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## Study of climatology of area of Vindhyan region (M.P.) for wild pteridophytes

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### Abstract

Vindhyan region has rich biodiversity. This region provides shelter to various plant species that belong to the lower and higher groups. It is interesting to note that in the area, proportionally it genera is relatively richer than species. In comparison to angiosperms plant diversity the pteridophytes are not rich in the area. The tribes and poor of this region are partially or completely dependent on forest product for their survival. These people have assimilated unique knowledge about the surrounding plant wealth. This indigenous knowledge is a potential tool in searching for new economic plants for food and medicines. They protect and conserve biodiversity of forest and by their cultural activities they also enrich the soil fertility. In the present study wild pteridophytes species which are normally growing in the wild habitat were taken into the consideration for assessing the eco-medicinal uses of different type of pteridophytes. Eco medicinal importance of pteridophytes and existence of greater biomolecules is already studied by many previous workers. In spite of medicinal and ecological importance the medicinal plants have also been considered for present study.

**Keywords:** Vindhyan region, biodiversity, plant species, angiosperms, pteridophytes etc.

### 1. Introduction

The Vindhyan series lies to the north of the central part of the range of Bhopal and Indore, which rises higher than the Indo- Gangetic plains to its North. The Western end of the state of Gujrat at the eastern side of the Gujrat peninsula near the border with the modern states of Rajasthan. The southern inclines of the series are drained by the Narmada River proceeds west side to the Arabian sea in the broad valley between the Vindhyan series and parallel Satpura series further to the south. The northern inclines of the series are drained by tributaries of Ganges, drains the southern slopes of the area. Pteridophytic flora of Vindhyan region play significant role for maintaining the microclimate of the habitat. Many number of contribution were made by different pteridologists of India as well as from abroad (Kirtkar & Basu, 1935; Shah & Singh, 1990; Verma & Singh, 1995; Morton, 1996) [3, 8, 13, 6]. Pteridophytes have an important role in the earth's biodiversity. Economic and medicinal values of higher plants have been investigated thoroughly, unfortunately Pteridophytes have been less studied (Caius, 1935; Manandhar, 1996; Kumar & Kaustik, 1999; Sharma, 2001; Benjamin, & Manickam, 2007) [2, 5, 4, 9, 1].

### 2. Material and Methods

#### 2.1 Characteristics of Rewa

Rewa the extreme eastern district of Madhya Pradesh state, situated between 24<sup>o</sup>.53 latitudes and 81<sup>o</sup>.30' longitudes. At the eastern boundary it is having important botanical pockets of high diversity. Vindhyan are the continuous range of mountains, rising up from the North India. Numerous hills in the mountain range of Vindhyan region are continuous and have higher peaks.

#### 2.2 Site Characteristics

The Govindgarh is situated (24<sup>o</sup>:38 latitude, 81<sup>o</sup>:30 longitude) at the boundary of Satna & Sidhi district. The vegetation types are tropical deciduous forests, scrub jungles and tropical dry deciduous forests. Pteridophyte grow luxuriantly in this region because of the tropical climate average humidity, moderate temperature and soil type. An additional feature for

luxuriant growth of ferns and the survival of a rich biodiversity is, the landscape diversity of this region. So, the surveys were conducted to know about the pteridophytic diversity of the area. Therefore, present work recorded 21 species of pteridophytic flora belonging to 13 genera and 13 families. The pteridophytic plants were observed at two sites for the present investigation

**Site I near Temple:** This site is situated near the Papra hill, on the Rewa–Shahdol Road.

**Site II:** This site is situated on the rocky area along Rewa–Shahdol Road. For the study of pteridophytic plants in this area regular monthly surveys were carried out on both study sites.

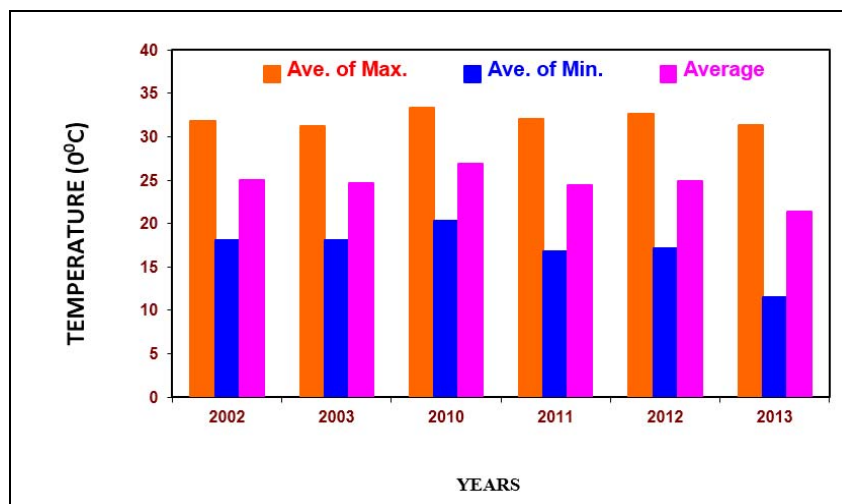
**3. Results**

Climate of any region is mostly determined by certain meteorological parameters such as relative humidity of air, temperature, wind pressure and rainfall. Table 4.1 shows the

monthly distribution of temperature of Rewa region for the years 2010 to 2013, based on the recorded data. The average temperature was recorded 26.85 °C for the year 2010, 24.45 °C for the year 2011, 24.85 °C for the year 2012 & 21.4 °C for the year 2013 which shows that year 2010 was average hot year in the these years. The lowest temperature was recorded in the month of January 2013, i.e. 3.3 °C while January was the lowest average temperature month i.e. 12.8 °C in the year 2013. Monthly mean temperature of January–12 was 15.0 °C from February-12 onwards the temperature started rising, reaching its maximum in the month of June-12 i.e. 33.2 °C. The average monthly mean temperature of February-12 to Jun-12 were 16.1 °C, 28.5 °C, 28.5 °C, 32.7 °C and 33.2 °C alternatively. July-12 also experienced the extreme temperature towards higher scale but the upward movement of mercury was checked by coming monsoon. In July-12 the average monthly mean temperature was 27.5 °C. In Aug.-12 it was 26.5 °C, In Sep.-12 27.2 °C, In October-12 i.e. 25.4 °C, November-12 i.e. 20.5 °C and in December-12 16.00 °C. (Table 4.1; Fig 4.1).

**Table 4.1:** Monthly Distribution of Temperature of Rewa Region (Year 2010 to 2013)

YEAR	Tempe- rature 0 °C	MONTHS												Average
		Jan.	Feb.	Mar.	Apr.	May	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	
2010	Max.	22.3	27.0	35.5	42.0	43.8	43.0	34.5	33.5	32.2	32.1	30.4	24.1	33.4
	Min.	4.7	8.7	16.7	22.5	26.1	28.0	34.1	26.8	25.3	21.0	17.9	6.3	20.3
	Average	13.5	17.8	26.1	32.4	34.9	35.5	34.3	30.1	28.7	26.5	24.1	15.2	26.85
2011	Max.	23.5	29.0	34.0	39.7	42.6	35.7	32.5	31.0	31.1	32.2	30.3	24.3	32.1
	Min.	4.4	9.0	13.5	17.6	23.4	24.2	26.5	24.7	24.9	17.5	11.0	5.7	16.8
	Average	13.9	19.0	23.7	28.6	33.0	29.9	29.5	27.8	28.0	24.8	20.6	15.0	24.45
2012	Max.	22.7	24.4	31.6	38.3	42.2	41.4	31.3	30.2	31.7	32.5	29.0	24.7	32.6
	Min.	7.2	7.8	15.5	18.6	23.2	25.0	23.8	23.4	22.8	18.2	12.1	7.2	17.1
	Average	15.0	16.1	28.5	28.5	32.7	33.2	27.5	26.5	27.2	25.4	20.5	16.0	24.85
2013	Max.	22.2	25.0	32.9	38.4	44.2	36.9	33.2	31.2	32.8	29.3	25.9	24.2	31.3
	Min.	3.3	7.5	12.7	16.0	22.3	23.9	23.9	24.4	24.7	20.4	11.4	8.2	11.5
	Average	12.8	16.2	22.8	27.2	33.2	30.4	28.5	27.8	28.7	24.8	18.6	16.2	21.4



**Fig 4.1:** Bar diagram of temperature of different years

**Table 4.2:** Monthly Distribution Of Rainfall Of Rewa Region (Year 2010 to 2013)

Year	Months Rainfall (mm)												Yearly Rainfall (mm)
	Jan.	Feb.	Mar.	Apr.	May	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	
2010	0	6.6	0	0	11.6	0	187.6	195.8	200.9	18.6	42.2	0	663.3
2011	0	0	0	0	13.6	296.8	238.0	430.2	181.2	0	0	0	1159.8
2012	32.4	0	17.8	0	0	4.9	549.0	469.8	237.6	21.2	0	7.4	1340.1
2013	0	71.2	41.0	5.6	0	138.8	429.2	541.2	112.2	142.2	0	0	1481.4

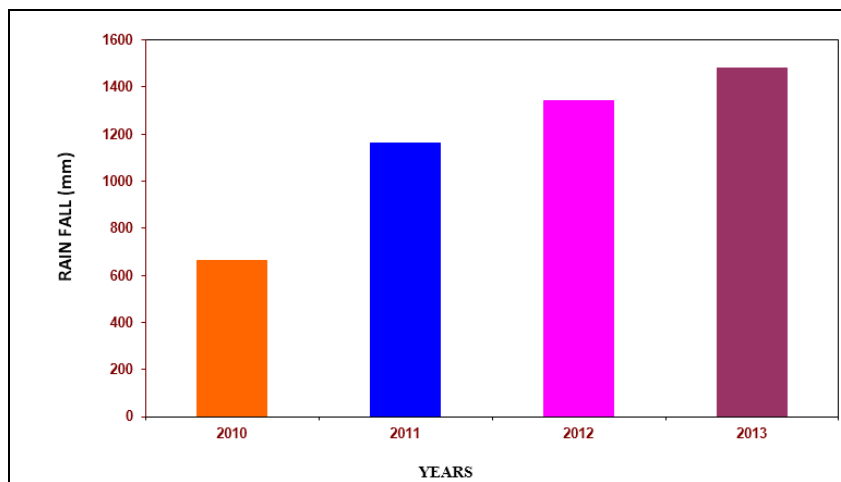


Fig 4.2: Bar diagram of Rainfall of different years

Table 4.3: District Wise Monthly Distribution of Rainy Days of Rewa Region (Year 2010 to 2013)

YEAR	MONTHS												Yearly Rainy Days
	Jan.	Feb.	Mar.	Apr.	May	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	
2010	0	2	0	0	2	0	11	11	10	2	1	0	39
2011	0	0	0	0	3	15	16	17	10	0	0	0	61
2012	2	0	1	0	0	3	14	20	20	01	0	01	62
2013	0	4	3	2	0	11	16	23	7	7	0	0	73

Table 4.4: Monthly Distribution of Humidity Of Rewa Region (Year 2010 to 2013)

YEAR	Humidity	Jan.	Feb.	Mar.	Apr.	May	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
2010	Max.	87	86	82	78	78	56	71	74	70	70	72	78.2	75.2
	Min.	59	54	41	37	29	33	53	59	52	50	59	57	48.6
	Average	73	70	61.5	57.5	53.5	44.5	62	66.5	61.0	60.0	65.5	67.6	61.9
2011	Max.	82.4	79.6	82.9	72.1	81.2	86.3	86.8	87.6	86.7	85.8	79.7	79.8	82.6
	Min.	60.6	51.9	36.6	40.6	43.2	46.1	58.7	63.8	59.9	62.8	62.9	56.2	53.6
	Average	71.5	65.7	59.7	58.8	62.2	66.2	72.7	78.2	73.3	74.3	71.3	68.0	68.5
2012	Max.	76.9	71.8	77.6	77.6	80.6	76.3	87.4	86.9	85.8	85.9	81.8	80.5	80.8
	Min.	23.7	36.7	44.6	32.4	33.8	33.1	60.1	58.3	53.9	49.9	50.9	52.4	44.2
	Average	50.3	54.2	61.1	55.0	57.2	54.7	73.7	72.6	69.8	67.9	66.3	66.4	62.4
2013	Max.	79.9	77.8	77.4	76.3	36.4	65.2	89.1	89.7	83.4	78.1	74.3	76.9	75.4
	Min.	56.4	57.4	49.4	38.6	33.4	35.6	51.1	53.5	44.1	59.6	53.2	59.7	49.3
	Average	62.1	67.6	63.4	57.4	34.9	50.4	70.1	71.6	63.7	68.8	63.7	68.3	61.8

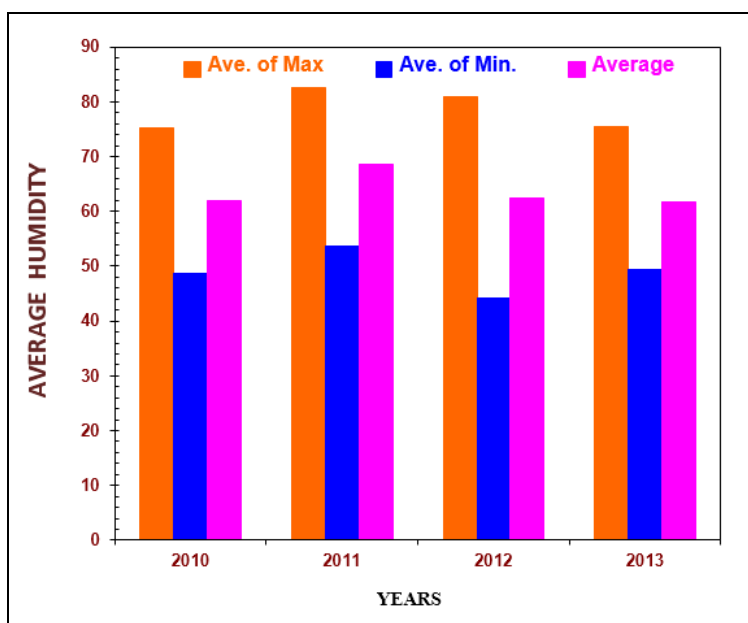


Fig 4.4: Bar diagram of Humidity of different years

**Table 4.5:** Monthly Distribution of Wind Velocity of Rewa Region (Year 2010 to 2013)

YEAR	MONTHS												Average Wind Velocity (Km/h)
	Jan.	Feb.	Mar.	Apr.	May	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	
2010	0.3	0.4	0.6	1.4	1.7	2.1	1.9	0.8	0.8	0.6	0.6	0.5	0.90
2011	0.5	0.5	0.7	1.5	0.0	3.2	1.1	1.2	0.9	0.6	0.5	0.3	1.33
2012	0.4	0.6	0.6	0.8	1.0	0.8	2.6	1.1	0.6	0.4	0.7	0.8	0.90
2013	1.6	1.2	1.9	2.1	2.8	3.3	2.5	2.2	2.1	2.0	1.8	1.4	2.70

Whereas Monthly mean temperature of January–13 was 12.8 °C from February-13 onwards the temperature started rising, reaching its maximum in the month of Jun-13 i.e. 30.4 °C. The average monthly mean temperature of February-13 to Jun-13 were 16.2 °C, 22.8 °C, 27.2 °C, 33.2 °C and 30.4 °C alternatively. July-13 also experienced the extreme temperature towards higher scale but the upward movement of mercury was checked by coming monsoon. In July-13 the average monthly mean temperature was 28.5 °C. In Aug.-13 it was 27.8 °C, In Sep.-13 28.7 °C, In October-13 24.8 °C, November-13 18.6 °C and in December-13 16.2 °C (Table 4.1; Fig 4.1). Table 4.2 represents the amount of rainfall per month from 2010 to 2013. It is evident from the noted data that average rainfall in the month of July 2012 was maximum i.e. 549.0mm, followed by 541.2 mm in August 2013, 469.8mm in August 2012, & 430.2 mm in August 2011, whereas May-2012 and May 2013 proved to be dried months with no precipitation or too little precipitation. Average rainfall of winter months specially for November-13 to December-13 was 0.00 mm, while in Nov.-12 & Jan.-13 was 0.0mm, and Dec., 2012 7.4mm (Table–4.2; Fig.–4.2).

The number of rainy days also plays crucial role in determining the vegetation pattern of a place. District wise monthly distribution of rainy days of Rewa region was recorded for the year 2010 to 2013. The maximum number of rainy days was recorded 73 in the year 2013 and 62 in the year 2012, 61 in the year 2011 & 39 in the year 2010 separately. The monthly maximum rainy days was recorded in the month of Aug.2013 i.e. 23, & 20 in Aug. 2012, Sep.2012 separately. Whereas April month of 2010, 2011 & 2012 was proved to be dried months with no rainy days recorded and November month of 2011, 2012 & 2013 & December and January Month of 2010, 2011 & 2013 was also proved to be dried months (Table 4.3).

Table 4.4 (Fig. 4.4) shows humidity condition of the region for the year 2010 to 2013. The average humidity was recorded maximum i.e. 68.5 in the year 2011, and 62.4 in the year 2012, 61.9 in the year 2010 and 61.8 in the year 2013 separately.

Monthly average humidity conditions was also noted. The monthly average humidity was maximum 78.2 in Aug. 2011, 74.3 in Oct. 2011, 73.7 in July 2012 & 73.3 in Sep. 2011 while minimum average humidity was noted 34.9 in the month of May 2013 & 44.5 in June 2010.

On observing the data maximum humidity was recorded 89.7 in Aug. 2013 and 89.1 in the month of July 2013 &, 86.9 in Aug. 2012, 86 in Feb. 2010 separately while minimum humidity was recorded 23.7 in Jan. 2012 & 29 in May 2010, 32.4 in April 2012, 33 in June 2010, 33.4 in May 2013 separately (Table 4.4, Fig. 4.4). Table 5.5 shows district wise monthly distribution of wind velocity of Rewa region for the year 2010 to 2013. The average wind velocity was recorded maximum 2.70 km/h in the year 2013 while minimum wind velocity was recorded 0.90 km/h in the year 2010 & 2012. Whereas observing monthly data of wind velocity shows that maximum wind velocity was noted 3.3 km/h Jun. 2013 & slight decreased value noted 2.8 km/h in May 2013, 2.6 km/h

in July 2012, 2.5 km/h in July 2013 separately while no wind velocity was recorded 0.00 in May 2011 & slight increased value recorded 0.3 km/h in Jan. 2010 & Dec. 2011, and 0.5 km/h in Dec. 2010 to Feb., 2011 & Nov. 2011. The recorded data shows that monthly wind velocity is increased in before monsoon (Table 4.5). Drastic variation of macro-micro climo-edaphic factors support the growth of rich phytodiversity of pteridophyte with dominant angiospermic flora of the region. The unique climo-edaphic factors and specific microclimatic conditions support the overall growth of angiospermic with wild pteridophytic plants specially grown in the region. The Vindhyan region is even now full of various types of medicinally useful wild pteridophyte plants.

#### 4. Discussion

Different traditional uses and medicinal uses of these plants were noted & verified. A comparison with available literature on ethnobotany of Indian plants revealed that every species is used in unique medicinal uses. The whole plant part of *Selaginella ciliaris* (Retz) is used in skin disease. The stem powder is used in itching of skin and also used to stop the headache and cure high fever (Patil, *et.al.*, 2013). *Selaginella bryopteris* (L.) is used as diuretic and in gonorrhoea. *Selaginella repanda* paste of fresh leaves is taken orally against amenorrhoea (Singh HB, 1999; Singh Shweta & Sahu, 2003; Singh Shweta & Singh Rita, 2012).

This is evident from the table 4.1 that the temperature was maximum in the year of 2010 as compare to that of 2011, 2012 & 2013. This yearly shows that uneven temperature favour plants for their establishment & completion of their life cycle. Year 2011, 2012 & 2013 clearly reflect moderate temperature in comparison to the data of 2010. This clearly reflects drier sub-tropical conditions coupled with arid and semi arid climate favours the growth of vegetation. The plants which have greater adoptability complete their life cycle according to the microclimatic situation of the habitat.

Table 4.2 clearly shows that year 2013 has maximum rainfall of 1481.4 mm as compare to that of 1340.1 mm in 2012, and 1159.8 mm in 2011. This clearly reflect the over hall situation for the availability of water from the various habitat specifically in the zone where work carried out to assess the ecological parameter of angiospermic and pteridophytic vegetation of the sites.

The maximum rainy days shows in table 4.3 recorded 73 rainy days in year 2013 as compared to that of 62, 61 in year 2012 & 2011. The relative humidity of various month given in table 4.4. The wind velocity was recorded 2.7 km/h in the year 2013 as compare to that of 1.33 km/h in 2011 whereas minimum wind velocity were recorded i.e. 0.90 km/h in 2010 & 2012.

#### 5. Acknowledgement.

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