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Rare, Endangered and Threatened Climbing Plants of the Southern Western Ghats Hills, India

This study assesses the conservation status of rare, endangered, and threatened (RET) climbing plant species in the southern Western Ghats of South Gujarat, India. This research aims to identify and document the RET climbing plants in this ecologically significant region. Field surveys were conducted between 2022 to 2024 to collect and identify RET-listed climbing species across various forested hills in South Gujarat. The collected specimens were systematically preserved, catalogued, and identified using standard taxonomic references. A total of 285 climbing plant species, belonging to 125 genera and 41 families, were recorded. Among these, 31 species were classified as RET, including Ceropegia mannarana and Gloriosa superba which are endangered, while Celastrus paniculata, Aganosma cymosa, Smilax wightii and Corallocarpus gracilipes were categorized as rare. The most species-rich families included Asclepiadaceae (7 species), Convolvulaceae (5 species), and Fabaceae (4 species), with other families contributing fewer species. The increasing pressure from anthropogenic activities, including over-exploitation of natural resources, is negatively impacting biodiversity, leading to a decline in many species. To prevent further loss, urgent conservation measures are needed to safeguard the endemic flora of the southern Western Ghats. Effective protection strategies must be developed to ensure the survival of these unique plant species.

Key words : Climbers, RET species, Western ghats, South Gujarat, Biodiversity conservation.

The study emphasizes the need to prioritize the conservation efforts and habitat protection of RET Species in the southern Western Ghats of South Gujarat

Introduction

India is recognized as one of the world's megadiverse countries, boasting an extraordinary wealth of flowering plants. Of the approximately 18,000 reported species, nearly one-third are endemic to the Western Ghats (Shetty *et al*., 2002). This biodiversity hotspot is home to around 1,600 endemic plant species out of the 5,000 documented, encompassing trees, shrubs, climbers, and herbs. The Western Ghats also host 54 monotypic genera (Ahmedullah and Nayar, 1987; Muthumperumal and Parthasarathy, 2009). Among its regions, the southern Western Ghats stand out as the richest in terms of floristic composition and concentration of endemic taxa (Muthumperumal and Parthasarathy, 2001). Climbing plants form an integral part of rainforest ecosystems and exhibit higher species richness compared to their non-climbing relatives. It is believed that highly diverse plant groups tend to show greater genetic differentiation among populations. Lianas, a major component of tropical forests, can constitute up to 35% of the total woody plant species and 45% of the woody stems present (Balachandran and Rajendiran, 2014; Behera *et al*., 2017; Gentry, 1991; Nayar and Sastry, 1987). Although climbing plants are found across various forest types worldwide, endemic species remain particularly vulnerable to extinction due to their restricted geographic distribution (Myers *et al*., 2000). This makes them crucial indicators for setting conservation priorities, especially when resources are limited (Brummitt and Lughadha, 2003). Identifying biodiversity hotspots and regions facing the greatest threats is essential for effective conservation efforts (Muthumperumal and Parthasarathy, 2011).

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Endemism within a region provides significant insights into its biogeography, revealing centres of diversity and evolutionary adaptation. Biogeographers have long been intrigued by the reasons behind the occurrence of endemic species, debating whether they arise due to unique ecological factors or historical processes such as vicariance and speciation in isolated environments followed by range restrictions (Muthumperumal and Parthasarthy, 2009; Nair and Daniel, 1986).

Although various floristic studies have been conducted in the Western Ghats, no comprehensive inventory has been undertaken for Rare, Endangered, and Threatened (RET) climbing plants in the southern Western Ghats (Myers *et al.,* 2000). Given the increasing human disturbances in these forests-mainly due to their proximity to human settlements-there is an urgent need to document and conserve these species. Without immediate attention, some species may disappear before they are even studied. This research aims to identify and document the RET climbing plant species in the southern Western Ghats of South Gujarat, India, highlighting the need for their conservation (Gentry, 1991; Hooker, 1872; Matthew, 1983).

Study Area

The Western Ghats, one of the 34 globally recognized biodiversity hotspots also forms a significant part of the state (Chitale *et al.,* 2015; Myers *et al.,* 2000). The Western Ghats of South Gujarat support exceptional plant diversity**,** largely influenced by variations in climate, altitude, and soil conditions. The region's vegetation can be broadly classified into two major categories**:** interior plains vegetation and hill and mountain vegetation**.** Each category encompasses multiple forest types found within the study area, including Dry Deciduous Forest, Shrub Jungle Forest, Moist Deciduous Forest, Tropical Wet Evergreen Forest, Tropical Semi-Evergreen Forest, Tropical Evergreen Forest (Champion and Seth, 1968).

Methodology

The study recorded Rare, Endangered, and Threatened (RET) climbing plant species in the Southern Western Ghats of South Gujarat. Plant collection and species identification were conducted across various forested hill regions between 2022 to 2024. Collected specimens were preserved as herbarium samples and identified using standard botanical methods. The initial identification was carried out with the assistance of local and regional floras (Gamble, 1915; Hooker, 1872; Matthew, 1983) and species identity was further validated by comparing them with authenticated herbarium specimens deposited at the Department of Biology, B.K.M Science College, Valsad, South Gujarat, India.

The conservation status of the recorded species was assessed using the IUCN Red List, along with additional RET data sources and standard publications (Nair and Daniel, 1986; Nayar and Sastry, 1987-1990; Muthumperumal and Parthasarthy, 2009). A database was compiled, including information on species binomial names, families, modes of dispersal, collection sources, morphological characteristics of useful plant parts, and conservation status. The voucher specimens were deposited at the Herbarium, Department of Biology, B.K.M Science College, Valsad, South Gujarat, India.

Results and Discussion

A total of 285 climbing plant species, representing 125 genera across 41 families**,** were documented from various forest types in the Southern Western Ghats. The taxonomic diversity of lianas was found to be relatively high in tropical forests, consistent with observations from previous studies (Gentry, 1991; Muthuramkumar and Parthsarathy, 2001; Nabe-Nielsen, 2001). Among these species, 31 taxa were classified under the RET category (Table 1).

The most species-rich family recorded was *Convolvulaceae* (9 species), followed by Asclepiadaceae (5 species). Dominant liana families in Asian forests include *Apocynaceae, Fabaceae, Annonaceae, Combretaceae, Loganiaceae, and Rutaceae* (Cai *et al.,* 2009; Dewalt *et al.*, 2006; Mittermeier *et al.,* 2004; Muthukumar *et al.* (2006); Muthuperumal and Parthasarathy, 2010; Nayar, 1996). The widespread dominance of *Apocynaceae and Fabaceae* in tropical forests, as reported in earlier studies (Addo-Fordjour *et al.,* 2009) was also evident in this study.

Among the endangered species, *Operculina turpethum* (L.) Silva Manso, *Ceropegia mannarana* Umam. & Daniel, *Gloriosa superba* L., and *Grewia heterotricha* Mast, were recorded in the study area. Although *Gloriosa superba* L., is listed as endangered, *Smilax wightii* A. DC., previously reported as rare by IUCN, was found to be abundant across different forest types in this study.

Several rare species were identified, including *Celastrus paniculatus* Willd., *Aganosma cymosa* G. Don., *Smilax zeylanica* L., *Corallocarpus gracilipes* Cong., *Argyreia nellygherrya* Choisy, *Argyreia pomacea* (Roxb.) Choisy, and *Coscinium fenestratum* (Gartn) Colebr. The limited occurrences and narrow distribution of some taxa highlight the need for further research on climber flora in the Western Ghats.

Certain species, such as *Cucumis dipsaceus* Enherb., *Corallocarpus gracilipes* Cong., *Bauhinia vahlii* Wight & Arn., *Bauhinia phoenicea* Wight & Arn., *Passiflora leschenaultia DC.*, *Ipomoea mulleri* Benth., and *Ipomoea rumicifolia* Choisy, were categorized as rare with highly restricted distribution, necessitating site-specific conservation strategies**.**

Table 1 : List of climber species of the Southern Western Ghats hills.

Sr. No.	Botanical name	Family	Mode of dispersal	Uses	References
1	*Abrus fruticulosus* Wight and Arn.	Fabaceae	AU	M	Data Deficient (IUCN, 2012)
2	*Ampelocissus latifolia* (Roxb.) Planch.	Vitaceae		M	vulnerable (IUCN book, 1997)
3	*Argyreia nervosa* (Burm. & fil.) Bojer	Convolvulaceae	–	M	Rare (Ahmedullah and Nayar, 1986)
4	*Aristolochia tagala* Cham.	Aristalochiaceae	AU	M	Nearly threatened (Torres-Díaz *et al*., 2013)
5	*Asparagus fysonii* J.F.Macbr	Liliaceae	ZO	E	Rare (Putz, 1984).
6	*Asparagus racemosus* Willd.	Liliaceae	ZO	M & E	Threatened (Uma and Parthipan, 2015)
7	*Bauhinia phoenicea* Wight & Arn.	Fabaceae	ZO	M	Endemic To Western Ghats (Alphons Baby and Regi Raphael 2015).
8	*Bauhinia vahlii* Wight & Arn.	Fabaceae	ZO	M	Rare to South Gujarat (Torres-Díaz *et al*., 2013)
9	*Celastrus paniculatus* Willd.	Celastraceae	ZO	M	Nearly threatened
10	*Ceropegia mannarana* P.Umam. and P.Daniel	Asclepiadaceae	–	M	Endangered (Uma and Parthipan, 2015)
11	*Corallocarpus gracilipes* Cogn.	Cucurbitaceae	ZO	–	Intermediate (Ahmedullah and Nayar, 1986)
12	*Coscinium fenestratum* (Goetgh.) Colebr.	Menispermaceae	–	M	Critically endangered (Schnitzer and Carson, 2001) Endemic to India
13	*Cucumis dipsaceus* Ehrenb. ex Spach	Cucurbitaceae	ZO	E	Rare to India
14	*Gloriosa superba* L.	Liliaceae	ZO	M	Endangered in Western Ghats (Amalraj *et al*., 1991; Uma and Parthipan, 2015)
15	*Grewia heterotricha* Mast.	Tiliaceae	–	M	Endangered (Muthumperumal and Parthasarathy, 2011).
16	*Gymnema khandalense* Santapau	Asclepiadaceae	ZO	–	Endengered (Ahmedullah and Nayar, 1986)
17	*Hemidesmus indicus* R. Br.	Asclepiadaceae	–	M	Depleted in Western Ghats (Amalraj *et al.,* (1991); Matthew, 1983); Uma and Parthipan 2015)
18	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	AN	–	Vulnerable
19	*Ipomoea muelleri* Benth.	Convolvulaceae	AN	–	Rare to South Gujarat
20	*Ipomoea rumicifolia* Choisy	Convolvulaceae	AN	–	Rare to South Gujarat
21	*Operculina turpethum* (L.) Silva Manso.	Convolvulaceae	AN	–	Endangered in peninsular India (Sivakamasundari *at el.,* 2015)
22	*Passiflora leschenaultii* DC.	Passifloraceae	AU	E	Endemic to peninsular India (Putz, 1984)]
23	*Piper longum* L.	Piperaceae	AU	E	Endangered in South Gujarat (Ahmedullah and Nayar, 1986)
24	*Pterolobium hexapetalum (*Roth*)* Santapau & Wagh	Mimosaceae	ZO	M	Endemic to peninsular India (Putz, 1984)
25	*Pueraria tuberosa* DC.	Fabaceae	AN	–	Vulnerable (Ahmedullah and Nayar, 1986)
26	*Rubus racemosus* Roxb.	Rosaceae	–	E	Rare (Ahmedullah and Nayar, 1986)
27	*Sarcostemma viminale* (L.) R.Br.	Asclepiadaceae	ZO	–	Endangered
28	*Smilax wightii* A. DC.	Smilacaceae	AN	E	Endemic to Southern western Ghats, sasi Rare (Nayar and Sastry, 1987–1990; Putz, 1984)
29	*Smilax zeylanica* L.	Smilacaceae	ZO	E	Least concern in South Gujarat (Ahmedullah and Nayar, 1986)
30	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae	ZO	E	Intermediate (Scott Walter and Harriet J. Gillett, 1997)
31	*Toxocarpus beddomei* Gamble	Asclepiadaceae	ZO		Rare (Nayar and Sastry, 1987–1990; Nelson and Platnick, 1981)

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

Climbing Mechanisms and Utilization

The study identified various climbing mechanisms among the recorded species. Members of Convolvulaceae, Menispermaceae, and Combretaceae primarily use twining for climbing, while tendrils were the second most common mechanism. Similar trends have been observed in other tropical forest studies (Nabe-Nielsen, 2001).

Several RET species were found to be highly exploited for medicinal and edible uses by local communities. Out of the 31 RET species, 15 species were used for medicinal purposes, including *Aganosoma cymosa* G. Don., *Argyreia nervosa* Dalz., *Aristolochia tagala* Cham., *Bauhinia phoenicea* Wight & Arn., *Ceropegia mannarana* Umam. & Daniel, and *Coscinium fenestratum* (Goetgh.) Colebr. These plants are traditionally used to treat ailments such as skin diseases, cough, fever, headaches, diabetes, rheumatism, asthma, dysentery, and poisonous bites. Additionally, 9 species were identified for edible use, including *Cucumis dipsaceus* Ehrenb., *Passiflora leschenaultii* DC., *Piper longum* L., *Rubus racemosus* Roxb., and *Solena amplexicaulis* (Lam.) Gandhi. The continuous harvesting and overexploitation of these species necessitate immediate conservation measures.

Invasive Species and Ecological Impact

The study recorded several invasive climbers, including *Ipomoea cairica* (L.) Sweet., *Lantana camara* L., *Ipomoea muelleri* Benth., *Celastrus paniculatus* Willd., and *Rubus racemosus* Roxb. Among them, *Lantana camara* L., was the most widespread, occurring throughout the study area. These invasive species aggressively colonize disturbed areas, leading to significant ecological damage.

Additionally, fruits produced by certain liana species (*Solena amplexicaulis* (Lam.) Gandhi, *Smilax zeylanica* L., *Rubus racemosus* Roxb., *Passiflora leschenaultii* DC., and *Piper longum* L.) serve as a crucial food source for birds and other wildlife. Unregulated harvesting of these lianas could disrupt the ecological balance and negatively impact biodiversity.

Threats and Conservation Implications

The forests of the Southern Western Ghats face multiple threats, including: Invasive species spread**,** Illegal timber extraction**,** Overharvesting of non-timber forest products**,** Human settlement expansion**,** Mining and hill cultivation**,** Cattle grazing and unregulated tourism.

To mitigate these threats, there is an urgent need to develop practical conservation strategies for RET climbing plant species in the region. Implementing conservation measures will ensure the long-term protection of these ecologically and economically valuable species**.**

Conclusion

This study highlights the importance of Rare, Endangered, and Threatened (RET) species in understanding the ecological niches and distribution patterns of endemic and threatened climbing plants at a regional scale. The findings provide valuable insights into the habitat preferences and population dynamics of these species, aiding in the identification of biodiversity-rich areas. By recognizing critical habitats with high concentrations of RET species, this study emphasizes the need to prioritize these areas for conservation efforts and habitat protection.

भारत के दक्षिणी पश्चिमी घाट की पहाड़ियों के दुर्लभ, संकटग्रस्त और लुप्तप्राय आरोही पौधे

ध्रुव पटेल, जिगित्सा पटेल और दिलीप कुमार पटेल

सारांश

यह अध्ययन भारत के दक्षिणी पश्चिमी घाट, दक्षिण गुजरात में दुर्लभ, संकटग्रस्त और लुप्तप्राय आरोही पौधों की प्रजातियों की संरक्षण स्थिति का आकलन करता है। इस शोध का उद्देश्य इस पारिस्थितिक रूप से महत्वपूर्ण क्षेत्र में संकटग्रस्ट लुप्तप्राय आरोही पौधों की पहचान और उनका दस्तावेजीकरण करना है। दक्षिण गुजरात की विभिन्न वनाच्छादित पहाड़ियों में संकटग्रस्त लुप्तप्राय आरोही-सूचीबद्ध वाली प्रजातियों को एकत्रित करने और पहचानने के लिए 2022 से 2024 के बीच क्षेत्र सर्वेक्षण किए गए। एकत्रित नमूनों को मानक वर्गीकरण संदर्भों का उपयोग करके व्यवस्थित रूप से संरक्षित, सूचीबद्ध और पहचाना गया। 125 वंशों और 41 कुलों से संबंधित कुल 285 आरोही पौधों की प्रजातियों को दर्ज किया गया। इनमें से 31 प्रजातियों को आरईटी के रूप में वर्गीकृत किया गया था, जिनमें *सेरोपेगिया मन्नाराना* और *ग्लोरियोसा सुपरबा* शामिल हैं जो लुप्तप्राय हैं, जबकि *सेलास्ट्रस पैनिक्युलेटा, एगानोस्मा सिमोसा, स्माइलैक्स वाइटी* और *कोरलोकार्पस ग्रेसिलिप्स* को दुर्लभ के रूप में वर्गीकृत किया गया था। सबसे अधिक प्रजाति-समृद्ध परिवारों में एस्क्लेपियाडेसी (7 प्रजातियां), कॉन्वोल्वुलेसी (5 प्रजातियां), और फैबेसी (4 प्रजातियां) शामिल हैं, अन्य परिवारों में कम प्रजातियां हैं। प्राकृतिक संसाधनों के अति-दोहन सहित मानवजनित गतिविधियों से बढ़ता दबाव जैव विविधता पर नकारात्मक प्रभाव डाल रहा है, जिससे कई प्रजातियों में गिरावट आ रही है। आगे की हानि को रोकने के लिए, दक्षिणी पश्चिमी घाटों के स्थानिक वनस्पतियों की सुरक्षा के लिए तत्काल संरक्षण उपायों की आवश्यकता है।

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