

REVIEW

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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. found to be Endangered species and *Celastrus paniculata* Willd., *Aganosma cymosa* G.Don. *Smilax wightii* A. DC., *Corallocarpus gracilipes* Cong., are rare species. The most speciose 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 mannanarana* Umam. & Daniel and *Gloriosa superba* L., *Grewia heterotracha* 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



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

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

<sup>a</sup>ZO Zoochory, AU Autochory, AN Anemochory, HY Hydrochory

<sup>b</sup>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 give 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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#### References

- Addo-Fordjour P, Anning AK, Larbi JA. Liana species richness abundance and relationship with trees in the Bobiri forest reserve Ghana: impact of management systems. *Fort Ecol Manage.* 2009;157:1822–8.
- Ahamedhullah M, Nayar MP. Endemic Plants of the Indian Region. Botanical Survey of India Calcutta. 1986;1:261.
- Ahmedullah M, Nayar MP. Endemic plants of the Indian Region, Peninsular India. *BSI Flora of India Ser.* 1987;41:143–53.
- Alphons Baby A, Regi Raphael K. First Step Towards Unraveling The Medicinal Properties Of An Endemic Traditional Medicine, *Bauhinia Phoenicea* Wight And Arn Bark. *Int J Pharm Pharm Sci.* 2015;7(9):403–5.
- Amalraj VA, Velayudhan KC, Abraham Z threatened medicinal plants in Western Ghats In CK Karunakaran (ed) Proc. Of the Symposium on rare endangered and Endemic Plants of Western Ghats. 1991; 215–20.
- Amirthalingam M. Sacred Groves of Tamil Nadu-A survey CPR Environmental Education Centre Chennai India. 1998.
- Balachandran N, Rajendiran A. Diversity and distribution of angiospermic climbers In Tropical dry evergreen forest of Tamil Nadu India. *Inter J Geo Earth and Envir Sci.* 2014;4(3):119–29.
- Brummitt N, Nic Lughadha E. Biodiversity: Where's hot and where's not. *Conserv Biol.* 2003;17:1442–8.
- Cai ZQ, Schnitzer SA, Wen B, Chen YJ, Bongers F. Liana communities in three tropical forest types in Xishuangbanna South-West China. *J Trop Forest Sci.* 2009;21:252–64.
- Champion HG, Seth SK. A Revised Survey of Forest Types of India. New Delhi: Govt, of India Press; 1968. p. 404.
- Chitale VS, Behera MD, Roy PS. Global biodiversity hotspots in India: significant yet under studied. *Curr Sci.* 2015;108(2):149–50.
- DeWalt SJ, Chave J. Structure and biomass of four lowland Neotropical forests. *Biotropica.* 2004;36:7–19.
- Dewalt SJ, Ickes K, Nilus R, Harms KE, Bursdem D. Liana habitat associations and community structure in a Bornean lowland tropical forest. *Plant Ecol.* 2006;186:203–16.
- Gamble JS. Flora of the Presidency of Madras. London: Adlard & Sons Ltd.; 1915.
- Gentry AH. The Distribution and Evolution of Climbing Plants. In: Putz FE, Mooney HA, editors. *The Biology of Vines.* UK: Cambridge University Press; 1991. p. 3–49.
- Gentry AH, Dodson C. Contribution of non-trees to species richness of a tropical rain forest. *Biotropica.* 1987;19:149–55.
- The IUCN Red list Threatened Species. Data Deficient ver 3.1 2012. <http://www.iucnredlist.org/>. Accessed 10 Apr 2015.
- Hooker JD. The Flora of British India. Vol. I-VII. London: Reeve & Co; 1872.
- Matthew KM. Flora of Tamil Nadu Carnatic Rapinat Herbarium Tiruchirappally Tamil Nadu Part 1 & 11. 1983.
- Mittermeier RA, Myers N, Gill PC, Mittermeier CG. Hotspots: Earth's Richest and Most Endangered Terrestrial Ecoregions. Mexico City: CEMEX; 2004.
- Muthukumar S, Ayyappan N, Parthasarathy N, Mudeppa D, Roman TRS, Selwyn MA, Pragasan LA. Plant community structure in tropical rain forest fragments of the Western Ghats India. *Biotropica.* 2006;38:143–60.
- Muthumperumal C, Parthasarathy N. Angiosperms Climbing plants in tropical forests of southern Eastern Ghats Tamil Nadu India. *Check List.* 2009;5(1):092–111.
- Muthumperumal C, Parthasarathy A. Large-Scale Inventory Of Liana Diversity And Distribution In Tropical Forests Of Southern Eastern Ghats, India. Ph D Thesis. 2011.
- Muthuperumal C, Parthasarathy N. A large scale inventory of lianas diversity in tropical forest of south Eastern Ghats India. *Syst Biodi.* 2010;8:289–300.
- Muthuramkumar S, Parthasarathy N. Tree-liana relationships in a tropical evergreen forest at Varagalaia Anamalais Western Ghats India. *J Trop Ecol.* 2001;17:395–409.
- Myers NRA, Mittermeier C, Mittermeier G. Biodiversity hotspots for conservation priority. *Nature.* 2000;403:853–8.
- Nabe-Nielsen J. Diversity and distribution of lianas in a neotropical rain forest Yasuni National Park Ecuador. *J Trop Ecol.* 2001;17:1–19.
- Nair NC, Daniel P. The floristic diversity of the Western Ghats and its conservation: A review, Proceedings of the Indian Academy of Sciences (Animal Science/Plant Science) Supplement. 1986. p. 127–63.
- Nayar MP. Hot spots of endemic plants of India, Nepal and Bhutan. Thiruvananthapuram: Tropical Botanic Garden and Research Institute; 1996.
- Nayar MP, Sastry ARK. Red Data Book of Indian Plants. BSI Calcutta Vol 1. 1987.
- Nayar MP, Sastry ARK. Red Data Book of Indian Plants. BSI Calcutta Vol 2. 1988.
- Nayar MP, Sastry ARK. Red Data Book of Indian Plants. BSI Calcutta Vol 3. 1990.
- Nelson G, Platnick NI. Systematic and biogeography: Cladistics and vicariance. New York: Columbia Univ Press; 1981.
- Prabhu Kumar KM, Sreeraj V, Binu Thomas Manudev KM, Rajendran A. Validation and documentation of rare endemic and threatened (RET) plants from Nilgiri, Kanuvai and Madukkarai forests of southern Western Ghats, India. *J Threatened Taxa.* 2012;4(15):3436–42.
- Putz FE. Liana biomass and leaf area of a tierra firme forest in the Rio Negro basin, Venezuela. *Biotropica.* 1983;15:185–9.
- Putz FE. The natural history of lianas on Barro Colorado Island Panama. *Ecology.* 1984;65:1713–24.
- Ramasubbu R. Protecting the wild beauties. *Science Reporter.* 2010;47(5):19–22.
- Sarvalingam A, Rajendran A. Climbing Plants of the Southern Western Ghats of Coimbatore in India and Their Economic Uses. *American-Eurasian J Agric Environ Sci.* 2015;15(7):1312–22.
- Schnitzer SA, Carson WP. Tree fall gaps and the maintenance of species diversity in a tropical forest. *Ecology.* 2001;82:913–9.
- Scott K, Harriet W, Gillett J. IUCN Red List of Threatened Plants. 1997.
- Sebastianraj J, Britto SJ, Kumar SRS. Micropropagation of *Operculina turpethum* (L) Silva manso. Using cotyledonary node explants. *Acad J Plant Sci.* 2013;6:77–81.
- Shetty BV, Kaveriappa KM, Bhat KG. Plant Resources of Western Ghats and Lowlands of Dakshina Kannada and Udupi Districts. Moodushedde, Mangalore: Pilikula Nisarga Dhama Society; 2002.
- Sivakamasundari, Karuppusamy S Parthipan R. Survey on the RET-listed Medicinal Plants in Thadagamalai Range of Kanyakumari District Tamil Nadu. *J Biodivers Endanger Species.* 2015; 3:1–4. doi: 10.4172/2332-2543.1000151.
- Sukumaran S, Raj ADS. Rare Endemic Threatened (RET) Trees and Lianas in the Sacred Groves of Kanyakumari District. *Indian Forester.* 2007;133:1254–66.
- Torres-Díaz C, Ruiz E, Salgado-Luarte C, Molina-Montenegro MA, Gianoli E. Within-population genetic diversity of climbing plants and trees in a temperate forest in central Chile. *Gayana Bot.* 2013;70(1):36–43.
- Uma R, Parthipan B. Survey on medico-botanical climbers in Pazhayaru river bank of Kanyakumari District, Tamilnadu. *J Medicinal Plants Studies.* 2015;3(1):33–6.

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