the ferns and fern-allies of Todgarh-Raoli wildlife sanctuary²¹⁻²⁶. Considering this aspect the present work has been investigated mainly Identification, habit, habitat, Phytodiversity, enumeration and Phenology of the fern and fern-allies occurring in this sanctuary. Increasing exploitation of natural resources resulted

in depletion in these important taxa fern and fern-allies. The erosion of plant biodiversity is a matter of global concern. One by one the building blocks of entire ecosystem are disappearing. The 2008 IUCN Red Data list shows that in India hundreds of fern and fern-allies are under the list of threatened and at the risk of extinction. Some RET, species were discussed and common household conservational techniques adapted by tribals and rural peoples of this region have been discussed in this paper.

Study Area

Rajasthan state is situated in between $23^{\circ}3'$ and $30^{\circ}12'$ N latitude and $69^{\circ}3'$ and $78^{\circ}12'$ E longitude. The Aravalli ranges which is one the oldest mountain range of the world, divides the Rajasthan into two vegetational segments like xerophytic and mesic. Todgarh-Raoli Wildlife Sanctuary located in central position of Aravalli range. Xerophytic and mesic vegetation occurs as mixed formation in this Sanctuary. The sanctuary is also an ecotone of both vegetational segments. Naturally variations in Pteridophytic flora are represented in this region. It is bounded on the north by Ajmer district, on the south by Udaipur district, on the east by Rajshamand district and on the west by Pali district (Text- Fig. 1).

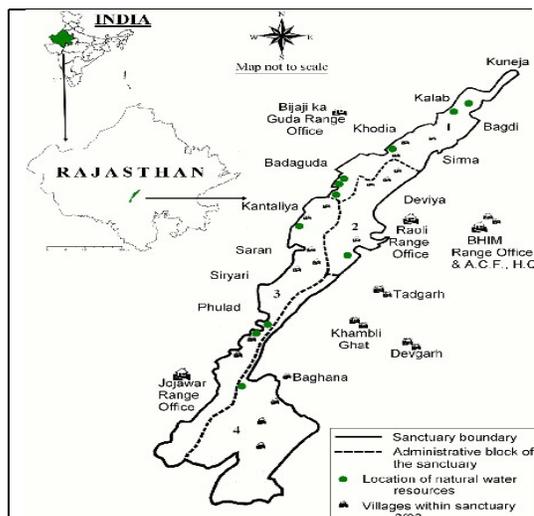


Fig. 1: Location of Todgarh-Raoli Wildlife Sanctuary

Material and Methods

The present paper is based on the Phyto-diversity and Survey of fern and fern-allies in different parts of Todgarh-Raoli wild life sanctuary Rajasthan. All the localities have been visited time to time throughout the year and mainly during monsoon period. The Botanical excursions were undertaken from time to time. Rainy season (i.e. from July to October each year) is the best time to visit as many places for the study habit and habitats of ferns and fern-allies. Every locality of the entire areas was extensively covered. All localities were visited corresponding to seasonal variation round the year. Topography of the Sanctuary comprises of hilly rocky and deciduous forest. Therefore the vegetation was much diversified. Collection trips were arranged in such a way to cover all the habitats of enlists all fern species occurring in this sanctuary.

Efforts were made to identify the fern and fern-allies plants from fresh materials and common name in use by local people. The species were identified with the help of “*An illustrated fern flora of the West-Himalaya*”²⁷ Vols. I & II.

Results and discussion

Out of 09 genera of fern and fern-allies distributed in the various localities of Todgarh-Raoli wild life sanctuary 04 genera namely *Actiniopteris*, *Cheilanthe*, *Salvinia* and *Azolla* are representing by single species each. *Marsilea* is represented by two species while *Adiantum* is represented by three species. The majority of fern genera represented in single species in the sanctuary. We have frequently observed that the population densities as well as number of individuals of *Marsilea aegyptiaca*, *Adiantum philippense* and *Cheilanthe sfarinose species* fall in the category of RET and many fern taxa are gradually decreasing at an alarming rate. A checklist of all fern taxa distributed in Todgarh-Raoli wild life sanctuary, Rajasthan has been provided in Table-01.

Table-01: A checklist of fern and fern-allies from various localities in Todgarh-Raoli wild life sanctuary and its adjoining regions with descriptions about distributions. Families and species within families are arranged alphabetically. Nomenclature is followed according to Fraser-Jekins¹⁴.

S. No.	Name of family	Name of Genus	Name of fern species	Name of surveyed localities and Distributions.
1.	Adiantaceae	<i>Actiniopteri</i> s Link	<i>Actiniopteri radiata</i> (Sw) Link.	-Most widely xerophytic fern found almost throughout sanctuary. -NearDudhaleshwar-Mahadev. -Near Bheel- beri, KhambliGhat. -Near Kachabalivillage.
		<i>Adiantum</i> L	<i>Adiantum incisum</i> Forssk.	-One of the most widely distributed fern of Aravalli range and also in throughout the sanctuary. -On the way of DudhaleshwarMahadev, Raoli lake. -Ghoram- Ghat and Behind the Forest guest house.
			<i>Adiantum capillus-veneris</i> L.	-Quit common especially under moist region Near DudhaleshwarMahadev. -Near Bheel-beri waterfalls KhambliGhat, Ghoram- Ghat.
			<i>Adiantum philippense</i> L.	It found in the localities like Bheel-beri waterfall, KhambliGhat. - Ghoram- Ghat in the sanctuary.
2.	Cheilanthaceae	<i>Cheilanthe</i> Kaulf.	<i>Cheilanthe sfarinosa</i> (Forssk.) Kaulf.	-Various localities of the sanctuary, near Todgarh area hills. -In the crevices of rock toward the way of Todgarh town.
3.	Marsileacea	<i>Marsilea</i> L	<i>Marsilea minuta</i> Linn	-Widely distributed water fern various localities of the sanctuary, Near Negaria pond, Near Barakhan, Jassakhera pond and Ghoram- Ghat.
			<i>Marsilea aegyptiaca</i> Willd	Water fern found inGugia pond and ditches near Bara Khera pond.
4.	Salviniaceae	<i>Salvinia</i> Seg.	<i>Salvinia molesta</i> Mitch.	Commonly occur on stagnant water bodies throughout the sanctuary
5.	Azollaceae	<i>Azolla</i> Lam	<i>Azolla pinnata</i> R. Br. subsp. <i>asiatica</i>	Widely distributed Free floating fern of ponds invarious localities of the sanctuary like Bara -Khera pond, Raoli lake area, Barakhan pond area, Negaria stream area.

An enumeration of fern and fern-allies with descriptions about distributions from various localities in Todgarh-Raoli wild life sanctuary and its adjoining regions. Families and species within families are arranged alphabetically. Nomenclature is followed according to Fraser-Jekins¹⁴.

1. *Actiniopteri radiata* (Swartz) Link,
Adiantaceae : Genus *Actiniopteri*
Link

One of the most widely distributed xerophytic fern of this sanctuary. Grows on old walls and in rock crevices. (Bir & Verma 1963, Mital 1969, Bhardwaja et al 1978).

Rhizome short-creeping, scaly and hairy, hairs dark brown, unicellular, Scales brown bicolor (central region black, margins light-coloured), margin entire, apex long acuminate. Stipes 4-10 cm long, lanceolate, apex with a terminal glandular cell, margin entire. The structure of the stipe and the branching of the lamina clearly separate from other members of family.

Ecology: Terrestrial or lithophytes along fully exposed roadside.

2. *Adiantum capillus-veneris*
Linn. **Adiantaceae** : Genus
Adiantum Linn.

A very common fern found occurring in plains under moist and shady habitats of this sanctuary (Mital 1969, Bhardwaja *et al* 1978).

Rhizome long creeping, thin, diameter 0.1 to 0.2 cm, scaly dark brown, 0.2 cm long linear lanceolate, margin entire, apex acuminate, Petiolate flabellate “fan-shaped”. Upper outer margin often irregularly lobed.

Ecology: Rare species, terrestrial along partially shaded

3. *Adiantum incisum* Forssk.,

Adiantaceae : Genus *Adiantum*

One of the most widely distributed fern of Aravalli as well as in Todgarh Raoli wild life Sanctuary. (Mital 1969, Bhardwaja *et al*, 1978).

Small plants with erect scaly rhizome, lamina simply pinnate, densely hairy pinnae present. Densely scaly, scales brown, linear lanceolate, margin entire, apex acuminate. Upper margin deeply lobed, veins forked free, sori marginal, oblong or reniform, indusiate.

Ecology: Terrestrial or lithophytes along fully exposed roadside.

4. *Adiantum philippense* Linn.

Adiantaceae : Genus *Adiantum*

A common fern species of moist and shady habitats of this sanctuary (Bir & Verma 1963, Mital 1969, Bhardwaja *et al* 1978).

Small plants, rhizome erect or sub-erect, thick, apex scaly, scales brown, linear lanceolate, margin entire, apex acute, Stipes black-brown, clustered towards rhizome. Rachis with a broad terminal pinna or sometime extended and then with a apical vegetative bud. Lamina pinnate. Fronds fan-shaped, glabrous, herbaceous, Ecology: Rare species, terrestrial along partially shaded

5. *Cheilanthes sarsinosa* (Forssk.)

Kaulf.

Cheilantheaceae: Genus *Cheilanthes*

One of the most common xerophytic fern of Rajasthan. Widely

distributed throughout Aravalli range and this sanctuary also. (Mital 1969, Bhardwaja *et al*, 1978).

Rhizome short, erect, thick, apex scaly, scales dark brown, lanceolate, margin entire, the thin herbaceous fronds generally without farina. Upper surface dark green glabrous.

Ecology: Rare along partially exposed

6. *Marsilea aegyptiaca* Willd

Marsileaceae : Genus *Marsilea*

First reported by Gupta & Bhardwaja (1957, 1958) and Gupta (1962) from Jodhpur. Quite widely distributed near pond margins in western Rajasthan and also present in the sanctuary.

Rhizome long creeping, thin, glabrous but apex hairy. Stipes arise in two dorsal rows on the rhizome, the length depending on the depth of water, lamina quadrifid, cruciform, divided in two four pinnae. Margin entire or crenate,

Ecology: Aquatic and amphibians

7. *Marsilea minuta* Linn

Marsileaceae: Genus *Marsilea*

One of the most widely distributed and common species of this water fern. Grow along the margins of ponds, lakes and streams during rainy season almost throughout the state and also in the sanctuary. (Gupta 1962, Bir & Verma 1963, Mital 1969).

Rhizome long creeping, thin, glabrous but apex hairy. Stipes 2-5 cm distant on rhizome. Base faintly connate, greenish, thin. Pinnae 1-2 cm long, 0.5 -1.5 cm broad. Margin entire.

Ecology: Aquatic and amphibians

8. *Salvinia molesta* Mitchell.

Salviniaceae : Genus *Salvinia*

A common floating fern species of Rajasthan (Vyas, 1964), and also found in the sanctuary.

Ecology: Aquatic

9. *Azolla pinnata* R. Brown

Azollaceae: Genus *Azolla* Lam.

A quite common free floating fern of ponds throughout Rajasthan (Mital 1969, Bhardwaja *et al*, 1977).

Ecology: Aquatic

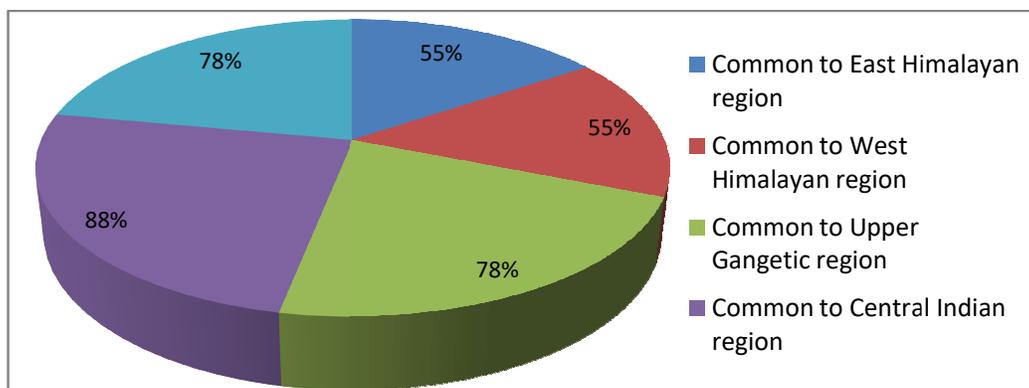
From table -02 it is evident that Pteridophytes of Todgarh Raoli wild life sanctuary, Rajasthan shows their affinities to those of other parts of India as follows given in below text fig -02.

1. Common to East Himalayan region
2. Common to West Himalayan region
3. Common to Upper Gangetic region
4. Common to Central Indian region
5. Common to South Indian region

Table-02: Regional analysis of fern and fern-allies from Todgarh- Raoli wildlife sanctuary, Rajasthan with other important regions of ferns localities in India (+ Species present, - Species absent)

S. No	Name of species (Todgarh Raoli Region)	East Himalayas	West Himalayas	Upper Gangetic	Central India	South India
1.	2.	3.	4.	5.	6.	7.
1.	<i>Actiniopteris radiata</i>	+	+	+	+	+
2.	<i>Adiantum capillus-veneris</i>	+	+	+	+	+
3.	<i>Adiantum incisum</i>	+	+	+	+	+
4.	<i>Adiantum philippense</i>	+	+	-	+	+
5.	<i>Cheilanthes fasinosa</i>	+	+	+	+	+
6.	<i>Marsilea aegyptiaca</i>	+	+	-	-	-
7.	<i>Marsilea minuta</i>	-	-	+	+	+
8.	<i>Salvinia molesta</i>	-	-	+	+	+
9.	<i>Azolla pinnata</i>	-	-	+	+	-
	TOTAL	06	06	07	08	07

Fig. -02: Regional analyses of fern and fern-allies occurring in Todgarh-Raoli wild life sanctuary indicate relationship to those other parts of India.



The erosion of plant biodiversity is a matter of global concern. One by one the building blocks of entire ecosystem are disappearing. The 2008 IUCN Red Data list shows that in India hundreds of fern and fern-allies are under the list of threatened and at the risk of extinction., *Adiantum philippense* and *Cheilanthes fasinosa* species fall in the category of RET in this area.

The life of tribal people and rural communities are closely interwoven with their environment and local flora. It becomes the integrated parts of their culture and custom and folklore. These A large number of fern and fern-allies are being used by tribal to cure human

and veterinary ailments, thus they co-relate it with god or spiritual power or religious ethics. The plants growing around them form an integral part of their culture and customs.

It is our duty to recognize and support the conservational strategies adopted by tribal and rural people by the term of faith, myths, taboos, tradition, religious aspect, sacred grove etc. Conservation of threatened fern and fern-allies is the responsibility of each and everyone's. We are needed to increase awareness among tribals and rural communities in ecological sensitive area.

Fern and fern-allies form a significant sometimes dominant component of

biosphere. 09 taxa belonging to 06 genera and 05 families were recorded from various localities from Todgarh-Raoli wild life sanctuary. The preceding data clearly indicate that fern and fern-allies have an important component of ecosystem of the sanctuary. *Actiniopteris radiata*, *Adiantum incisum*, and *A. capillus-veneris* are found growing more or less frequently throughout the sanctuary in crevices of rocks at low as well as higher altitude. These species are popular among the tribals due to its considerable medicinal value and is used for curing various skin diseases. Collectors totally uproot the plants with their rhizome, these species grows during the rainy season by their persisting rhizome. It was found from our survey that *Adiantum incisum*, *A. capillus-veneris*, *Azolla pinnata* subsp. *asiatica*, and *Marsilea minuta* occurs frequently at various localities but *Adiantum philippense* is of 'At Risk' status while *Cheilanthes fasinosa* species fall in the category of RET in this area and it is restricted in particular area only *Marsilea aegyptiaca* is rare and it found only at found in Gugia pond and ditches near Bara Khara pond in the sanctuary. Two species of free floating water fern *Salvinia molesta* and *Azolla pinnata* subsp. *asiatica* are found growing abundantly in various ponds, ditches and stagnant water bodies in the sanctuary. It was also observed that *Azolla pinnata* subsp. *asiatica* is used as fodder for animals by local people. Conservational strategies adopted by tribals by the term of religious aspect may be fruitful in long time.

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