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DIVERSITY OF CHASMOPHYTES IN URUMBIKKARA HILLS OF IDUKKI DISTRICT, KERALA, INDIA

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ABSTRACT

The present paper gives emphasis to chasmophytic diversity of Urumbikkara Hills of Idukki district, Kerala. A total of 72 species of chasmophytes belongs to 63 genera and 41 families were identified. Of which 6 species are chasmophytic ferns and 2 species are chasmophytic bryophytes. The present study infers that these habitats are not formed for the felling but for sustaining ecological balance.

Keywords: Microclimate, Biopeculiarity, Chasmophytes, Urumbikkara hills, Kerala.

INTRODUCTION

The chasmophytes are plants rooted in clefts of rocks, that are filled with detritus. The flora of the clefts varies with factors such as temperature fluctuations, width of the rocky cliffs, amount of accumulation of both water and minerals, the presence or absence of any covering of snow during winter etc. [1]. Rocky cliffs are the microhabitats in which slightly mineral rich and it can support the growth and survival of chasmophytic species. The occurrence of such habitat is ultimately depends on number of factors such as geographical location, levels of exposure, high evaporation rates, nature of soil geology and water runoff during the rainy season [2,3].

The growth of chasmophytic plants are mainly depends on the availability of water, depth of soil with nutrients. The number of plants was more during wet season than the dry season. The rocky cliffs and crevices represents a good indicator of rich biodiversity within small areas [4]. The competition of chasmophytes with other plants is very limited and solar radiation is often abundant. They produce small and easily dispersed seeds. The seeds reaching these light-rich habitats can afford to be small because they require little stored food but they are free from competition with surrounding vegetation [5, 6]. The vegetation of rocky tracts posses certain biological peculiarities that enable it to occupy this type of habitat [7].

The chasmophytic vegetation in the rock crevices enhanced the biogenic impact on the rock due to the mechanical action of the plant roots and the biochemical action of the plants and their products decomposition. Thus it leads to the formation of fine earth components in the fissures and cavities [8]. The chasmophytic species growing on rock crevices and cliffs have to deal with an extremely inhospitable environment. Therefore they have developed several adjustments such as strong roots and reduced life form structures etc. The root system also supports them on the cliffs and also allows the maximum exploitation of the little water and nutrients contained in minimum soil. More over this habitat is susceptible to strong winds and full sunlight, as there is no tall vegetation to protect it from these climatic factors [9].

MATERIALS AND METHODS

STUDY AREA: *Urumbikkara Hills Idukki district, Kerala*

The present study was conducted in the rocky habitats of Urumbikkara hills (9º 15' and 10º 21' of North

latitude and 76º 37' and 77º 25' of East longitudes) of Idukki district, Kerala. It is one of the biodiversity rich region of Western Ghats possess many floristic elements with varied climatic conditions. The temperature is ranges between 19°C-34^0 C. The humidity is about 45-61% and wind from west at 10 K/h. This area gets rain from two monsoon seasons, the South-West monsoon and the North-East monsoon. The average rainfall is around 3600 mm per year. The South-West monsoon starts in June and ends in September. The North-East monsoon season is from October to November. Pre-monsoon rains during March to May are accompanied by thunder and lightning. The months like December. January and February are cooler, while March, April and May are warmer (**Fig.1**) [10].

DOCUMENTAION

Several explorative field works was undertaken in the Urumbikkara hills of Idukki district, Kerala during December 2013 – April 2014. During the field visits, the plant specimens were collected at different reproductive stages to prepare herbarium specimens [11]. and authenticate their correct identity with help of available floras and Literature [12,13,14]. The voucher specimens were deposited in the Herbaria of Department of Botany, Deva Matha College, Kuravilangad, Kottayam for future reference.

RESULTS AND DISCUSSION

The present study was undertaken to assess the chasmophytic diversity of Urumbikkara hills of Idukki District, Western Ghats region of Kerala, India. A total of 72 taxa belonging to 63 genera in 41 families were collected. Dicots are dominating with 27 families and monocots with 7 families. Among dicots, the group Polypetalae with 12 families, 17 genera and 18 species, Gamopetalae with 11 families, 23 genera and 24 species, Monochlamydeae with 4 families, 6 genera and 8 species. In monocots 7 families are spreading over 10 genera and 14 species. In addition to angiosperms, the present study also collected chasmophytic pteridophytes and bryophytes also. Pteridophyte consists of 5 families spreading over 5 genera and 6 species. In bryophytes 2 families are spreading over 2 genera and 2 species each. The analysis of distribution and diversity of chasmophytic plants in the study area reveals that, 24 species are common, 10 species are uncommon or occasional and 38 species are rarely occur in the various chasmophytic habitats of the study area (Table-1&3).

The fissures and rock crevices representing below ground gaps that may be differently exploited by plants with contrasting root architectures. The chasmophytic plant species such as *Ischaemum indicum* (Houtt.) Merr, *Eriocaulon heterolepis* Steud., *Bulbophyllum distans* Lindl. *etc.,* having fibrous and tuberous root systems for anchoring and absorbing available nutrients in the rock crevices. The grasses generally have relatively shallow, fibrous root system and it is well suited for intensively exploiting upper volumes fissure soil [15,16]. It indicates that the morphology of the chasmophytic species is a characteristic feature for adapting to those micro-environments.

In order to infer the dominant families of angiosperms Asteraceae and Commelinaceae are the first dominant families with 7 species, Lamiaceae is the second dominant family with 5 species, Melastomataceae is the third dominant family with 4 species. The other dominant families such as Scrophulariaceae and Utricaceae having 3 species each (Fig.2). In pteridophytes, Selaginellaceae is the dominant family with 2 species. In chasmpohytic bryophytes, total 2 families equally distributing with 1 species each.

The analysis were found that, a total of 46 genera of dicotyledons was represented. In Polypetalae *Impatiens* is the dominant genus with 2- species. In Gamopetalae *Leucas* is the dominant genus with 2- species. In Monochlamydeae *Persicaria* and *Pouzolzia* are the first dominant genus with 2- species. Out of 10 genera represented in Monocotyledons, *Murdannia* is the first dominant genera with 3- species, *Commelina* and *Cyanotis* are the second dominant genus with 2- species each (Fig. 3).

In pteridophytes, out of 5 genera were distributed. Among these *Selaginella* is the dominat genus with 2 species. While in bryophytes, the genera like *Dumortiera* and *Pogonatum* are having single species each.

In order to presume the total life forms of the chasmophytic flora of the study area reveals that, Herbs are more dominant form in which 58 species, followed by Shrubs with 10 species, Sub shrubs with 1 species and Climbers or ramblers possess 3 species (Fig. 4). The micro-habitat like crevices posses diverse forms of plants, mainly seasonal herbs. These habitats differ from each other due to the change in the geographical terrain and soil cover [17].

The soil samples were collected from the different regions of the study area (by mixing of 5 samples per altitude) and it is used for analysis. The total of essential nutrients such as Nitrogen (N), Phosphorus (P) and Potassium (K) were determined [18]. The result of the present study indicates that, altitude decreases the rate and accumulation of minerals in the rock crevices become increases. The present study reveals that, the nutrient enrichment is more in lower altitudinal regions of the study area when compared to both middle and upper altitudinal regions. It indicates that, during rainy season water runoff from higher altitudinal regions to lower altitudinal regions can washed out most soil and essential nutrients (Table – 2).

The soils in the rock crevices are very limited and loosely packed. So it can easily fluctuated during

such ecological phenomena. More over the litter decomposition and death and decay of chasmophytic plants in the rocky cliffs are also add some amount of soil nutrients in to this fragile ecosystem. Most of the chasmophytic plants produces strong roots for absorbing the available nutrients in the limited soil and also for anchoring in such crevices.

The similar studies like, diversity of chasmophytic plants in the rocky habitats of Kinathukadavu, Kurunthamalai, Kanuvai and Madukkarai areas in the Western Ghats regions of Coimbatore district of Tamil Nadu was studied by Binu Thomas *et al*., [7]. According to them, total of 85 – species chasmophytic plants belonging to 64 - genera and 43 - families of angiosperms. Out of these 23- species are shrubs 12- climbers, lianas 48 - herbs and 2- grasses respectively. Besides, the study was under taken for the assessment of the diversity of chasmophytic species in rocky habitats of Malabar Wilde Life Sanctuary in Southern Western Ghats of Calicut district of Kerala was studied by Binu Thomas & Rajendran [19]. The present study enumerates 75 - species belonging to 55 - genera and 30 - families. Of these 54 species are herbs, 7- shrubs, 6- grasses and 8- ferns. The rocky habitat provides extremely harsh physical environment for plants that leads to the development of specialized plant communities with number of habitat specific species.

Table 1. Statistical synopsis of the Chasmoflora of the study area

Floristic analysis		Families		Genera		Species	
Dicotyledons	Polypetalae	12	27	17	46	18	50
	Gamopetalae	11		23		24	
	Monochlamydeae	4		6		8	
Monocotyledons		7		10		14	
Pteridophytes		5		5		6	
Bryophytes		2		2		2	
Total		41		63		72	

Table 2. Soil analysis from different altitudinal regions of the study areas

Altitude	PH	EC(dsm^{-1})	N ($Kgha^{-1}$)	P($Kgha^{-1}$)	K($Kgha^{-1}$)
800-900 MSL	5.1	0.01	0.69	5.92	140
500-750 MSL	5.2	0.03	1.67	7.89	151
300-450 MSL	5.3	0.06	2.31	11.11	202

Table 3. Chasmophytes in the Urumbikkara Hills of Idukki district, Kerala

Sl. No.	Botanical Name	Family	Distribution		
			Common / Uncommon / Rare	Ornamental Potentiality	Medico Potentiality
	Bryophytes				
1.	***Dumortiera hirsuta*** (Sw.) Nees **(Pl.1A)**	Marchantiaceae	**U**		
2.	***Pogonatum aloides*** (Hedw.) P. Beauv. **(Pl.1B)**	Polytrichaceae	**U**		
	Pteridophytes				
3.	***Actinopteris radiata*** Link	Actinopteridaceae	**C**		✓
4.	***Adiantum raddiannum*** L. **(Pl.1C)**	Adiantaceae	**C**		✓
5.	***Drynaria quercifolia*** (Borry) J. Smith **(Pl.1D)**	Drynariaceae	**C**		
6.	***Lygodium flexuosum*** L. **(Pl.1E)**	Lygodiaceae	**R**		✓
7.	***Selaginella delicatula*** (Desv.)	Selaginellaceae	**U**		✓
8.	***Selaginella involvens*** P. Beauv**(Pl.1F)**	Selaginellaceae	**C**		✓
	Angiosperms				
9.	***Ageratum conyzoides*** L.	Asteraceae	**R**		✓
10.	***Anisomeles indica*** (L.) O. Ktze.	Lamiaceae	**U**	✓	
11.	***Asparagus racemosus*** Willd.	Asparagaceae	**R**	✓	✓
12.	***Begonia malabarica*** Lam.	Begoniaceae	**R**	✓	✓

13.	***Biophytum sensitivum*** (L.) DC.	Oxalidaceae	**R**	✓	✓
14.	***Bulbophyllum distans*** Lindl. **(Pl.2A)**	Orchidaceae	**C**	✓	✓
15.	***Catharanthus roseus*** (L.) G. Don **(Pl.2B)**	Apocynaceae	**U**	✓	
16.	***Centella asiática*** (L.) Urban in Mart.	Apiaceae	**U**	✓	✓
17.	***Christonia tubulosa*** (Wight.) Benth. *Ex* Hook.f. **(Pl.2C)**	Orobanchaceae	**C**	✓	
18.	***Chromolaena odorata*** (L.) R.	Asteraceae	**R**		✓
19.	***Cleome viscosa*** L.	Cleomaceae	**R**	✓	✓
20.	***Clidemia hirta*** (L.)Don.	Melastomaceae	**C**	✓	✓
21.	***Commelina benghalensis*** L.	Commelinaceae	**R**	✓	✓
22.	***Commelina ensifolia*** R. Br. **(Pl.2D)**	Commelinaceae	**R**	✓	
23.	***Cyanotis arachnoidea*** Clarke	Commelinaceae	**C**	✓	
24.	***Cyanotis fasciculata*** (Heyne *ex* Roth) Schult.	Commelinaceae	**R**	✓	
25.	***Cyperus difformis*** L.	Cyperaceae	**R**	✓	
26.	***Desmodium triflorum*** (L.) DC. **(Pl.2E)**	Fabaceae	**C**	✓	✓
27.	***Didymocarpus tomentosa*** Wight	Gesneriaceae	**R**	✓	
28.	***Drymaria cordata*** Edgew.	Caryophyllaceae	**R**	✓	✓
29.	***Elephantopus scaber*** L.	Asteraceae	**R**	✓	✓
30.	***Emilia sonchifolia*** (L.)DC. **(Pl.2F)**	Asteraceae	**C**	✓	✓
31.	***Eriocaulon heterolepis*** Steud. **(Pl.3A)**	Eriocaulaceae	**C**	✓	
32.	***Euphorbia hirta*** L.	Euphorbiaceae	**R**		✓
33.	***Hemidesmus indicus*** (L.) R.Br.	Asclepiadaceae	**C**		✓
34.	***Heteropogon contortus*** (L.) P. Beauv.	Poaceae	**C**		
35.	***Hyptis suaveolens*** (L.) Poit.	Lamiaceae	**R**	✓	✓
36.	***Impatiens scapiflora*** Heyne *ex* Roxb.	Balsaminaceae	**C**	✓	✓
37.	***Impatiens viscosa*** Bedd.	Balsaminaceae	**C**	✓	
38.	***Ischaemum indicum*** (Houtt.) Merr.	Poaceae	**R**		
39.	***Kalanchoe tubiflora*** Harvey.	Crassulaceae	**R**	✓	
40.	***Lantana camara*** L.	Verbenaceae	**C**	✓	✓
41.	***Leucas aspera*** (Willd.) Spreng.	Lamiaceae	**R**	✓	✓
42.	***Leucas ciliata*** Benth.	Lamiaceae	**C**	✓	✓
43.	***Lindernia ciliata*** (Colsm.) Pennell	Scrophulariaceae	**R**	✓	
44.	***Medinilla beddomei*** Clarke	Melastomaceae	**C**	✓	✓
45.	***Melastoma malabathricum*** L.	Melastomaceae	**R**	✓	
46.	***Mimosa pudica*** L.	Mimosaceae	**R**		✓
47.	***Mollugo pentaphylla*** L.	Molluginaceae	**R**	✓	
48.	***Murdannia dimorpha*** (Dalz.) Brueck.	Commelinaceae	**R**	✓	
49.	***Murdannia fadeniana*** Nampy & Joby	Commelinaceae	**C**	✓	
50.	***Murdannia pauziflora*** (wight) Brueck.	Commelinaceae	**C**	✓	
51.	***Ophiorrhiza mungos*** L.	Rubiaceae	**R**	✓	✓
52.	***Oxalis corniculata*** L.	Oxalidaceae	**R**	✓	✓
53.	***Peperomia pellucida*** (L.) Kunth.	Piperaceae	**R**	✓	✓
54.	***Persicaria barbata*** (L.)Hara	Polygonaceae	**R**	✓	
55.	***Persicaria chinensis*** (L.)Gross.	Polygonaceae	**R**	✓	
56.	***Pilea microphylla*** (L.) Liebm.	Utricaceae	**U**	✓	
57.	***Pouzolzia wightii*** Bennett	Utricaceae	**U**		✓
58.	***Pouzolzia zeylanica*** (L.) Bennett.	Utricaceae	**R**	✓	✓
59.	***Rhynchoglossum notonianum*** (Wall.) Burtt.	Gesneriaceae	**C**	✓	✓
60.	***Sauropus androgynous*** (L.)Merr.	Euphorbiaceae	**R**		✓
61.	***Scoparia dulcis*** L.	Scrophulariaceae	**R**		✓

62.	***Scutellaria oblonga*** Benth.	Lamiaceae	**C**		✓
63.	***Sida rhombifolia*** L.	Malvaceae	**R**	✓	✓
64.	***Sonerila rheedei*** Wight. **(Pl.3C)**	Melastomaceae	**R**	✓	
65.	***Spilanthes calva*** DC.	Asteraceae	**R**	✓	✓
66.	***Torenia bicolor*** Dalz. **(Pl.3D)**	Scrophulariaceae	**R**	✓	
67.	***Tridax procumbens*** L.	Asteraceae	**U**	✓	✓
68.	***Thunbergia fragrans*** Roxb. **(Pl.3E)**	Acanthaceae	**C**	✓	✓
69.	***Urena lobata*** L.	Malvaceae	**R**	✓	✓
70.	***Utricularia graminifolia*** Vahl. **(Pl.3F)**	Lentibulariaceae	**C**	✓	
71.	***Vernonia cinerea*** (L.) Less.	Asteraceae	**R**	✓	✓
72.	***Zingiber nimmonii*** (J.Graham) Dalzel.	Zingiberaceae	**U**	✓	✓

Figure 1. Map of Kerala state, Idukki district and satellite image of study area

Figure 2. Analysis of dominant angiosperm families in the study area

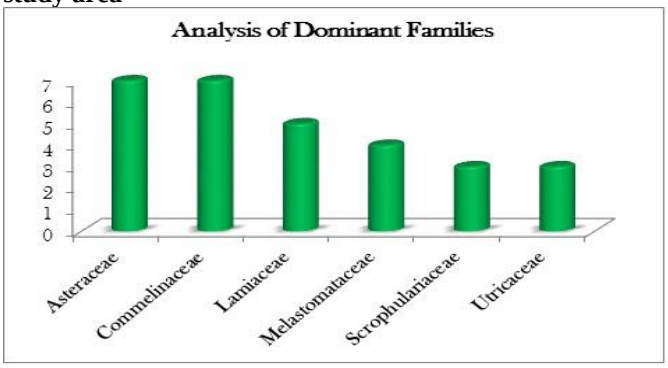


Figure 3. Analysis of dominant angiosperm genera in the study area

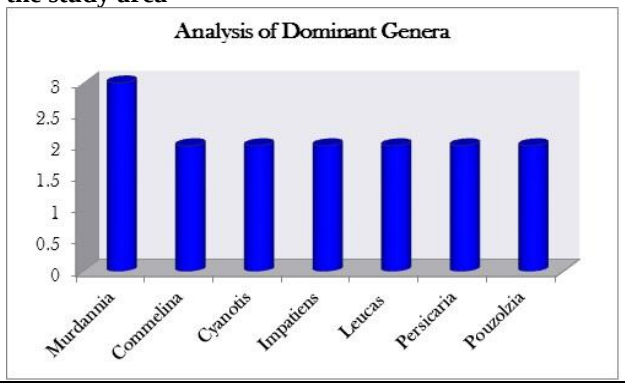


Figure 4. Life form analysis of chasmophytic plants in the study area

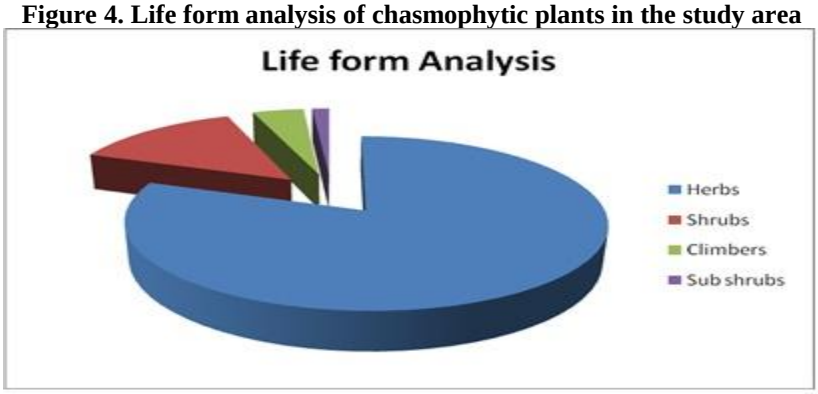
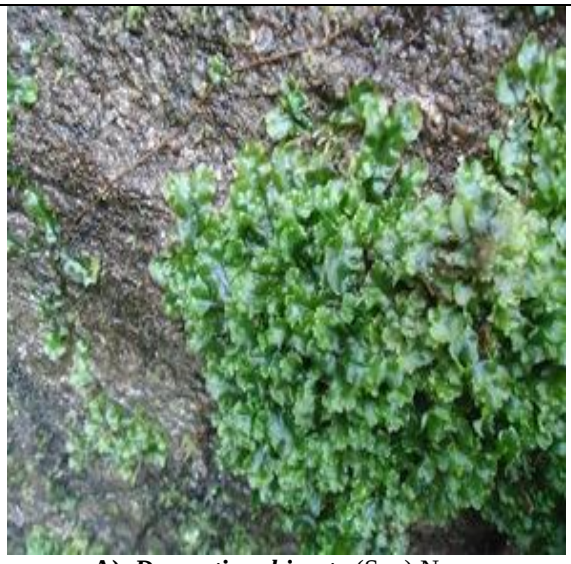


PLATE 1.



A). *Dumortiera hirsuta* (Sw.) Nees.

B). *Pogonatum aloides* (Hedw.) P. Beauv.

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D). *Drynaria quercifolia* (Borry) J. Smith

E).*Lygodium flexuosum* L.

F). *Selaginella involvens* P. Beauv .

PLATE 2.

A). ***Bulbophyllum distans*** Lindl.

B).*Catharanthus roseus* (L.) G. Don.

C). *Christonia tubulosa* (Wight.)Benth.

D).*Commelina ensifolia* R. Br.

E). *Desmodium triflorum* (L.) DC.

F). *Emilia sonchifolia* (L.)DC.

PLATE 3.

A). *Eriocaulon heterolepis* Steud.

B). *Hemidesmus indicus* (L.) R.Br.

C). *Sonerila rheedei* Wight.

D). ***Torenia bicolor*** Dalz.

E).*Thunbergia fragrans* Roxb.

F). *Utricularia graminifolia* Vahl. Enum.

CONCLUSION

The main thrust of the present study is to document the diversity of chasmophytic plants of Urumbikkara Hills Idukki district, Kerala. Nowadays there are several threatened factors are challenging the equilibrium of this fragile ecosystem such as fluctuation of temperature, pressure, extreme drought, nutrient deficiency, limited soil profile in the crevices, etc. In addition to these natural threatened factors, some of the anthropogenic pressures and other associated activities also exigent this ecosystem. Hence an urgent attention has to be taken to conserve this valuable group of plants for future generation. Chasmophytes to some extend determine the vegetation of the valley.

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