

ENDEMIC FLORA OF PENINSULAR INDIA AND ITS SIGNIFICANCE

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ABSTRACT

There is comparatively high degree of endemism in Peninsular India and thus the flora is distinct. Blasco (1971) has estimated about 1,268 endemic dicotyledons in South India. The Peninsular India has an endemic concentration of 32% while rest of India has about 27% endemics. Out of the 304 families of flowering plants recorded from India, there is not a single endemic family. In this paper the phytogeography of endemic genera and characteristic endemic species of Peninsular India are analysed in relation to its distribution and affinities. The distribution is also analysed in relation to plate tectonics.

The endemic angiosperms of Peninsular India consist of about 56 genera and they are distributed over 25 families. The families with the largest number of endemic genera are Gramineae (10 genera) and Acanthaceae (9 genera). There are about 2100 endemic species in Peninsular India of which 890 are woody species, 254 semi-woody and the rest 859 are herbaceous species. The endemic flora of Peninsular India is considered to be old one and the nature of endemics is analysed in terms of phytogeography, taxonomy and palaeobotany. The dynamics of characteristic endemic genera and their speciation is given. According to the analysis, majority of the endemics are palaeoendemics belonging to humid tropic belt. Wherever interphase of climatic shifts occur with different ecotones some endemic genera show epibiotic speciation.

INTRODUCTION

Endemic floristic elements of a country or geographical region throw light on the biogeography of the area, centres of speciation, areas of extinction, vicariance and adaptive evolution of the flora occurring in the area. The Peninsular India, bordered in the north by the Bundelkhand and Rajmahal hills has a characteristic true Indian flora which is reflected in its components. It is the palaeotropic flora derived from the original Gondwanaland. Nayar (1977) estimated about 2100 endemic flowering plants in Peninsular India which represent about 32% of its flora. In Peninsular India there are no endemic families and phylogenetically primitive families like Magnoliaceae, Schisandraceae, Annonaceae, Ranunculaceae, etc. are poorly represented in this landmass of ancient origin which represents the Indian plate of the Gondwanaland. It is proposed to analyse the endemic taxa of Penin-

sular India at the generic level in relation to its spread and speciation and evaluate the causes of its present distribution, contraction and possible extinction.

TYPES OF ENDEMIC

Engler (1882) classified endemics as follows: (i) palaeoendemics, (ii) autochthonous endemics. Most of the palaeoendemics which remain relatively unchanged over a long period of time are called Patroendemics. They occur in geographically isolated habitats with few species complements in a closed environment where the ecosystem is stable. But once such ecosystem become disturbed they find themselves in an evolutionary death-trap as there is not enough reservoir of gene-pool for adaptive experimentation. Such patroendemics are usually extinction-prone. When palaeoendemic taxa show active adaptive radiation due to different ecological niches and various en-

vironmental stimuli they become "active epibiotics". Species displacement of the same genera in different ecotopes is also another mode of speciation of the endemic taxa. Neoendemics develop due to mutations, chromosomal rearrangements, polyploidy, adaptive radiation and vicariance in a new environment having different climatic and edaphic stresses. These species have closely related species in the same area or adjacent areas. Because of the extensive chromosomal rearrangements and aneuploidy, the hybrids of these closely related species have low fertility. The quantum speciation enunciated by Grant (1971) also plays an important part in the development of neoendemics.

It is generally considered that neoendemics in favourable environmental condition behave as haloendemics and may lead to palaeoendemics through the following steps: origin, expansion, stabilization, diversification, migration, fragmentation, contraction and later extinction. Because of selective pressures and environmental stress some palaeoendemics can become active epibiotics. These stages occur in both ways leading either to contraction of species with possible extinctions or explosion of speciation depending upon the genetical, ecological and temporal factors affecting the species.

ENDEMIC GENERA

There are about 56 endemic genera in Peninsular India of which 45 are monotypic. The families with the largest representatives of endemic genera are Gramineae (10 genera) and Acanthaceae (9 genera). Of the endemic genera, the genus *Nilgirianthus* has the largest number of species (20 spp.). The tree species are mainly represented in the genera *Poeciloneuron*, *Blepharistemma*, *Pseudoglochidion*, *Meteoromyrtus*, *Otonophelium* and *Erinocarpus*. Taxonomically interesting genera are seen in *Frerea*, *Haplothysmia* and *Hubbardia*.

Chatterjee (1940) listed 34 endemic dicotyledonous genera for Peninsular India. Of these, the genera *Adenoon*, *Calacanthus*, *Decaschistia*, *Diotocanthus*, *Goniocaulon*, *Meyenia*, *Nothopegia*, *Octotropis*, *Stenosiphonium* mentioned by Chatterjee (1940) are not endemics as they have wider distribution beyond India. The genera *Beddomea*, *Neopeltandra*, *Prosorus* and *Solenocarpus* mentioned by Chatterjee (1940) are reduced to the genera *Aglaia*, *Meineckia*, *Margaritaria* and *Spondias* respectively in view of further taxonomic revision. Subramanyam & Nayar (1974) enumerated characteristic endemic species of W. Ghats and considered W. Ghats summits are comparable to islands regarding endemic species.

A list of endemic genera with its species complements and their distribution are given in Table I.

The endemic generic category of Peninsular India is a diverse assemblage of herbs, succulent scapigerous herbs, shrubs, undershrubs, climbers and trees. Trees are poorly represented in the endemic generic category. It is generally considered that woody "life-forms" are of relictual nature. The genus *Poeciloneuron* (Bonnetiaceae) with two species, *P. indicum* and *P. parviflorum* are big trees occurring in the rain forest of southern W. Ghats. *Blepharistemma* (Rhizophoraceae) is a genus of inland habit and is represented by *B. membranifolia*, trees species growing in the evergreen forests of W. Ghats. Another characteristic endemic tree is *Erinocarpus nimmonii*. The genus *Pseudoglochidion* is monotypic and represented by tree species, *P. anamalayanum*. The endemic monotypic genus *Otonophelium* is represented by *O. stipulaceum*, an endemic tree occurring in the rain forests of W. Ghats from Malabar southwards. The endemic genera of shrubs and undershrubs are as follows: *Carvia*, *Nilgirianthus*, *Phlebophyllum*, *Taeniandra*, *Xenacanthus* all belonging to the family

Acanthaceae, occurring in the forest floor of the rain forests of W. Ghats, and they are gregarious in growth and shade tolerant. The endemic genus *Meteoromyrtus* is monotypic and the small tree *M. wynaadensis* occurs in the Malabar region on the windward side of southern W. Ghats. *Utleria salicifolia* (Periplocaceae) is an interesting shrub growing in the crevices of rocks in Anamalai hills at altitudes ranging between 1000-1350 m. Other twining undershrubs which have restricted distribution are seen in endemic genera *Baeolepis*, *Decalepis*, *Janakia*, *Oianthus* and *Seshagiria*. The endemic monotypic genus *Wagatea* represented by *W. spicata* with gregarious scandent growth is seen in the foothills of secondary forests of W. Ghats in Maharashtra and Karnataka. The taxonomically isolated endemic genus *Haplothismia* is endemic to a small restricted area, Parambikulam hills of W. Ghats. The endemic genera in Orchidaceae is represented by *Diplocentrum*, *Protoeroceras* and *Smithsonia* occurring in southern W. Ghats. The herbaceous endemic genera are mainly seen in the family Gramineae occurring in different ecological conditions.

THE AGE AND DYNAMICS OF ENDEMICS

It is generally accepted that the age of endemic genera can be assessed by the study of the following features: (i) dominance of woody or arborescent habit, (ii) taxonomically isolated endemic taxa, (iii) possible fossil evidences provided by homologous taxa or congeners of living taxa.

Willis's view (1922) that the area of a species is proportional to its age did not take into account the contraction of a species or loss of its intermediate range due to palaeoclimatic changes and hence it is not accepted (van Steenis 1969, Wolff 1950) as a valid theory for the spread of species. Since endemic genera occur in a restricted area, reservoir of genepool specific to this group is limited and hence the chances of

its adaptation and survival is also limited. Such endemic genera which are adaptation-oriented to a particular ecological niche like mountain top, crevice of rocks or rocky substratum of fast flowing rivers (*Willisia*, *Indotristicha*), steep surface of rocks which receive trickles of water (*Frerea*), sprays of water near water falls (*Hubbardia*) or other endemic taxa which are specific to insect pollinators may become extinct once their ecological or habitat parameters are disturbed. Such palaeoendemics are extinction-prone unless they become active epibiotics. When endemic species become "schizoendemics" due to gradual speciation or behave as "apoendemics" by ploidy, it is an expanding actively evolving population and such endemics are called "haloendemics." Hence for the conservation of species it is necessary to identify such groups of endemics which are haloendemics on the path of expansive evolution or those endemics which are extinction-prone. The rarity or extinction of an endemic species or expansive spread of an endemic species depends on the ecological and environmental parameters.

The studies on the following taxa in W. Ghats clearly indicate the parameters for the survival and spread of endemics. *Frerea indica* is an example of a palaeoendemic on the verge of extinction due to loss of habitat and inefficiency of the complex pollinating mechanism without parallel supply of specific pollinators. The same may be the case with the monotypic genus *Utleria* occurring in a restricted ecotone, rocky crevices of Anamalai hills (*U. salicifolia*, a shrub with attractive flowers).

The genus *Frerea* (Asclepiadaceae) is a monotypic genus and there are only 10 to 15 populations of *Frerea indica* in Junnar hill fort, Shivnar hill fort, Mahabaleswar escarpment and Purandhar hill fort near Poona, occurring on the vertical rocky faces constantly wetted with trickles of water.

This is a palaeotropic endemic species with poor fruit set, but efficient seed dispersal strategy having comose seeds. The poor fruit set may be due to the complicated pollinia translator mechanism which depends on the visit of a insect pollinator perhaps no longer available to it. This species has a remarkable capacity to tide over the drought period by shedding its leaves and further reducing the transpiration surface by condensation of stem into thick succulent knots with silver grey outer surface for sunlight deflection. *Frerea indica* are capable of vegetative rooting from stem cutting. Because of silvery coated stem without leaves during drought period these plants from a distance appear in the shape of silvery worms and it is seen vultures pick on these plants and in this process some of its branches get detached. Whether this results in the destruction of the plant or birds act as an agency for its spread by transporting to another mountain top rocky crevices, requires further observation and study.

Contrary to *Frerea indica* and *Utleria salicifolia*, the endemic monotypic genera *Wagatea*, *Lamprachaenium*, *Nanothamnus* and *Carvia* occurring in Deccan, show successful adaptation for survival and spread. (i) *Wagatea* (Caesalpiniaceae); *W. spicata* a thorny scrambler, growing all along the foothills of W. Ghats of Maharashtra with beautiful dark orange flowers in spicate racemes has successfully adapted itself to the environment with attractive flowers for insect pollinators resulting in good fruit set. The woody scrambling habit with sharp thorns gives protection and probably helps in survival. (ii) *Lamprachaenium* (Compositae): *L. microcephalum*, a branching annual herb with silvery undersurface of leaves is spreading at altitudes ranging from 1000 to 1500 m in the W. Ghats of Maharashtra. This palaeoendemic is becoming a haloendemic in open hill slopes. (iii) *Nan-*

othamnus (Compositae): *N. sericeus* is a prostrate pubescent herb common in Northern Deccan is spreading fast and reported up to Nilgiri and Palni hills (Rao, 1978). (iv) *Carvia* (Acanthaceae): *Carvia callosa*, successfully adapted to the monsoon climatic conditions of W. Ghats, is an important gregarious understorey element in W. Ghats of Maharashtra. This species has good seed-set due to successful flower-insect adaptation and interactions of flower by way of provision of honey, balsamic exudates from the bracts and warmth inside the corolla tube. "It is interesting to note that some of the *Carvia* populations achieve tree habit reaching to a height of 7-8 m.

A palaeoendemic which has become an epibiotic through vicarious speciation in different ecological niches is seen in the endemic genus *Manisuris* (Gramineae). Jain (1970) mentioned that all the taxa of *Manisuris* found in India are endemic and the genus *Manisuris* might have originated in Peninsular India since there are ten taxa endemic to Peninsular India. Of the ten endemics, two species *M. forficulata* and *M. clarkei* extend upto Central India and the other endemic species are restricted to different climatic and altitudinal zones of W. Ghats and plains of S. India. Species restricted to small pockets in southern Deccan comprising Coorg and Mysore are tufted grasses *M. divergens* and *M. mysorensis*, whereas *M. santapau* and *M. ratnagirica* occur along pools in the exposed laterite hills of Ratnagiri in the windward side of W. Ghats. While *M. talbotii* and *M. goensis* have restricted distribution and they are endemic to Goa. *M. myuros* is a widely distributed endemic commonly seen in the plains of Tamil Nadu and Andhra Pradesh. The genus *Manisuris* is an interesting example of palaeoendemic epibiotic taking advantage of different ecological niches for speciation. Stebbins & Major (1965) mentioned that "in the regions on the border-

line between zones of adequate moisture and of deficient moisture even small climatic shifts and species migrations will bring together related species which previously were isolated from each other and so will promote hybridization between differently adapted types. In this way climatic and adaphic diversity occurring in ecotones or border regions between different biotic provinces are factors which most actively promote the evolution and differentiation of species of higher plants" The endemic species of *Manisuris* (*M. ratnagirica* & *M. santapauli*) occurring in the windward side of W. Ghats on exposed laterite soils are vicarids and different from the species (*M. goaensis*) occurring in Goa and those species (*M. divergens*) occurring in the sheltered hills of Coorg and the species *M. myuros* commonly seen in the plains of Andhra Pradesh and Tamil Nadu.

Another example of extinction-prone endemic monotypic genus in Peninsular India is *Hubbardia* (Gramineae) occurring in the steep rocks of Gersoppa falls in Karnataka constantly getting sprays of water from water falls and hill cascades. The leaves of the species *Hubbardia heptaneuron* are filmy as commonly seen in aquatic plants like *Vallisneria spiralis*. Any change in the environment can cause extinction of this species, as this species is reported from this ecological niche.

(I) *Predominance of arborescent woody habit:*

On an analysis of about 2100 endemic taxa occurring in Peninsular India, it is seen there are about 890 woody species, 254 semi woody species and the rest about 859 species are herbaceous. The arborescent nature at the generic level are seen in the endemic genera *Poeciloneuron*, *Blepharistemma*, *Erinocarpus*, *Pseudoglochidion*, *Otonophium* and *Meteoromyrtus*. Some of the arborescent genera with more than two ar-

borescent endemic species occurring in Peninsular India are given below:

Memecylon (16 sp.); *Litsea* (15 sp.); *Symplocos* (14 sp.); *Syzygium* (11 sp.); *Actinodaphne* (9 sp.); *Grewia* (9 sp.); *Glochidion* (9 sp.); *Diospyros* (8 sp.); *Drypetes* (6 sp.); *Cinnamomum* (7 sp.); *Jambosa* (7 sp.); *Dalbergia* (7 sp.); *Hopea* (6 sp.); *Mallotus* (6 sp.); *Humboldtia* (5 sp.); *Holigarna* (5 sp.); *Euonymus* (5 sp.); *Terminalia* (5 sp.); *Garcinia* (5 sp.); *Cryptocarya* (5 sp.); *Aglaia* (5 sp.); *Desmos* (4 sp.); *Goniothalamus* (4 sp.); *Schefflera* (4 sp.); *Phyllanthus* (4 sp.); *Salacia* (2 sp.); *Ficus* (4 sp.); *Ardisia* (4 sp.); *Pittosporum* (4 sp.); *Isonandra* (4 sp.); *Millettia* (3 sp.); *Orophea* (3 sp.); *Cynometra* (3 sp.); *Neolitsea* (3 sp.); *Strychnos* (3 sp.); *Dysoxylon* (3 sp.); *Myristica* (3 sp.); *Ochna* (3 sp.); *Canthium* (3 sp.); *Wendlandia* (3 sp.).

According to Meusel (1952) the woody habit in the endemic group is a relict character while Carlquist (1965) suggested that woody habit especially in islands is a derived condition resulting from insular isolation. In this it is interesting to observe woody nature in few species in an otherwise predominantly herbaceous genus like *Vernonia* (*V. travancorica*, *V. anaimudica*) in the mountains of W. Ghats in Kerala. The giant *Senecios* and giant *Cirsiums* (Friis 1975) seen in the alpine flora of E. African mountains achieve woody habit and it is considered that E. African mountain tops behave ecologically as that of island ecosystem for endemism and speciation (Mabberley, 1974). In Peninsular India, the original palaeotropic vegetation is seen in refugia along the folds of mountain valleys which are called the Shola forests. As species compete for sunlight by developing woody habit and achieve tree form, even genera which are primarily herbaceous become woody in a close-canopied forest where sunlight is the limiting factor. Species like *Vernonia travancorica*, *Lobelia nicotianifolia*, *Impatiens fruticosa* and *Carvia callosa*

which primarily belong to genera of herbaceous habit represent the end products of close canopied ecosystem of a bygone age by developing semi-woody habit. As more and more forests get opened up this competitive ability of species for reaching the sky is getting lost in the genetic make-up. The pachycaulous habit as seen in the giant Lobelia (*Lobelia deckenii*) in Mt. Kilimanjaro in Africa and giant *Espeletia*, a compositae tree in the Andes of Columbia in S. America are not seen in W. Ghats mountain top endemics.

The taxonomically and phytogeographically interesting endemic tree genera occurring in Peninsular India are given below:

(1) The genus *Poeciloneuron* comprises two species, *P. indicum* occurring in southern W. Ghats from S. Kanara southwards to Kerala and *P. pauciflorum* restricted to Travancore and Tinnevely hills. It belongs to the family Bonnetiaceae which has the main centre of distribution in tropical S. America with six genera (*Mahurea*, *Keilmeyera*, *Bonnetia*, *Caraipa*, *Archytaea* and *Haploclathra*), while the genus *Ploiarium* with 3 species occurs in Malesia and S. E. Asia. The fibre tracheids of *Poeciloneuron* agree with most of the members of Bonnetiaceae (Seetharam & Pocock 1978). The nature of lobulate stamens and gynaecium with two styles are unique and it is appropriate to consider *Poeciloneuron* under the family Bonnetiaceae as proposed by Hutchinson (1973). The phytogeographical distribution of the genera in S. America, southern W. Ghats in India and Malesia can be explained on the basis of Gondwanaland connections. The intermediate link in Africa was lost due to years of desiccation and followed by desertification of major parts of Africa (Nayar, 1972).

(2) *Blepharistemma* an endemic genus of small trees occurring in Peninsular India from plains to mountain ranges is an inland Rhizophoraceous tree which has lost its

mangrove habit as it moved to the montane region. It will be interesting to observe the speciation in *Blepharistemma membranifolia* in different ecotones from coast to the mountains with possible development of new populations in different ecological niches.

(3) *Erinocarpus* a monotypic endemic genus (*E. nimmonii*) with large yellow flowers in terminal panicles is a conspicuous tree in W. Ghats in Maharashtra belonging to the tribe *Triumfetteae* which mainly comprises undershrubs and herbs. The nearest allied genus *Heliocarpus* occurs in central and tropical S. America.

(4) *Otonephelium* is a monotypic genus of tree (*O. stipulaceum*) of restricted distribution which is the counterpart of the Indomalayan genus *Nephelium*.

(5) *Meteoromyrtus* is an endemic monotypic genus of small trees represented by the species *M. wynaadensis* occurring in the windward side of the W. Ghats restricted to Malabar in Kerala and its homologous genus *Rhodomyrtus* is represented by *R. tomentosa* var. *parviflora* occurring in the hills of Nilgiris and Kodaikanal in Tamil Nadu (Schott, 1978). It is interesting to note that the above variety occurs in Sri Lanka also.

(II) Taxonomically isolated Endemic genera:

The presence of endemic elements in a flora which are taxonomically isolated from the nearest taxonomic group indicates its isolation from the main stock for a long period of time. Such taxonomically isolated endemic genera indicate the age of its origin, since intermediate groups might have become extinct due to palaeoclimatic changes. Following endemic genera in Peninsular India are of a phylogenetic and taxonomic importance: (1) The genus *Haplothismia*, a monotypic genus (*H. exannulata*) occurring in a small restricted area, Parambikulam hills in Kerala represents a tribe

Haplothismieae in the family Burmanniaceae, which is taxonomically isolated; (2) The genus *Hubbardia* (Gramineae) is monotypic and is the only representative of the tribe *Hubbardeae* and the structure of the spikelet in *H. heptaneuron* is unique (Bor, 1951); (3) The genus *Dicoelospermum* (Cucurbitaceae) belongs to subtribe *Dicoelosperminae*. The species *Dicoelospermum ritchiei*, a climbing herb is endemic to W. India; (4) The endemic genus *Indotristicha* (Tristichaceae) with two species is endemic to southern W. Ghats while it generically *Terniola* occurs in W. Ghats and Sri Lanka. Other taxonomically interesting endemic genera are *Helicanthes*, *Indobanalia*, *Limnopoia*, *Indopoa*, *Oianthus* and *Uleria*. (III) Possible evidences provided by fossils in relation to endemics.

The Intertrappean beds in Central India is of upper Cretaceous close to Eocene and in this strata there are fossil woods referable to some of the modern genera. It is interesting to evaluate the genera of fossils closely allied to modern genera which have a large complements of endemic species in Peninsular India. So far there is no record of leaf impressions or fossil woods representing exclusively the present endemic genera occurring in Peninsular India. Most of the palaeoendemics enumerated below are species of humid tropics and they have distributional range in W. Ghats especially

in southern W. Ghats. Representative collection of fossil woods from the Deccan Intertrappean beds Cuddalore Series and Neyveli lignites indicate probable modern genera these fossil woods represent and this indicates they had a wide spread distribution during upper Cretaceous. Due to tectonics, Deccan lava flow and progressive desiccation most of the characteristic Peninsular Indian flora became extinct as Indian plate moved northwards through different climatic regimes after its separation from the main Gondwanaland about 100 m Y.B.P. (Nayar, 1972). Some of the fossil genera which are referable to modern genera with number of endemics species occurring in Peninsular India are given below. The fossil wood *Homalioxylon* (Bande, 1974) is represented by the modern genus *Homalium* (Flacourtiaceae) and *H. travancoricum* is endemic to southern W. Ghats. The fossil wood *Michelioxylon* (Bande, 1974) is represented by the modern genus *Michelia* (*M. nilagirica*). Endemic species *Elaeocarpus munroii* and *E. venustus* occur in W. Ghats and the fossil wood *Elaeocarpoxyton* (Prakash & Dayal, 1963) is collected from the Intertrappean beds near Nagpur. The genus *Glochidion* has 9 endemic species in Peninsular India and the fossil wood *Glochidioxyton* (Prakash, 1958; Lakhanpal, 1973) is collected from Madhya Pradesh.

TABLE I

ENDEMIC GENERA OF PENINSULAR INDIA AND THEIR DISTRIBUTION

1. Anaphyllum Schott. (Araceae)		
<i>A. wightii</i> Schott.	Tall herb with creeping root stock.	From plains to 1400 m, southern W. Ghats.
<i>A. beddomei</i> Engl.	Tall herb with creeping root stock.	From 1300 m, to upwards southern W. Ghats.
2. Ascopholis Fisch. (Cyperaceae)		
<i>A. gamblei</i> Fisch.	Erect herb.	Nilgiris.
3. Baeolepis Decne ex. Moq. (Periplocaceae)		
<i>B. nervosa</i> (Wt. & Arn.) Decne	Climbing undershrub.	Nilgiris.
4. Bhidea Stapf. (Gramineae)		
<i>B. burnsiiana</i> Bor	Annual herb.	Bombay neighbourhood.

5. **Blepharistemma** Wt. ex DC.
(Rhizophoraceae)
B. membranifolia (Miq.) Ding Hou Trees. Peninsular India.
6. **Bonnoydes** Blatt. & Halb.
(Scrophulariaceae)
B. limnophiloides Blatt. & Halb. Herbs. Bombay neighbourhood.
7. **Cambellia** Wt. (Orobanchaceae)
C. cytinoides Wt. Parasitic herbs. Southern W. Ghats, Nilgiris and Palni hills.
8. **Carvia** Bremek. (Acanthaceae)
C. callosa (Nees) Bremek. Shrub. W. Ghats in Maharashtra and N. Karnataka.
9. **Danthonidium** C. E. Hubb.
(Gramineae)
D. gammiei (Bhide) C. E. Hubb. Herbs. Maharashtra and N. Karnataka.
10. **Decalepis** Wt. & Arn.
(Periplocaceae)
D. hamiltonii Wt. & Arn. Climbing shrubs. Peninsular India.
11. **Dicoelospermum** Clarke
(Cucurbitaceae)
D. ritchei Clarke Climbing herb. W. Peninsular India.
12. **Diplocentrum** Lindl. (Orchidaceae)
D. congestum Wt.
D. recurvum Lindl. Epiphytic herbs.
Epiphytic herbs. Southern W. Ghats.
Southern W. Ghats from Nilgiri southwards.
13. **Erinocarpus** Nimmo ex J. Grah.
(Tiliaceae)
E. nimmonii J. Grah. Trees. W. Ghats in Maharashtra and N. Karnataka.
14. **Frerea** Dalz. (Asclepiadaceae)
F. indica Dalz. Trailing succulent herbs. W. Ghats in central Maharashtra.
15. **Gantelbua** Bremek. (Acanthaceae)
G. urens (Heyne ex Roth) Bremek. Herb with prostrate stem. Peninsular India.
16. **Griffithella** (Tul.) Warm.
(Podostemaceae)
G. hookeriana (Tul.) Warm. Herbs attached to rocks in fast flowing mountain streams. W. Ghats.
17. **Haplothismia** Airy Shaw
(Burmanniaceae)
H. exannulata Airy Shaw Herbs. Parambikulam hills of W. Ghats.
18. **Helicanthes** Danser (Loranthaceae)
H. elastica (Desr.) Danser Parasites with woody stem. W. Peninsular India especially in W. Ghats in Maharashtra.
19. **Hubbardia** Bor (Gramineae)
H. heptaneuron Bor Delicate herb in rocks receiving sprays of water. Gersoppa water falls and neighbouring hill cascades in Karnataka.
20. **Hyalisma** Champ. (Triuridaceae)
H. janthina Champ. Saprophytic herbs. Travancore and Tinnevely hills of southern W. Ghats.
21. **Hydrobryopsis** Engl. (Podostemaceae)
H. sessilis (Willis) Engl. Herbs attached to rocks of fast flowing rivers, W. Ghats and also in mountains near Waltair in E. Ghats.

22. **Indobanalia** Henry & Roy
(Amaranthaceae)
I. thyrsiflora (Moq) Henry et Roy Undershrubs. Southern W. Ghats.
23. **Indopoa** Bor (Gramineae)
I. paupercula (Stapf.) Bor Herb. W. Ghats.
24. **Indotristicha** van Royen
(Podostemaceae)
I. ramissima (Wt.) van Royen Submerged herbs in fast flowing rivers. Southern W. Ghats.
I. tirunelvelica Sharma, Karthik & Shetty Herbs in fast flowing mountain streams. Tinnevely hills of southern W. Ghats.
25. **Janakia** Joseph & Chandrasekaran
(Periplocaceae)
J. arayalpathra Joseph et Chandrasekaran Herb. Kerala hills of southern W. Ghats.
26. **Jerdonia** Wt. (Gesneriaceae)
J. indica Wt. Scapigerous herb. Nilgiris southwards in southern W. Ghats.
27. **Kanjarum** Ramam. (Acanthaceae)
K. palghatense Ramam. Undershrub. Palghat hills of southern W. Ghats.
28. **Lamprachaenium** Benth. (Compositae)
L. microcephalum Benth. Annual herbs. Peninsular India.
29. **Limnopoia** C. E. Hubb. (Gramineae)
L. meeboldii (Fisch.) C. E. Hubb. Aquatic herbs. Water tanks and pools in central Kerala.
30. **Meteoromyrtus** Gamble (Myrtaceae)
M. wynadensis (Bedd.) Gamble Small trees. Southern W. Ghats in Malabar.
31. **Manisuris** L. (Gramineae)
M. acuminata (Hack) O. Kuntze var. *acuminata* Herb. Western coast of Peninsular India.
M. acuminata var. *stocksii* (Hook.f.) Jain Herb. W. coast of Peninsular India.
M. acuminata var. *woodrowii* Bor Herb. W. coast of Peninsular India.
M. clarkei (Hack) Bor Herb. Peninsular India upto northern limit of Bundelkhand hills and Parasnath hills, Chotanagpur plateau. Coorg & Bababudan hills in Karnataka.
M. divergens (Hack) O. Kuntze Herb. Karnataka.
M. divergens var. *hirsuta* (Fisch.) Jain Herb. Peninsular India upto Bundelkhand hills.
M. forficulata Fisch. Herb. Goa.
M. goensis Rolla Rao et Hemadri Herb. Karnataka.
M. mysorensis Jain et Hemadri Herb. Plains of Andhra Pradesh and Tamil Nadu.
M. myuros L. Herb. Ratnagiri, Maharashtra.
M. ratnagirica Kulkarni et Hemadri Herb. Maharashtra.
M. santapau Jain et Deshpande Herb. Maharashtra.
M. talbotii (Hook.f.) Bor Herb. Goa.
32. **Nanothamnus** Thoms. (Compositae)
N. sericeus Thoms. Herb. W. Ghats in Maharashtra, Karnataka and Nilgiri and Palni hills.
33. **Nilgirianthus** Bremek. (Acanthaceae)
N. asper (Wt.) Bremek. Shrub. W. Ghats in Maharashtra, Karnataka, Nilgiris and Anamalai and Travancore hills.
N. barbatus (Nees) Bremek. Gregarious shrub. W. Ghats in Maharashtra, Karnataka, Nilgiris, Anamalai and Travancore hills.

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| <i>N. beddomei</i> Bremek. | Shrub. | Nilgiri hills, Travancore and Tinnevely hills. |
| <i>N. campanulatus</i> (Wt.) Bremek. | Undershrub. | Coorg hills in W. Ghats. |
| <i>N. ciliatus</i> (Nees) Bremek. | Slender shrub. | W. Ghats in Karnataka to Travancore hills. |
| <i>N. circarensis</i> (Gamble) Bremek. | Shrub. | Hills of Vizag in E. Ghats. |
| <i>N. decurrens</i> (Nees) Bremek. | Herb. | W. Ghats in Karnataka, southwards to Travancore and Tinnevely hills. |
| <i>N. foliosus</i> (Wt.) Bremek. | Gregarious shrub. | W. Ghats in Karnataka, southwards to Travancore and Tinnevely hills. |
| <i>N. heyneanus</i> (Nees) Bremek. | Small gregarious shrub. | W. Ghats in Maharashtra, Karnataka, Nilgiris, Anamalai, Travancore and Tinnevely hills. |
| <i>N. lupulinus</i> (Nees) Bremek. | Shrub. | W. Ghats in Maharashtra, Karnataka, Nilgiris and Wynaad region of Kerala. |
| <i>N. meeboldii</i> (Craib.) Bremek. | Small shrub. | W. Ghats in Karnataka. |
| <i>N. membranaceus</i> (Talb.) Bremek. | Stout gregarious herb. | W. Ghats in Karnataka. |
| <i>N. neilgherrensis</i> (Bedd.) Bremek. | Large shrub. | W. Ghats in Karnataka, Nilgiris, Palni hills, Wynaad and Palghat hills in Kerala. |
| <i>N. papillosus</i> (T. And.) Bremek. | Large shrub. | Nilgiris. |
| <i>N. perrottetianus</i> (Nees) Bremek. | Large shrub. | Nilgiris, Anamalai hills and Travancore hills. |
| <i>N. punctatus</i> (Nees) Bremek. | Slender undershrub. | W. Ghats in Karnataka, Wynaad hills, Travancore and Tinnevely hills. |
| <i>N. reticulatus</i> (Stapf.) Bremek. | Small shrub. | Mahabaleswar-W. Ghats in Maharashtra. |
| <i>N. urceolaris</i> (Gamble) Bremek. | Shrub. | Nilgiris, Palni hills and Travancore hills. |
| <i>N. warreensis</i> (Dalz.) Bremek. | Shrub. | W. Ghats in Maharashtra and Karnataka. |
| <i>N. wightianus</i> (Nees) Bremek. | Gregarious shrub. | Nilgiris. |
34. **Ochreinauclea** Ridsd. & Bakh. f.
(Rubiaceae)
35. **Oianthus** Benth. (Asclepiadaceae)
O. beddomei Hook. f. Twining undershrubs. Kerala hills bordering Karnataka and Wynaad region of Kerala.
O. deccanensis Talbot. Twining undershrub. W. Ghats in Maharashtra.
O. disciflorus Hook. f. Twining undershrub. N. Kanara, Karnataka.
O. urceolatus (Dalz.) Benth. Twining undershrub. Southern Maharashtra.
36. **Otonephillum** Radlk. (Sapindaceae)
O. stipulaceum (Bedd.) Radlk. Trees. Southern W. Ghats from Kerala, southwards.
37. **Paracautleya** R. M. Smith
(Zingiberaceae)
P. bhotti R. M. Smith Herb. Karnataka.
38. **Phlebophyllum** Nees (Acanthaceae)
P. canaricum (Bedd.) Bremek. Shrub. W. Ghats in southern Karnataka.
P. humile (Gamble) Bremek. Small shrub. W. Ghats in Anamalai and Tinnevely hills.
P. jeyporensis (Bedd.) Bremek. Shrub. Hills of Vizagapatnam, E. Ghats.
P. kunthianum Nees A gregarious shrub with definite intervals of flowering every 7 to 12 years. Southern W. Ghats from Nilgiri southwards above 2000 m.
P. lanatum (Nees) Bremek. Shrub. Nilgiris.
P. lawsonii (Gamble) Bremek. Erect shrub. Windward side of W. Nilgiris and Wynaad and Travancore hills in southern W. Ghats.
P. spicatum (Roth.) Bremek. Shrub. Flowering at 12 years intervals. Southern W. Ghats from Nilgiri southwards.
P. versicolor (Wt.) Bremek. Large shrub. Flowering in every 7 years. W. Ghats above 1300 m and northern Circar hills of E. Ghats.

39. **Pleocaulus** Bremk. (Acanthaceae)
P. sessilis (Nees) Bremk. Small undershrub with W. Nilgiris. Altitude 2000-2600 m.
 flowering annually or at short
 intervals throughout year.
P. sessiloides (Wt.) Bremk. Small undershrub. Bababudan hills of Karnataka and
 Nilgiris. Altitude 2000-2500 m.
P. ritchiei (Clarke) Bremk. Shrub, flowering once in 7 W. Ghats near Bombay.
 years.
40. **Pocilloneuron** Bedd. (Bonnetiaceae)
P. indicum Bedd. Large tree. Southern W. Ghats from S. Kanara
 down southwards.
P. pauciflorum Bedd. Large tree. Travancore and Tinnevely hills of
 of southern W. Ghats.
41. **Pogonachne** Bor (Gramineae)
P. racemosa Bor Stilt-rooted grass. Maharashtra near coastal area.
42. **Polyzygus** Dalz. (Umbelliferae)
P. tuberosus Dalz. Herbs with tuberous roots. W. Ghats in Konkan (Maharashtra)
 and Karnataka.
43. **Protoeroceras** Joseph et Vajravelu (Orchidaceae)
P. holtunii Joseph et Vajravelu Herb. W. Ghats in Tamil Nadu.
44. **Pseudodichanthium** Bor (Gramineae)
P. serrafalcoides (Cooke & Stapf.) Bor Herb. Maharashtra.
45. **Pseudoglochidion** Gamble (Euphorbiaceae)
P. anamlayanum Gamble Tree. Anamalai hills.
46. **Santapaua** Balakr. & Subram. (Acanthaceae)
S. madurensis Balakr. & Subram. Herb. Alagar hills in Tamil Nadu.
47. **Seshagiria** Ansari et Hemadri (Asclepiadaceae)
S. sahyadrica Ansari et Hemadri Climbing undershrub. W. Ghats in Maharashtra.
48. **Smithsonia** Saldanha (Orchidaceae)
S. maculata (Dalz.) Saldanha Herb. W. Ghats in Maharashtra and
 Karnataka.
S. straminea Saldanha Herb. W. Ghats in Hassan District in
 Karnataka.
S. viridiflora (Dalz.) Saldanha Herb. W. Ghats in Maharashtra and
 Karnataka, Kerala.
49. **Taeniandra** Bremk. (Acanthaceae)
T. micrantha (Wt.) Bremk. Undershrub Southern W. Ghats from Nilgiris
 southwards.
50. **Trilobachne** Schenek ex Henr. (Gramineae)
T. cookei (Stapf.) Schenek ex Henr. Herb. Western peninsular India.
51. **Triplopogon** Bor (Gramineae)
T. ramossissimus (Hack.) Bor Herb. Western peninsular India.
52. **Utleria** Bedd. (Periplocaceae)
U. salicifolia Bedd. Shrub. Anamalais in southern W. Ghats.
53. **Vanasushava** Mukherjee et Constance (Umbelliferae)
V. pedata (Wight) Mukherjee & Constance Herb. Southern W. Ghats.

54. **Wagatea** Dalz. (Caesalpiniaceae)
W. spicata Dalz. Scandent shrubs. Peninsular India, Maharashtra and Karnataka.
55. **Willisia** Warm. (Podostemaceae)
W. selaginoides (Bedd.) Warm. ex Willis. Tufted herb attached to rocks of fast flowing mountain streams. Anamalai hills of southern W. Ghats.
56. **Xenacanthus** Bremek. (Acanthaceae)
X. heteromallus (T. And. ex Clarke) Bremek. A large shrub reaching upto 7 m and flowering in intervals of about 12 to 14 years. Southern W. Ghats at altitude 1200 m and above. Nilgiris southwards.
X. pulneyensis (Clarke) Bremek. A shrub. Flowering at long intervals. Southern W. Ghats from Nilgiris southwards.
X. zenkerianus (T. And.) Bremek. A large shrub. Flowering at long intervals. Southern W. Ghats from Nilgiris southwards.

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