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Rare, Endangered and Threatened (RET) climbers of Southern Western Ghats, India

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Abstract

Background and Aims: The Mountains of the Western Ghats are the second most important shelter in the world for threatened species. The current paper is an attempt to study the conservation assessment of rare, endangered and threatened species (RET) of the southern Western Ghats. A species is endangered when it is threatened with extinction. Since time began, countless species have gone extinct from natural processes. The present study was conducted to identify the rare, endangered and threatened climbing plants in Southern Western Ghats of Tamil Nadu, India.

Methods: The plant collection and identification of the RET listed climbing species of the Southern Western Ghats was done during 2011–2014. The collection and identified RET plant species from the study were selected from different hills (forest) of Tamil Nadu. During the work the selected study sites were visited, plant specimens were collected and systematically pressed, stored for identification.

Key results: A total number of 285 climber species comprising 125 genera of 41 families were identified from Southern Western Ghats of Tamil Nadu. Out of 285, 33 species are listed as RET species like *Ceropegia mannarana* Umam. & Daniel and *Gloriosa superba* L. fond to be Endangered species and *Celastrus paniculata* Willd., *Aganosma cymosa* G.Don. *Smilax wightii* A. DC., *Corallocarpus gracilipes* Cong., are rare species. The most specious families include Asclepiadaceae (7 species), Convolvulaceae (5-species) followed by, Fabaceae (4-species), Cucurbitaceae and Liliaceae each 3-species, and all the other remaining families having two or one species each.

Conclusion: Some of the threatened factors such as over-exploitation of natural resources and other anthropogenic activities adversely affect the existing ecosystem and it may lead to the rarity of many species in future. There is an urgent need for developing pragmatic conservation strategies for endemic plants in the southern Western Ghats, which may lead to their effective protection.

Keywords: Climbers, RET, Southern Western Ghats, Tamil Nadu, India

Background

India is rich with flowering plants and is considered as one of the mega diversity country in the world. Of the 18,000 species of flowering plants reported from India, one-third is considered endemic in the Western Ghats. Nearly 1600 species of plants were endemic among the 5000 reported species, which includes trees, shrubs, climbers and herbs. There are 54 monotypic genera in the Western Ghats [3, 42]. The southern Western Ghats is by far the richest area in context to floristic composition and concentration of endemic taxa [29].

Climbers are a typical constituent of rain forest. Climbing plant taxa have greater species richness than their non-climbing sister groups. It is considered that highly diversified clades should show increased among-population genetic differentiation [45]. Climbing plant taxa have greater species richness than their non-climbing sister groups. The majority of lianas are restricted to tropical forests, where they can contribute up to 35 % of the total number of woody plant species and up to 45 % of woody stems present [7, 12, 15, 35].

Climbing plants are found in all kinds of forests and all over the world. Endemic species are more vulnerable to extinction than more widespread species because of their limited geographic ranges and thus

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have become one of the most effective surrogates for identifying conservation priorities [26]. When conservation resources are limited, identifying priority areas or hotspots where biodiversity is most threatened is critical [8]. The endemism in the flora of a country or geographical region provides an important insight into the biogeography of that region and also to the centers of diversity and adaptive evolution of the floristic components of that region. There has been much interest among bio-geographers to explain why areas of endemism occur, whether it is by a unique combination of ecological factors or because of a history of vicariance and speciation in isolation followed by continued range restriction [33].

In the past few years some reports have been appeared on the floristic studies of the Western Ghats region [22, 38]. As far as RET climbing plants of the Southern Western Ghats are concerned, no detailed inventory was undertaken in the past. Hence there is an urgent need to conserve each and every RET climbing plant species. Some of the species may be lost without receiving any attention. Since most of the southern Western Ghats are located near the human settlements, human disturbance in these forest are progressively increasing. In view of the above facets, the present study was identify the rare, endangered and threatened climbing plants in southern Western Ghats of Tamil Nadu, India.

Methods

Study area

The Western Ghats, one of the 34 globally recognized biodiversity hotspots also forms a significant part of the state [11, 26]. In fact, Tamil Nadu is the only state with both hill ranges, Western Ghats and Eastern Ghats, both meet at the Nilgiri hills. Almost the entire western border of the state is occupied by the Western Ghats with Kerala. Doddabetta in the Nilgiris district of Western Ghats is the tallest peak (2637 m) in Tamil Nadu. The present study was conducted in Southern Western Ghats forests area of Tamil Nadu (Fig. 1). It represents a hilly area meeting the mountain range of the Eastern Ghats in the Sathyamangalam Tiger Reserve Forest. Present study covers seven districts viz. Nilgiris (NG), Coimbatore (CBE), Dindugul (DG), Theni (TN), Viruthunagar (VN), Kanyakumari (KK) and Tirunelveli (TVL).

The Western Ghats of Tamil Nadu exhibits great plant diversity, due to immense variety of climate, altitude and edaphic factors. Vegetation can broadly be classified into two major categories, namely Vegetation of the interior plains and Vegetation of the hills and mountains and each vegetation category may be further divided into various forest types of the present study area viz. Dry Deciduous Forest, Shrub jungle Forest, Moist Deciduous Forest, Tropical Wet Evergreen Forest, Tropical Semi Evergreen Forest, Tropical Evergreen Forest, Shola forest and Mangrove forest based on "A revised survey of forest types of India" by [10].

Methodology

Rare, Endangered and Threatened plants were recorded from the present study area. The plant collection and identification of the RET listed climbing species were selected from different hills (forest) of the Southern Western Ghats, Tamil Nadu from 2011 to 2014. The collected specimens were made into herbarium for identification with standard traditional method. The primary identification of plant specimens done with help of local and regional Floras [14, 18, 19] and the conformity of identification compared with authentic herbarium deposited Botanical Survey of India, Southern Circle, Coimbatore. The threatened status of the plants was confirmed with IUCN Ret list and also the help of using available RET data books and standard publications such as [28, 30–32, 40]. The botanical information was made into a database consisting of binomial name, family, mode of dispersal, source of collection, morphology of useful part and conservation status. The voucher specimens were deposited in Bharathi Herbarium, Department of Botany, Bharathiar University, Coimbatore, Tamil Nadu, India.

Result and Discussion

A total of 285 climbing plant species belonging to 125 genera and 41 families were identified from different forest types identified in the Southern Western Ghats of Tamil Nadu. The taxonomic diversity of lianas was relatively high in the tropical forest of India. Many studies [15, 16, 25, 27] carried out in different tropical forests have reported similar results. Out of the 285 species, 33 taxa were collected under RET category (Table 1). Most species rich family was Convolvulaceae (9-species) followed by Asclepiadaceae (5-species)

Lianas families of Asian forest are dominated by Apocynaceae, Fabaceae, Anonaceae, Combrataceae, Loganiaceae, Rutaceae etc. [9, 13, 20, 21, 24, 44]. The dominance of liana families by Apocynaceae, and Fabaceae in wide-ranging tropical forests [1] is also evident in this study.

Among the endangered species, *Operculina turpethum* (Linn.) Silva Manso, *Ceropegia mannarana* Umam. & Daniel and *Gloriosa superba* L., *Grewia heterotricha* Mast. were collected from the study area. Even though the species *Gloriosa superba* L. was reported as an endangered species, *Smilax wightii* A. DC. in the earlier research articles and IUCN reported it as Rare but the

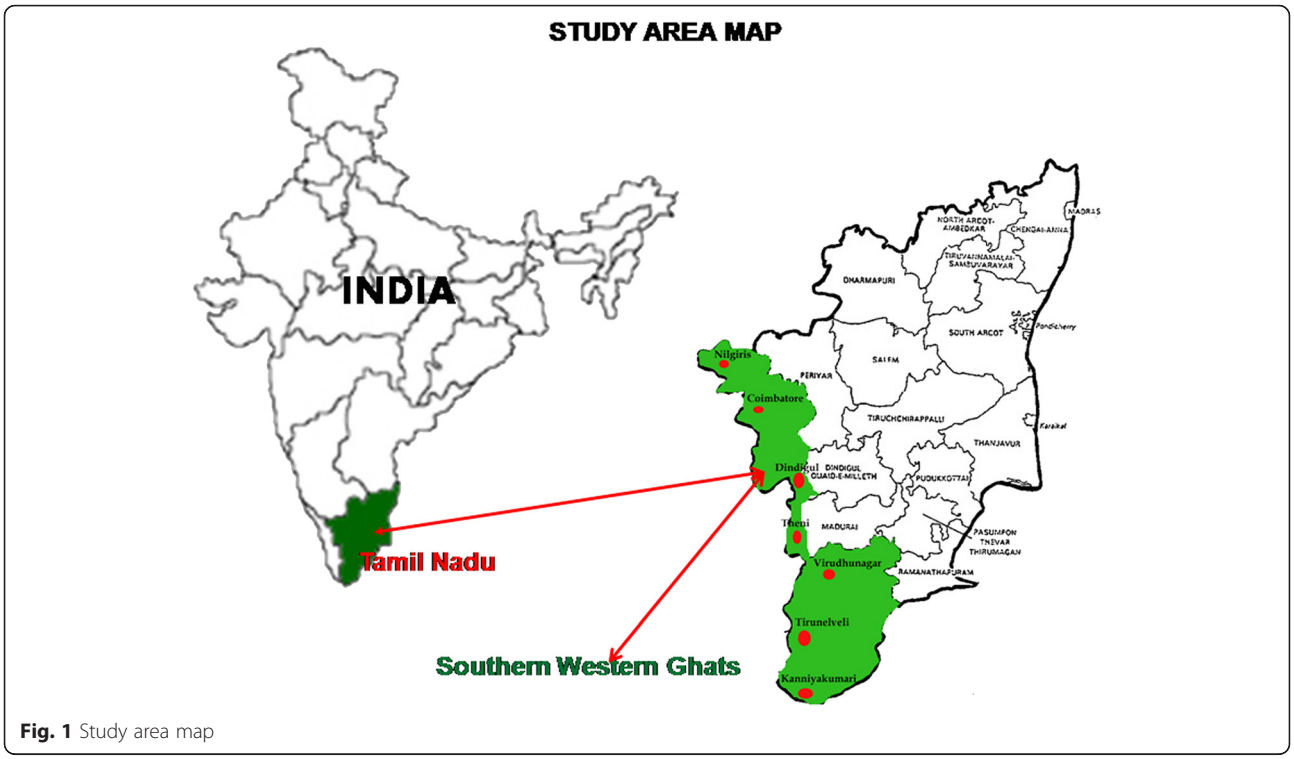

Fig. 1 Study area map

present study observed it as most abundant species in all types of forests. Some of the rare species, *Celastrus paniculata* Willd., *Aganosma cymosa* G.Don. *Smilax zeylanica* L., *Corallocarpus gracilipes* Cong., *Argyreia nellygherrya* Choisy, *Argyreia pomacea* (Roxb.) Choisy and *Coscinium fenestratum* (Gartn) Colebr, were collected in the Southern Western Ghats. The present study found that some identified taxa occur only from few samples and have a narrow distribution. It indicates the need to carry out further studies on the flora of climbers in Western Ghats.

The species *Cucumis dipsaeceus* Enherb., *Corallocarpus gracilipes* Cong., *Bauhinia vahalli* Wt Arn., *Bauhinia phoenicea* Wight & Arn., *Passiflora foetida var. ellisonii* Vander, *Ipomoea mulleri* Benth, and *Ipomoea rumicifolia* Choisy were found to be in rare category with restricted distribution in these forest areas. These species require site-specific conservation strategies.

The present study recorded different climbing mechanisms. The species of the families Convolvulaceae, Menispemaceae and Combrataceae climb by twining around the host plants, tendril climber is the second dominant mechanisms of the present study. Similar studies [27] were carried out in different tropical forests.

In the area of research, many species are highly exploited for either curative or some other purposes. Out of 33 RET plants, local people were observed to use 15 plants for curative purposes species viz. *Aganosoma cymosa* G. Don., *Argyreia nervosa* Dalz., *Aristolochia tagala* Cham., *Bauhinia phoenicea* Wight & Arn., *Ceropegia mannarana* Umam. & Daniel and *Coscinium fenestratum* (Goetgh.) Colebr. etc. They are using these plants to cure skin diseases, cough, fever, headache, diabetes, rheumatism, asthma, dysentery and poison bites etc. and 9 plants for edible purposes viz. *Cucumis dipsaceus* Ehrenb, *Passiflora leschenaultii* DC., *Piper Longum* L., *Rubus racemosus* Roxb. *and Solena amplexicaulis* (Lam.) Gandhi etc. these plants were continuously collected and over exploited by local people in the study regions, which need to be mentioned by concerned official for its sustainability.

Of the total invasive species (*Ipomoea cairica* (L.) Sweet., *Lantana camara* L., *Ipomoea muelleri* Benth, *Celastrus paniculatus* Willd. and *Rubus racemosus* Roxb.) *Lantana camara* L. were the most abundant and occurred in all the study area. These invasive species are ready colonizer in disturbed areas and cause considerable ecological damages to natural areas.

The present study observed that some species fruits of climbers produced by the lianas for sustaining their population (*Solena amplexicaulis* (Lam.) Gandhi, *Smilax zeylanica* L., *Rubus racemosus Roxb.*, *Passiflora leschenaultii* DC. and *Piper Longum* L. etc.) also sustain numerous birds and other animals species. Therefore,

Table 1 List of RET climber species of the Southern Western Ghats

S. No	Botanical name	Family	Mode of dispersal[a]	Uses[b]	References
1.	*Abrus fruticulosus* Wight & Arn.	Fabaceae	AU	M	Data Deficient [17]
2.	*Aganosma cymosa* (Roxb.) G. Don,	Apocynaceae	AN	M	Rare to Western Ghats of Tamil Nadu.
3.	*Ampelocissus latifolia* (Roxb.) Planch.	Vitaceae	–	M	vulnerable (IUCN book, 1997)
4.	*Argyreia nervosa* (Burm. fil.) Bojer	Convolvulaceae	–	M	Rare [2]
5.	*Aristolochia tagala* Cham.	Aristalochiaceae	AU	M	Nearly threatened [43]
6.	*Asparagus fysonii* J.F.Macbr	Liliaceae	ZO	E	Rare [34]
7.	*Asparagus racemosus* Willd.	Liliaceae	ZO	M & E	Threatened [46]
8.	*Bauhinia phoenicea* Wight & Arn.	Fabaceae	ZO	M	Endemic To Western Ghats [4]
9.	*Bauhinia vahlii* Wight & Arn.	Fabaceae	ZO	M	Rare to Tamil Nadu
10.	*Celastrus paniculatus* Willd.	Celastraceae	ZO	M	Nearly threatened [43]
11.	*Ceropegia mannarana* P.Umam. & P.Daniel	Asclepiadaceae	–	M	Endangered [46]
12.	*Corallocarpus gracilipes* Cogn.	Cucurbitaceae	ZO	–	Intermediate [2]
13.	*Coscinium fenestratum* (Goetgh.) Colebr.	Menispermaceae	–	M	Critically endangered [37]. Endemic to India (1997 IUCN Red List of Threatened Plants)
14.	*Cucumis dipsaceus* Ehrenb. ex Spach	Cucurbitaceae	ZO	E	Rare to India
15.	*Gloriosa superba* L.	Liliaceae	ZO	M	Endangered in Western Ghats [5, 44]
16.	*Grewia heterotricha* Mast.	Tiliaceae	–	M	Endangered [23]
17.	*Gymnema khandalense* Santapau	Asclepiadaceae	ZO	–	Endengered [2]
18.	*Hemidesmus indicus* R. Br.	Asclepiadaceae	–	M	Depleted in Western Ghats [5, 19, 44]
19.	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	AN	–	Vulnerable
20.	*Ipomoea muelleri* Benth.	Convolvulaceae	AN	–	Rare to Tamil Nadu
21.	*Ipomoea rumicifolia* Choisy	Convolvulaceae	AN	–	Rare to Tamil Nadu
22.	*Operculina turpethum* (L.) Silva Manso.	Convolvulaceae	AN	–	Endangered in peninsular India [41]
23.	*Oxystelma esculentum* (L. f.) R. Br. ex Schult.	Asclepiadaceae	AU	M	Least concern (IUCN 2011)
24.	*Passiflora leschenaultii* DC.	Passifloraceae	AU	E	Endemic to peninsular India [34]
25.	*Piper longum* L.	Piperaceae	AU	E	Endangered in Tamil Nadu [2]
26.	*Pterolobium hexapetalum (*Roth*)* Santapau & Wagh	Mimosaceae	ZO	M	Endemic to peninsular India [34]
27.	*Pueraria tuberosa* DC.	Fabaceae	AN	–	Vulnerable [2]
28.	*Rubus racemosus* Roxb.	Rosaceae	–	E	Rare [2]
29.	*Sarcostemma viminale* (L.) R.Br.	Asclepiadaceae	ZO	–	Endangered
30.	*Smilax wightii* A. DC.	Smilacaceae	AN	E	Endemic to Southern western Ghats, sasi Rare [30, 34]
31.	*Smilax zeylanica* L.	Smilacaceae	ZO	E	Least concern in Tamil Nadu [2]
32.	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae	ZO	E	Intermediate (Kerry Scott Walter and Harriet J. Gillett, 1997)
33.	*Toxocarpus beddomei* Gamble	Asclepiadaceae	ZO	–	Rare [30, 31]

[a]*ZO* Zoochory, *AU* Autochory, *AN* Anemochory, *HY* Hydrochory
[b]*M* Medicinal, *E* Edible

imprudent utilization of lianas could have significant impacts on the forest diversity.

The forest of the southern Western Ghats are prone to diverse distribution like invasion of alien species, illegal timber extraction, collection of non-timber forest products, human settlement, removal of minerals, hill cultivation, cattle grazing and tourism. An urgent requisite for developing practical conservation strategies for RET plants in the Southern Western Ghats may lead their effective protection.

Conclusion

The present study suggests that RET species could gives vital information about the niches and amplitudes of rare endemic, endangered and threatened species in a regional scale. This report can help in identifying areas

and habitats of rich concentration of these species so that critical habitat and habitat sites would get priority for conservation.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
As conducted research on Taxonomic research field work and Dr. AR was Research supervisor, designed the study. Both authors read and approved the final manuscript.

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