

Records of *Cyathea spinulosa* Wallich ex Hooker (Cyatheaceae) and *Cycas pectinata* Griff.(Cycadaceae) from the Churiya Hills of Eastern Nepal

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Abstract

Nepal hosts 16 plant species of CITES appendix. The CITES appendix II includes *Cyathea* spp. (tree fern, Family Cyatheaceae) and the appendix III includes *Cycas pectinata* (Family Cycadaceae). During an ecological survey of Churiya hills of eastern Nepal, these two rare and endangered plants have been recorded in their natural habitats. The Churiya in eastern Nepal receives relatively high precipitation, and for its steep slopes with erodible poor soil, Churiya has very little to offer for agriculture and human settlement keeping the natural forest intact. However, the human population growth in the area has put pressure on the habitat and threatened the rare plants.

Key words : ecology, forest, fossil plants, threatened species

Introduction

Some 60 species of plants have been reported as threatened in Nepal. Twenty-six of these species including *Cycas pectinata* and *Cyathea* sp. are distributed in the Terai and Churiya zones (Shrestha & Joshi 1996, Press *et al.* 2000). There are 20 species of *Cycas* in the world, and Nepalese flora is represented by only one species of *C. pectinata*. Similarly, *Cyathea*, a living fossil has been found in the Churiya range of eastern Nepal.

The Churiya hills, also known as Siwaliks are the youngest and the southernmost mountain chain of the Himalayan system (Hagen 1998). The range consists of Tertiary unconsolidated and highly erodible fluvial sediments ranging from relatively fine-grained gray wackes in the south (Lower Siwalik), through soft of clay (Middle Siwalik) to very coarse sands and conglomerates (Upper Siwalik) in the north (Bhatt 1977, Jhingra 1981, Carson 1985). The Churiya rocks are rich in vertebrate fossil contents (Itihara *et al.* 1972, Sah *et al.* 1993). Several fossils of later Tertiary have provided basis for much of our present knowledge of the evolution of Asian flora and fauna.

In Nepal (area: 147,181 km²), the Churiya occupies 12.7% of the total land and contributes to 25.8% of the

forest cover of the country (LRMP 1986). Churiya's hardwood component (*Shorea robusta* & *Terminalia* spp.) is the highest in the country which comprises 37% of the total (HMGN 1988). For many years, the Churiya range had been neglected for agriculture and human settlement due to its steep slope with erodible and poor soil. This, on the other hand, helped keep its natural habitat intact. However, human encroachments have increased leading to a rapid deterioration of the forest resources in recent years. For example, the Churiya forests in east Nepal have decreased by 23% (ca. 150 km²) in less than 35 years (Bhujju *et al.* 2007).

Methodology

Study area. Thirty-five reference points (sampling sites) were visited during an ecological survey carried out in the Churiya hills of eastern Nepal between the Koshi and Mechi rivers (Fig. 1). The study area stretched about 105 km with the altitude from 115m to 1400m asl, and covered an area of 77,924 ha (Bhujju & Yonzon 2000).

Climate. Climatological records of two nearest stations Dharan (400 m, 26°47'N & 87°17'E) and Saktim (530 m, 26°48'N & 87°54'E) showed that mean maximum

temperature varied between 32.4-33.9 °C in May and mean minimum temperature varied between 12.2-13.1 °C in January (DOHM/HMGN 1999). GIS analysis of rainfall map presented five types of precipitation pattern in the area with the highest precipitation (> 3200 mm year⁻¹) in the east near Mechi and lowest in the west near Koshi (< 2000 mm year⁻¹). Precipitation occurred mainly between June-September by monsoon.

Sampling. Sampling plots for the ecological survey was ascertained using geographical grids using random table of Rohlf and Sokal (1969). In the field, the grids were located with the help of Global Positioning System (GPS 4000 XL, Magellan, USA), and visited on foot between January - April 2000. During the walk, records of *Cycas pectinata* and *Cyathea spinulosa* were carefully noted when observed.

Results and discussion

***Cycas pectinata* Griff. (Cycadaceae).** We recorded 36 plants of *Cycas pectinata* from 15 sites in the Churiya hills of eastern Nepal between the longitudes of 87°39'48"E and 87°44'09"E (Table 1). The species occurred in solitary in eight sites, viz. Chulipokhari, Ratuwa khola, Singfere, Sundhwakhola, Besare, Mainachuli and Thakle. The highest density (10 individuals) was in Mainachuli of Mahamai village development committee (VDC), Ilam district. The habitats of the species were either the forest of *Shorea robusta*, sometimes *Shorea-Schima* or riverside. In the altitudinal distribution, *Cycas pectinata* was found up to 730m asl in the *Shorea-Schima* forest of Chulipokhari at Tadi VDC of Morang district. The tallest individuals recorded were up to 5m, which were recorded at Singfere and Besare of Ilam district. Sometimes, the species was also recorded in association with *Phoenix* and/or *Pandanus*.

Table 1. Records of *Cycas pectinata* in the Churiya hills of eastern Nepal

SN	Site ref.	Vdc, District	Habitat/Forest	Association	Lon. E	Lat. N	Alt.m	Den.	Ht.m
1	Chuli pokhari	Madi, Morang	<i>Shorea-Schima</i>		87°39'48"	26°47'09"	730	1	3.0
2	Chuli pokhari	Madi, Morang	<i>Shorea-Schima</i>		87°39'48"	26°47'03"	730	3	2.0
3	Ratuwa Khola	Bajho, Ilam	<i>Shorea</i>	<i>Phoenix</i>	87°42'32"	26°47'56"	390	1	2.5
4	Ratuwa Khola	Bajho, Ilam	<i>Shorea</i>	<i>Phoenix-Pandanus</i>	87°42'37"	26°47'28"	390	1	0.5
5	Ratuwa Khola	Bajho, Ilam	<i>Shorea</i>	<i>Phoenix</i>	87°43'22"	26°46'31"	390	1	3.0
6	Ratuwa Khola	Bajho, Ilam	Near stream		87°43'37"	26°47'35"	350	1	2.5
7	Singfere	Bajho, Ilam	<i>Shorea</i>		87°43'43"	26°46'42"	380	1	3.5
8	Sundhwakhola	Bajho, Ilam	Near stream	<i>Phoenix-Pandanus</i>	87°43'43"	26°44'40"	300	3	2.0
9	Singfere	Bajho, Ilam	<i>Shorea</i>	<i>Phoenix-Pandanus</i>	87°43'53"	26°46'43"	400	3	4.0
10	Singfere	Bajho, Ilam	Near stream	<i>Pandanus</i>	87°44'00"	26°46'45"	400	5	1.0
11	Singfere	Bajho, Ilam	<i>Shorea</i>		87°44'27"	26°46'57"	300	3	5.0
12	Besare	Mahmai, Ilam	Near stream		87°49'40"	26°45'00"	300	1	2.5
13	Besare	Mahmai, Ilam	Near stream	<i>Phoenix</i>	87°49'44"	26°44'57"	300	1	5.0
14	Mainachuli	Mahmai, Ilam	<i>Shorea</i>		87°50'59"	26°40'52"	400	10	2.0
15	Thakle	Laxmipur, Ilam	<i>Shorea</i>		87°56'44"	26°47'05"	420	1	3.5

***Cyathea spinulosa* Wallich ex Hooker (Cyatheaceae).** A total of 19 individual plants of *Cyathea spinulosa* were recorded from four sites of Shantidanada of Bajho VDC and Ghaletar of VDC Chisapani in Ilam district. All the recorded habitats of the plant were near stream in the altitude varying

between 300-400m asl. The distribution of the species was between 87°43'55"E - 87°52'36"E. The height of the species varied from 2.0m to 8.0m, both at Shantidanada, Bajho VDC of Ilam district. In majority of the sites, *Cyathea spinulosa* was found solitary or less number indicating its rarity in occurrence (Fig. 1).



Cycas pectinata at Chulipokhari



Cyathea spinulosa at Shantidada

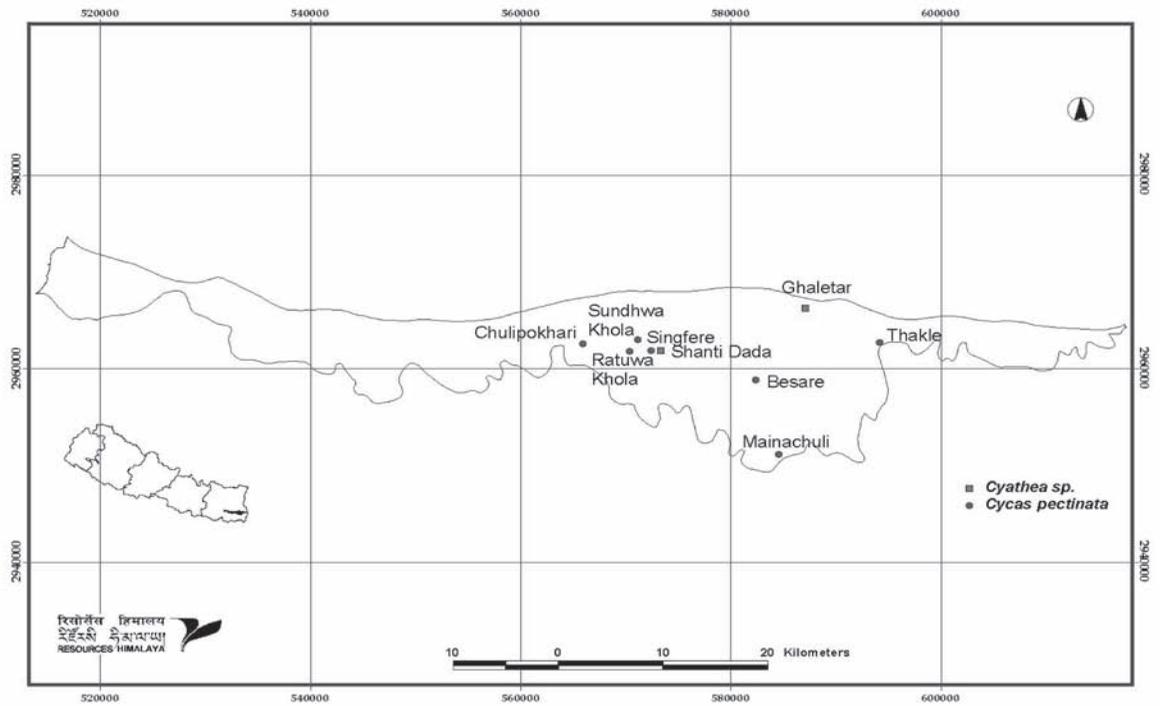


Fig. 1. Study area in Churiya hills of eastern Nepal

Table 2. Records of *Cyathea spinulosa* in the Churiya hills of eastern Nepal

SN	Site Ref.	Vdc, District	Habitat	Lon. E	Lat. N	Alt.m	Den.	Ht.m
1	Shantidanda	Bajho, Ilam	Near stream	87°43'55"	26°46'14"	320	1	3.0
				87°43'55"	26°46'14"	320	2	7.0
2	Shantidanda	Bajho, Ilam	Near stream	87°43'59"	26°45'58"	300	6	7.5
				87°43'59"	26°45'58"	300	4	3.0
3	Shantidanda	Bajho, Ilam	Near stream	87°44'09"	26°46'09"	310	2	3.5
4	Shantidanda	Bajho, Ilam	Near stream	87°44'09"	26°46'09"	310	1	2.0
5	Shantidanda	Bajho, Ilam	Near stream	87°44'09"	26°46'09"	310	1	8.0
6	Ghaletar	Chisapani, Ilam	Near stream	87°52'36"	26°49'02"	400	2	6.0

The study area contained, over 265 vascular plant species, belonging to 85 families and 178 genera. Beside, *Cyca pectinata* and *Cyathea spinulosa*, few other rare/threatened tree species like *Dalbergia latifolia* and *Acacia catechu*, and endemic species *Ormosia glauca* were also recorded (Bhujy & Yonzon 2000). The forests, predominated by *Shorea robusta* (relative basal area 44%), contained a good stock of trees and shrubs with a basal area (BA) of 37.28 m² ha⁻¹ and a density of 786.5 n ha⁻¹. It is assumed that the Churiya hills have been less encroached due to its steep slope and poor soil with deep water table.

The forests of Churiya in the eastern Nepal is also an important habitat for rare species such as *Cyathea spinulosa* and *Cycas pectinata*. Although, the Churiya have settlements all around the forests, it has considerable potential to meet the daily need of people from forests and contribute to conservation such as maintaining landscape level forest contiguity.

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