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COMMUNICATION

Observations on the flowering plant diversity of Madayippara, a southern Indian lateritic plateau from Kerala, India

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Abstract: Northern Kerala of southern India is characterized by widely spread lateritic plateaus which provide an extremely harsh physical environment for life leading to the development of specialized plant communities with a large number of endemic and habitat specific species. Madayippara, a midland lateritic plateau located in the Kannur District of northern Kerala is an icon of rich floristic diversity and endemism. The plateau forms a number of microhabitats due to the difference in geographic terrain and soil cover, thus forming a complex of habitats with diverse forms of plants, mainly ephemeral herbs. Out of the 636 flowering plant taxa recorded from the microhabitats of the plateau, within a limited area of 3.65km^2, 160 (c. 25%) are endemics. Most of the endemic species occur in specialized microhabitats. The plateau is the type locality of 11 taxa. Lateritic plateaus of southern India, which are associated with characteristic and rich biodiversity, are now under varied types of anthropogenic threats such as large scale mining for bricks and clay, and they need urgent attention for conservation of the biodiversity.

Keywords: Biodiversity, conservation, endemism, floristic diversity, microhabitats, plateau.

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Author contribution: CP and AKP designed and conceptualized the study. CP collected specimens and data for analysis, CP and AKP performed analysis of data. CP and AKP prepared the first draft of the manuscript and equally contributed in further editions.

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INTRODUCTION

In India, the hard crusts of laterite are mainly found on the western coast, from Dapoli in Ratnagiri in Maharashtra to Malappuram District in Kerala, and also on the Deccan Plateau (Balakrishnan et al. 2011). Distribution of laterite in Kerala, is mostly confined to an elevation of less than 600m, forming low flat topped ridges and hills, between the foothills of the Western Ghats and the Arabian Sea, mainly from Malappuram to Kasaragod (Varghese & Byju 1993). In the geographical documentation of the Government of Kerala these landscapes are marked as 'wastelands' (Anonymous 2019). The laterite hills are the most imposing feature of northern Kerala, which are extremely threatened both in terms of topography and biodiversity (Muraleedharan 2011). These plateaus are characterized by extremely harsh environment such as high temperature and lack of moisture content in the summer, leading to the development of unique vegetation, many of which show special adaptation to the environment. These severe conditions play a decisive role in the development of seasonal vegetation, where most of the plant species complete their life cycle during the monsoon period. When compared with granitic inselbergs (granitic rock outcrops), the vegetation and flora of lateritic plateaus has many unique peculiarities. The present study is an effort to record the floristic diversity and endemism of the Madayippara lateritic hillock in Kannur District of Kerala.

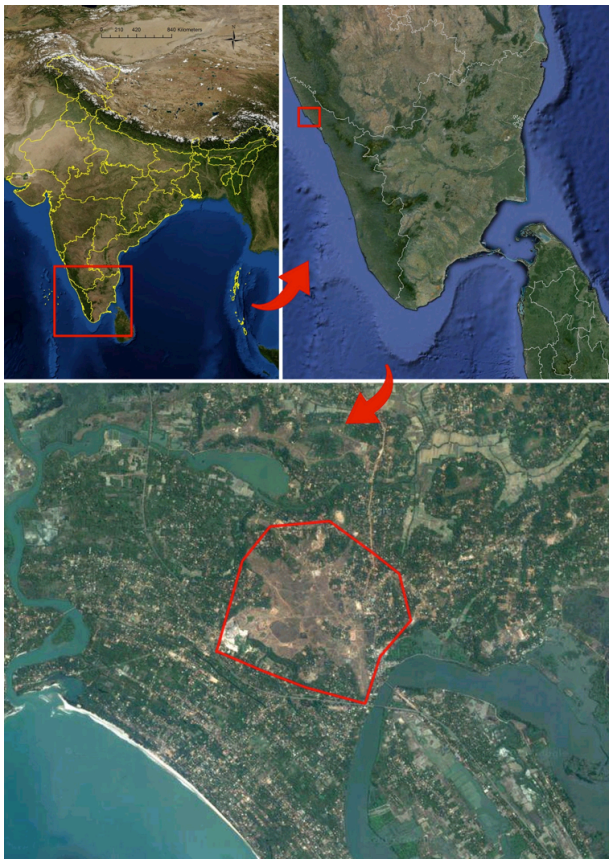

Image 1. Madayippara (From Google Earth).

Study Area

Madayippara, a good representative of the southern Indian midland lateritic plateaus, is located in Madayi Panchayath, near Payangadi Town in Kannur District of Kerala, southern India. The plateau covers an area of 3.65km^2, between 12.01–12.05 ^{0}N and 75.23–75.27 ^{0}E, at an altitude of about 50m from the mean sea level (Fig. 1; Image 1–3). The climatic conditions vary from hot dry to warm humid in different seasons, viz., pre-monsoon (March–May), monsoon (June–November), and post-monsoon (December–February); these together with edaphic factors account for the development of characteristic vegetation, as observed by Muller (2007).

Methods

Intensive field visits were carried out at Madayippara lateritic plateau covering all seasons during the period 2008–2017 to document floristic diversity. Different microhabitats on the plateau such as seasonal pools, soil covered areas, rocky surfaces, and tree associated vegetation along the valleys were surveyed repeatedly at different seasons and specimens were collected for laboratory studies and for the preparation of voucher specimens. Photographs of plants and habitats were taken using Nikon Coolpix L110 and Olympus C-7070 cameras. The voucher specimens were prepared following the wet method (Fosberg & Sachet 1965). The specimens were pressed in blotting paper, dried in a hot air oven, mounted on standard size, hand-made herbarium mount boards using a synthetic gum (Fevicol SH) and labeled and deposited at Calicut University Herbarium (CALI), duplicates of which are deposited at the herbarium of the Government Brennen College, Thalassery, Kerala. The specimens collected for laboratory studies were worked out using a LEICA M80, ZEISS Stemi DV4 and LABOMED CSM2 microscopes and identified using pertinent floras and relevant revisions and monographs; and by comparison with the specimens available at Calicut University Herbarium (CALI), Madras Herbarium (MH) and with the images in the Kew Herbarium (K) Catalogue (http://apps.kew.org/herbcat/navigator.do). Some of the specimens were referred to concerned experts in India and abroad for the confirmation of

Image 2. Views of the Madayipparara Plateau in different seasons: A—dried grasses in summer | B—sprouting of herbaceous species in early monsoon | C—flowering in monsoon. © Pramod C.

identification. The literature on phytogeography and endemism were referred to assess the distribution and endemism of each species. Conservation status of each species was checked with the available assessed data as per the IUCN Red list Categories and Criteria Version 3.1 (IUCN 2012). Endemism of taxa were recorded based on previous publications such as Sasidharan (2004) and online databases such as *World Checklist of Selected Plant Families* (http://apps.kew.org/wcsp/home.do). Botanical names were updated using online databases like *The International Plant Names Index* (IPNI) (http://ipni.org/ipni/plantnamesearchpage.do) and *World Checklist of Selected Plant Families* (http://apps.kew.org/wcsp/home.do) of the Royal Botanical Gardens, Kew.

RESULTS AND DISCUSSION

The vegetation of Madayippara lateritic plateau is divided into four broad categories with the characteristic flora associated with each of them (Jacobi et. al. 2007, modified). The plant species in the microhabitats are adapted to sustain in the adverse environmental conditions, such as seasonal drought, high temperature and nutrient scarcity. It has been observed that there is an overlap between most of the species in microhabitats with varying degree of dominance, as stated by Watve (2013), however, some species are always restricted to a particular microhabitat.

Bhattarai et al. (2012) in a study on the mesoscale distributions of endemic, rare, or locally important plant species on the plateau habitats and its escarpments, assessed the hydrological and edaphic parameters of seasonal plateau microhabitats on the Kas Plateau in Maharashtra. They found that almost two-thirds of over hundred phytogeographically important species occur on the plateau top. Since botanically critical plateau habitats are generally small, dependent on seasonal moisture of monsoon, and determined by drainage-related parameters that are altered by anthropogenic activities, they are highly threatened. Using the Kas region as a model lateritic system, they assessed its significant flora and habitats at two scales: mesoscale distributions in major ecological zones of the plateau and its subtending slopes, and microscale distributions on the plateau in seasonal habitats defined by hydrogeomorphic parameters such as moisture content, seasonal water retention capacity, profile of the soil, topographic variation, depth and texture of soil, and micro-elevational gradients. They identified 11 microhabitat types on the plateau top, that support varieties of plant species of phytogeographic significance during the monsoon. The plateau consists of a mosaic of floristically different habitats determined by hydrogeomorphic factors; for many of these habitats, the occupied area is very small in extent and seasonally ephemeral.

In a similar floristic analysis conducted in 10 threatened high altitude lateritic plateau ecosystems including Kas in the southwestern Maharashtra part of Western Ghats, Lekhak & Yadav (2012) recorded the presence of 361 taxa of herbaceous plants. Out of the reported 67 endemic species from the study area, 39 are restricted to lateritic plateaus only. They also identified 11 microhabitat types that support distinct plant communities depending primarily on the availability of soil and moisture. The plant communities of these

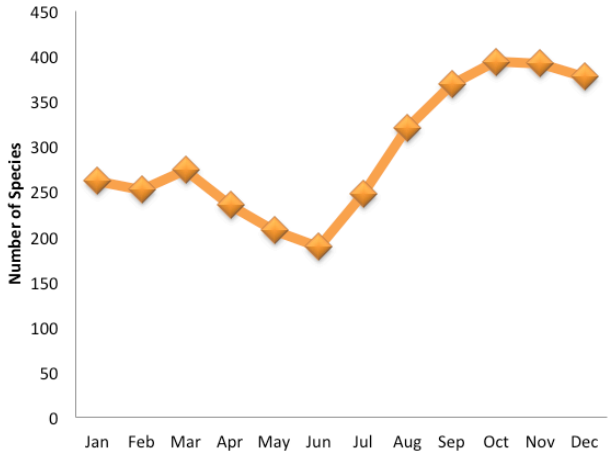

Figure 1. Flowering in different months.

habitats are usually edaphically controlled and show adaptation for water accumulation, such as succulence and poikilohydry, carnivory in response to the lack of nutrients in the soil and the presence of underground organs to overcome extreme temperature during summer.

The studies discussed above are from high altitude lateritic plateaus of the northern Western Ghats, and the area surveyed is large compared to the present study, however, climatic and geomorphologic characteristics of the microhabitats are found to be important for the distribution of endemic species in all cases. In a small area, strong endemic component in the flora is associated with seasonal moisture availability. These endemics occur in a variety of ephemeral microhabitats associated with edaphic features of the plateau (Bhattarai et al. 2012). In the present study, microhabitats are included in broader categories, as more emphasis is given to the floristic documentation of the entire plateau habitats and its escarpments. As tree cover and scrub patches on and around the plateau sustain more number of plant species, they support more number of endemic species.

(1) Exposed rock surfaces and crevices (RC): Laterite rock surfaces form one of the most important habitats that support a number of species adapted to this habitat. The micro environment of the lateritic rock surface and crevices are extremely different from that of the surrounding soil covered areas. The rock surfaces are characterized by very low moisture content, high thermal variation, very low organic carbon content and less availability of nutrients. The crevices and fissures on the rocks show the presence of little soil. A few of the plant species growing on exposed rock surfaces are desiccation tolerant.

(2) Seasonal ponds and small ephemeral pools (SP): During rainy seasons small and shallow ephemeral pools and some large ponds are formed on the plateau. These support a large number of hydrophytes including endemic species showing various degrees of rarity. The seasonal pools in the plateau are varying in their area, depth, soil cover and soil texture. The pools are just depressions on the plateau, either on laterite rock or on soil covered areas. If it is on rocks, thin layers of soil, rich in organic matter has been noted, which support the vegetation. The pools get dried up in post-monsoon periods and remain dry till pre-monsoon. They become water logged with the onset of southwest monsoon and dry up after the retreat of the northeast monsoon. Water in the seasonal pools is subjected to extreme diurnal changes in temperature due to the high surface to volume ratio (Pramod 2015). Germination of ephemeral vegetation in the seasonal pools is noticed after the first shower in May end or early June every year. A series of species are noticed progressively until they become dry in the months of October–November. This series include species such as *Geissaspis cristata*, *G. tenella, Isachne veldkampii*, *Murdannia ochracea*, *M. semiteres*, *Rotala malabarica*, *R. malampuzhensis*, *Schoenoplectiella articulata*, *S. lateriflora*, *Blyxa aubertii*, *B. octandra*, *Nymphoides krishnakesara*, *Echinochloa colona*, *Glyphochloa acuminata*, *Utricularia cecilii*, *U. graminifolia*, *Drosera indica*, *Fimbristylis tenera*, *F. aestivalis*, *F. ferruginea*, *Eriocaulon cuspidatum*, *E. reductum*, *E. eurypeplon*, *Coelachne madayensis*, *Neanotis subtilis*, *Dopatrium junceum*, *Oryza rufipogon*, *Rhamphicarpa longiflora*, *Wiesneria triandra*, *Hydrilla verticillata*, *Monochoria vaginalis*, and *Lindernia hyssopioides*. Almost all species are herbaceous and most of them complete their life cycle in a short period as the pools dry up.

(3) Soil covered areas and grassy plains and slopes (SC): Surrounding the rocky surfaces are the areas with soil cover of varied thickness from less than 1cm to more 1m, and on the southeastern part of the plateau grassy slopes with thick soil cover occur. The vegetation of the soil covered areas varies slightly depending on soil thickness. The areas with low soil thickness, which usually hold higher moisture content in the early monsoon are characterized by ephemeral flush vegetation, that are later replaced by grass and sedge species.

(4) Tree cover and scrub patches (TS): The upper flat terrain of the plateau, which is almost devoid of thick vegetation, is surrounded by tree vegetation of varying characteristics, from scrub jungles to thick semi

evergreen forests. These forest patches are highly diverse with respect to species composition and the presence of endemic and rare elements. Though the top of the plateau is devoid of continuous tree cover, some isolated tree species are found. There are small scrub patches with short trees, shrubs and herbs. Madayikkavu is a sacred grove covering an area of 0.005km^2 with vegetation mainly composed of trees, shrubs, and climbers.

A total of 636 taxa of flowering plants, under 110 families, 406 genera, and 631 species were documented from the plateau. They are listed in the Table 1, with the families arranged according to APG system of classification (APG IV 2016). The genera and species are arranged in alphabetical order under respective families and genera. The area of the plateau is very small (3.65km^2), representing less than 0.01% of Kannur District, but it harbors about 59% of the flora of Kannur District (Ramachandran & Nair 1988). The immense diversity of flowering plants in Madayippara is due to the occurrence of diverse types of microhabitats and the ecological factors acting on them. The occurrence of a high percentage of endemic species belonging to diverse families in a small area indicates the complex nature of the habitat.

Eleven new taxa were discovered by different workers from this plateau, since 1990 (Table 2). They are *Rotala malabarica* (Pradeep et al., 1990), *Nymphoides krishnakesara* (Joseph & Sivarajan, 1990), *Justicia ekakusuma* (Pradeep & Sivarajan 1991), *Lepidagathis keralensis* (Madhusoodanan & Singh, 1992), *Eriocaulon madayiparense* (Swapna et al. 2012), *Lindernia madayiparensis* (Ratheesh Narayanan et al., 2012), *Coelachne madayensis* (Pramod et al. 2012), *Parasopubia hofmannii* (Pradeep & Pramod, 2013), *Parasopubia hofmannii* var. *albiflora* (Pradeep & Pramod, 2013), *Fimbristylis pokkudaniana* (Sunil et al., 2016), and *Chrysopogon narayaniae* (Sunil et al., 2017). Two recently described species from southern India, viz., *Eriocaulon gopalakrishnanum* K.Rashmi & G.Krishnak. and *Lindernia tamilnadensis* M.G.Prasad & Sunojk. also occur in this plateau. Recently, a number of new species were described from similar lateritic habitats of northern Kerala (Image 4 & 5) and plateaus of the Konkan region (Ansari et al. 1982; Bhat & Nagendran 1983; Nair et al. 1983; Yadav & Janarthanam 1994; Raju 1985; Potdar et al. 2004; Gad & Janarthanam 2007; Raj & Sivadasan 2008; Yadav et al. 2008, 2009, 2010; Malpure & Yadav 2009; Prabhugaonkar et al. 2009; Shimpale & Yadav 2010; Nandikar & Gurav 2011; Kambale et al. 2012; Potdar & Yadav 2012; Prasad & Raveendran 2013a&b; Prasad et al. 2012; Shahina & Nampy 2014; Gaikwad et al. 2014; Biju et al. 2016a,b,c; Darshetkar et al. 2017; Bokil et al. 2020). Most of the species described from such habitats belong to diverse families. This shows that complex and diverse microhabitats of the plateaus support rich and varied flora.

The substrata of the plateau are highly variable ranging from the deep soil profile of grasslands in the valleys to the ultra-thin film of humus on the exposed rock surfaces. In rock surfaces, the vegetation is very distinct with the predominance of drought tolerant species. The fine dust and humus accumulated in the vermiform tubes and cavities of the laterite rock provide nutrients to the supporting herbaceous vegetation. Species such as *Lepidagathis keralensis*, *Euphorbia deccanensis*, and *Polycarpaea corymbosa* occur on open lateritic surfaces mostly rooted in the humus rich crevices of the laterite rocks. The plateau is subjected to high degree of seasonal variation in the vegetation and flora. The most important factor that determines the vegetation is the soil moisture content. In the pre-monsoon period, the open plateau is looking almost barren with few dried grass species of the post-monsoon period. The germination of the seasonal vegetation starts with the summer shower in May and continues later at the onset of south-west monsoon in June. The early monsoon is dominated by ephemeral flush vegetation, which is taken over later by grass and sedge species at the end and continued in the post monsoon period. The monsoon months (June–November) shows the peak of flowering of species, due to the appearance of ephemeral species, grasses and sedges in the open plateau, as shown in Figure 1. In the pre-monsoon and post-monsoon months, flowering is dominated by woody species in the scrub patches and tree cover.

Rarity and endemism

Western Ghats harbours around 1,600 endemic plant species (Nayar 1996), which are documented by many workers, but the diversity and endemism of midland lateritic hillocks and wetlands are seldom documented. Out of the 636 taxa recorded from Madayippara, 160 (c. 25%) are endemics (Table 1). Since the maximum number of plant species were recorded in the tree cover and scrub patches, they hold highest number of endemic species also. Many of the endemic species occur in specialized microhabitats. For example, species such as *Lepidagathis keralensis* is restricted to hard lateritic rocks with extreme xeric environment; *Coelachne madayensis* occur in seasonal pools in well exposed sunny locations with submerged foliage and emergent panicles;

Table 1. A list of flowering plant taxa recorded from the Madayippara Lateritic Plateau.

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
PIPERACEAE	*Peperomia pellucida* (L.) Kunth	TS	Sep–Dec		
	Piper argyrophyllum Miq.	TS	Jul–Feb	WG & SL	
	P. longum L.	TS	Aug–Jan		
ARISTOLOCHIACEAE	*Aristolochia indica* L.	TS	Jul–Mar		
MAGNOLIACEAE	*Magnolia champaca* (L.) Baill. ex Pierre	TS	Mar–Jul		
ANNONACEAE	*Miliusa tomentosa* (Roxb.) Finet & Gagnep.	TS	Oct–May		
	Polyalthia korinti (Dunal) Thwaites	TS	Apr–Jun	SI & SL	
	Uvaria narum (Dunal) Blume	TS	Nov–Jun	SI & SL	
LAURACEAE	*Alseodaphne semecarpifolia* Nees var. *semecarpifolia*	TS	Feb–Apr	PI & SL	
	Cinnamomum verum J.Presl	TS	Mar–Apr	SWI & SL	
	Litsea deccanensis Gamble	TS	Nov–Dec	SI & SL	
	L. glutinosa (Lour.) C.B.Rob.	TS	Apr–May		
ARACEAE	*Amorphophallus hohenackeri* (Schott) Engl. & Gehrm.	TS	Jun–Aug	WG	
	A. paeoniifolius (Dennst.) Nicolson	TS	May–Jun		LC
	Ariopsis peltata Nimmo	TS	Jun–Aug		
	Arisaema neglectum Schott	TS	Apr–Jul	WG	
	Caladium bicolor (Aiton) Vent.	SC	Dec–Jan		
	Colocasia esculenta (L.) Schott	SC	May–Oct		LC
	Cryptocoryne spiralis (Retz.) Fisch. ex Wydler	SC	Oct–Apr	I	
	Pistia stratiotes L.	SP	Oct–Mar		LC
	Pothos scandens L.	TS	Oct–Nov		
	Rhaphidophora pertusa (Roxb.) Schott	TS	Aug–Sep	I & SL	
	Theriophonum infaustum N.E.Br.	TS	Jul–Sep	SWG	
ALISMATACEAE	*Wiesneria triandra* (Dalzell) Micheli	SP	Aug–Nov	PI	LC
HYDROCHARITACEAE	*Blyxa aubertii* Rich.	SP	Jun–Sep		LC
	B. octandra (Roxb.) Planch. ex Thwaites	SP	Jun–Oct		LC
	Hydrilla verticillata (L.f.) Royle	SP	Jan–Dec		LC
BURMANNIACEAE	*Burmannia coelestis* D.Don	SC	Oct–Dec		LC
DIOSCOREACEAE	*Dioscorea bulbifera* L.	TS	Sep–Oct		
	D. pentaphylla L.	TS	Sep–Dec		
	D. wallichii Hook.f.	TS	Oct–Nov		LC
PANDANACEAE	*Pandanus odorifer* (Forssk.) Kuntze	TS	Jul–Nov		LC
COLCHICACEAE	*Iphigenia indica* (L.) A.Gray ex Kunth	TS	Jul–Sep		
SMILACACEAE	*Smilax zeylanica* L.	TS	Jul–Jan		
ORCHIDACEAE	*Acampe praemorsa* (Roxb.) Blatt. & McCann	TS	Mar–Apr		
	Bulbophyllum rosemarianum C.S.Kumar, P.C.S.Kumar & Saleem	TS	Jan–Mar	SWG	
	Crepidium resupinatum (G.Forst.) Szlach.	TS	Jul–Sep		
	Habenaria diphylla (Nimmo) Dalzell	SC	Sep–Nov		
HYPOXIDACEAE	*Curculigo orchioides* Gaertn.	SC	Jun–Dec		
AMARYLLIDACEAE	*Crinum viviparum* (Lam.) R.Ansari & V.J.Nair	SC	Jan–Dec	I & SL	LC
	Hymenocallis littoralis (Jacq.) Salisb.	SC	Jan–Dec		
	Pancratium triflorum Roxb.	SC	Mar–May	I & SL	

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
ASPARAGACEAE	*Chlorophytum nimmonii* (Graham) Dalzell	TS	Aug–Nov		
	Borassus flabellifer L.	TS	Mar–Sep		
	Calamus metzianus Schltdl.	TS	Nov–Jun	WG	
	Caryota urens L.	TS	Jan–Apr		LC
COMMELINACEAE	*Commelina diffusa* Burm.f.	SC	Jul–Sep		LC
	C. kurzii C.B.Clarke	TS	Jul–Oct		
	Cyanotis axillaris (L.) D.Don ex Sweet	SC	Aug–Dec		LC
	C. burmanniana Wight	RC	Aug–Dec	WG	LC
	C. cristata (L.) D.Don	SC	Jul–Oct		LC
	Murdannia dimorpha (Dalzell) G.Brückn.	SC	Jul–Sep	PI & SL	
	M. ochracea (Dalzell) G.Brückn.	SP	Aug–Sep	PI	
	M. semiteres (Dalzell) Sant.	SC/RC	Aug–Dec	PI	LC
	M. spirata (L.) G.Brückn.	SC	Aug–Nov		LC
PONTEDERIACEAE	*Monochoria vaginalis* (Burm.f.) C.Presl	SP	Jul–Nov		LC
COSTACEAE	*Hellenia speciosa* (J.Koenig) S.R.Dutta	TS	Jul–Oct		
ZINGIBERACEAE	*Curcuma aeruginosa* Roxb.	TS/SC	Apr–May		
	C. cannanorensis R.Ansari, V.J.Nair & N.C.Nair	TS	May–Jun	SWG	
	C. longa L.	TS	Sep–Oct		
	C. zedoaria (Christm.) Roscoe	TS	Apr–May	I	
	Zingiber zerumbet (L.) Roscoe ex Sm.	TS	Jul–Nov		
XYRIDACEAE	*Xyris pauciflora* Willd.	SC	Aug–Oct		LC
ERIOCAULACEAE	*Eriocaulon cuspidatum* Dalzell	SP	Aug–Jan	WG	LC
	E. eurypeplon Körn.	SP	Jul–Dec	PI	LC
	E. gopalakrishnanum K.Rashmi & G. Krishnak.	SC	Aug–Dec	SI (K)	
	E. kolhapurense S.P. Gaikwad, Sardesai & S.R. Yadav	SC	Aug–Nov	WG	VU
	E. reductum Ruhland	SP	Sep–Mar	WG	
	E. xeranthemum Mart.	SC	Jul–Sep		LC
CYPERACEAE	*Bulbostylis densa* (Wall.) Hand.-Mazz.	SC	Sep–Nov		LC
	Cyperus amabilis Vahl	SC	Aug–Dec		LC
	C. compressus L.	SC	Jan–Dec		LC
	C. cyperinus (Retz.) Suringar	SC	Jun–Aug		
	C. difformis L.	SC	Jan–Dec		LC
	C. iria L.	SC	Nov–Dec		LC
	C. javanicus Houtt.	SC	Jan–Dec		
	C. rotundus subsp. *retzii* (Nees) Kuk.	SC	Jun–Dec		LC
	C. rotundus L. subsp. *rotundus*	SC	Jun–Dec		LC
	C. surinamensis Rottb.	SC	Jul–Dec		
	Eleocharis atropurpurea (Retz.) J.Presl & C.Presl	SC	Nov–Dec		LC
	E. dulcis (Burm.f.) Trin. ex Hensch.	SP	Sep–Dec		
	Fimbristylis aestivalis (Retz.) Vahl	SC	Jan–Apr		
	F. argentea (Rottb.) Vahl	SC	Jun–Dec		LC
	F. dichotoma subsp. *podocarpa* (Nees & Meyen) T.Koyama	SC	Mar–Dec		LC
	F. dipsacea (Rottb.) C.B.Clarke	SC	Jan–May		LC

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	F. ferruginea (L.) Vahl	SC	Aug–Dec		LC
	F. ovata (Burn.f.) J.Kern	SC	Aug–Mar		LC
	F. pokkudaniana Sunil, Ratheesh & Sivad.	SP	Aug–Sep	SWG (K)	
	F. quinquangularis (Vahl) Kunth	SP	Oct–Nov		LC
	F. schoenoides (Retz.) Vahl	SC	Sep–Dec		LC
	F. tenera Roem. & Schult.var. *tenera*	SC	Jul–Jan		
	Fuirena ciliaris (L.) Roxb.	SC	Oct–Mar		LC
	Kyllinga brevifolia Rottb. var. *brevifolia*	SC	Jul–Nov		LC
	K. brevifolia var. *stellulata* (Valck.Sur.) S.S.Hooper	SC	Jul–Nov		LC
	K. bulbosa P.Beauv.	SC	Jun–Dec		LC
	Lipocarpha squarrosa (L.) Goetgh.	SC	Aug–Dec		
	Pycreus malabaricus C.B.Clarke	SC	Jul–Dec	PI	
	P. polystachyos (Rottb.) P.Beauv. subsp. *polystachyos*	SC	Jan–Dec		LC
	P. pumilus (L.) Nees	SC	Jan–Dec		LC
	P. stramineus C.B.Clarke	SC	Aug–Dec		LC
	Rhynchospora wightiana (Nees) Steud.	SC	Aug–Nov		
	Schoenoplectiella articulata (L.) Lye	SP	Aug–Dec		
	S. lateriflora (J.F.Gmel.) Lye	SP	Aug–Dec		LC
	Scleria lithosperma (L.) Sw. var. *lithosperma*	TS	Jan–Dec		
POACEAE	*Alloteropsis cimicina* (L.) Stapf	SC	Jul–Nov		
	Apocopis mangalorensis (Hochst. ex Steud.) Henrard	SC	Oct–Feb	PI	
	Arundinella cannanorica V.J.Nair, Sreek. & N.C.Nair	RC	Oct–Dec	SWG (K)	
	A. ciliata (Roxb.) Nees ex Miq.	SC	Oct–Nov	PI	
	A. pumila (Hochst. ex A.Rich.) Steud.	SC/RC	Jul–Dec		
	A. purpurea Hochst. ex Steud.	SC	Aug–Dec	SI	
	A. setosa Trin.	SC	May–Dec		
	Bambusa bambos (L.) Voss	TS	Jul–Feb	I & SL	
	Brachiaria ramosa (L.) Stapf	SC	Mar–Sep		LC
	B. subquadripara (Trin.) Hitchc.	SC	Jul–Dec		LC
	Capillipedium assimile (Steud.) A.Camus	SC	Oct–Nov		
	Chloris barbata Sw.	SC	Mar–Dec		
	Chrysopogon narayaniae Sunil, Ratheesh & Sivad.	RC	Oct–Dec	SWG (K)	
	C. tadulingamii Sreek., V.J. Nair & N.C.Nair	RC	Oct–Dec	SWG (K)	
	Coelachne madayensis Pramod & Pradeep	SP	Jul–Sep	SI (K)	
	Coix lacryma-jobi L.	SC	Jul–Mar		
	Cynodon dactylon (L.) Pers.	SC	Mar–Oct		
	Cyrtococcum trigonum (Retz.) A.Camus	SC	Sep–Oct		
	Dactyloctenium aegyptium (L.) Willd.	SC	Jan–Dec		
	Digitaria ciliaris (Retz.) Koeler	SC	Jul–Nov		
	Dimeria copeana Sreek., V.J.Nair & N.C.Nair	SC	Dec–Mar	SI (K)	
	D. hohenackeri Hochst. ex Miq.	SC/RC	Oct–Dec	PI	EN
	D. stapfiana C.E.Hubb. ex Pilg.	SC/RC	Oct–Dec	SI	

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	D. thwaitesii Hack. in A.DC. & C.DC.	SC/RC	Sep–Dec	I & SL	
	Echinochloa colona (L.) Link	SP	Jan–Dec		LC
	Eleusine indica (L.) Gaertn.	SC	Jan–Dec		
	Eragrostis amabilis (L.) Wight & Arn.	SC	Jul–Nov		
	E. atrovirens (Desf.) Trin. ex Steud.	SC	Jan–Dec		
	E. gangetica (Roxb.) Steud.	SC	Jun–Dec		
	E. unioloides (Retz.) Nees ex Steud.	SC	Jan–Dec		LC
	Eulalia trispicata (Schult.) Henrard	SC	Oct–Mar		
	Glyphochloa acuminata (Hack.) Clayton var. *acuminata*	SC/SP/RC	Oct–Feb	PI	
	G. acuminata var. *woodrowii* (Bor) Clayton	RC	Oct–Dec	SI	
	Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.	SC	Oct–Dec		
	Isachne globosa (Thunb.) Kuntze	SC	Jan–Dec		LC
	I. miliacea Roth	SC	Jan–Dec		
	I. veldkampii K.G.Bhat & Nagendran	SP	Aug–Oct	SI	CR
	Ischaemum barbatum Retz.	SP	Oct–Jan		
	I. cannanorense Sreek., V.J.Nair & N.C.Nair	RC	Sep–Dec	SI (K)	
	I. ciliare Retz.	SC	Oct–Nov		
	I. keralense Sreek., V.J.Nair & N.C.Nair	SC	Oct–Dec	SWG (K)	
	I. lanatum Ravi, N.Mohanan & Shaju	TS	Oct–Jan	SWG (K)	
	I. rangacharianum C.E.C.Fisch.	SP	Sep–Dec	SI & SL	
	Limnopoa meeboldii (C.E.C.Fisch.) C.E.Hubb.	SP	Sep–Nov	SI (K)	EN
	Melinis repens (Willd.) Zizka	SC	Mar–Aug		
	Oplismenus burmanni (Retz.) P.Beauv.	TS	Sep–Nov		
	Oryza rufipogon Griff.	SP	Sep–Mar		LC
	O. sativa L.	SC	Sep–Jun		
	Panicum repens L.	SC	Jul–Sep		LC
	Paspalidium geminatum (Forssk.) Stapf	SC	Jun–Mar		LC
	Paspalum conjugatum P.J.Bergius	SC	Jan–Dec		LC
	P. scrobiculatum L.	SC	Jan–Dec		LC
	Pennisetum pedicellatum Trin.	SC	Sep–Dec		
	P. polystachion (L.) Schult.	SC	Apr–Dec		
	Pseudanthistiria umbellata (Hack.) Hook.f.	TS	Nov–Dec	PI & SL	
	Sacciolepis interrupta (Willd.) Stapf	SP	Jan–Dec		
	Setaria pumila (Poir.) Roem. & Schult.	SC	Jul–Oct		
	Sporobolus diandrus (Retz.) P.Beauv.	SC	Mar–Sep		
	S. pilifer (Trin.) Kunth	SC/RC	Sep–Dec		
	Themeda triandra Forssk.	SC	Oct–Jan		
MENISPERMACEAE	*Anamirta cocculus* (L.) Wight & Arn.	TS	Aug–Dec		
	Cyclea peltata (Lam.) Hook.f. & Thomson	TS	Apr–May	I & SL	
	Diploclisia glaucescens (Blume) Diels	TS	Mar–Aug		
	Tinospora cordifolia (Willd.) Miers.	TS	Jan–Jun		
	T. sinensis (Lour.) Merr.	TS	Feb–Jun		
RANUNCULACEAE	*Naravelia zeylanica* (L.) DC.	TS	Oct–Apr		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
CRASSULACEAE	*Bryophyllum pinnatum* (Lam.) Kurz	TS	Jul–Oct		
VITACEAE	*Ampelocissus latifolia* (Roxb.) Planch.	TS	May–Jun		
	Cayratia tenuifolia (Wight & Arn.) Gagnep.	TS	Sep–Mar		
	C. trifolia (L.) Domin	RC	Jan–Dec		
	Cissus discolor Blume	TS	Jul–Jan		
	C. heyneana Steud.	TS	Apr–Jun	SI & SL	
	C. latifolia Lam.	TS	Jun–Sep	PI & SL	
	C. repens Lam.	TS	Nov–Dec		
	Leea indica (Burm.f.) Merr.	TS	Mar–Aug		
FABACEAE: Papilionoideae	*Abrus precatorius* L.	TS	Oct–May		
	A. pulchellus Wall. ex Thwaites	TS	Oct–Mar		
	Aeschynomene americana L.	SC	Sep–Dec		
	A. indica L.	SP	Aug–Dec		LC
	Alysicarpus bupleurifolius (L.) DC.	SC/RC	Sep–Jan		LC
	A. vaginalis (L.) DC. var. *vaginalis*	SC	Sep–Jan		
	Cajanus cajan (L.) Millsp.	SC	Dec–Mar		
	C. scarabaeoides (L.) Thouars	SC	Sep–Jan		LC
	Calopogonium mucunoides Desv.	SC	Aug–Dec		
	Canavalia gladiata (Jacq.) DC.	TS	Jul–Dec		
	Centrosema molle Benth.	TS	Sep–Jan		
	Clitoria ternatea L. var. *ternatea*	SC	Jul–Oct		
	Crotalaria evolvuloides Wight ex Wight & Arn.	SC	Oct–Feb	PI & SL	
	C. pallida Aiton var. *pallida*	SC	Sep–Jan		
	C. quinquefolia L.	SC	Sep–Dec		LC
	C. verrucosa L.	SC	Aug–Nov		
	Dalbergia horrida (Dennst.) Mabb. var. *horrida*	TS	Sep–Jan	SWG	
	Derris scandens (Roxb.) Benth.	TS	Jun–Dec		
	Desmodium heterophyllum (Willd.) DC.	SC	Jul–Dec		
	D. scorpiurus (Sw.) Desv.	SC	Dec–Jul		
	D. triflorum (L.) DC.	SC	Jul–Dec		
	D. triquetrum (L.) DC.	TS	Jul–Dec		
	Erythrina variegata L.	TS	Mar–Apr		LC
	Geissaspis cristata Wight & Arn.	SP	Jul–Sep		LC
	G. tenella Benth. var. *tenella*	SP/RC	Aug–Nov	WG	LC
	Gliricidia sepium (Jacq.) Kunth ex Walp.	TS	Mar–May		
	Indigofera hirsuta L.	SC	Jul–Dec		
	I. tinctoria L.	SC	Aug–Dec		
	I. trifoliata L.	SC	Sep–Dec		
	Mucuna pruriens (L.) DC. var. *pruriens*	TS	Oct–Feb		
	Pongamia pinnata (L.) Pierre	TS	Apr–Dec		LC
	Pseudarthria viscida (L.) Wight & Arn.	TS	Nov–Mar	PI & SL	
	Pterocarpus marsupium Roxb.	TS	Sep–Oct	I & SL	VU
	Sesbania bispinosa (Jacq.) W.Wight	SP	Jul–Dec		LC
	Smithia conferta Sm.	SC	Nov–Feb		

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	S. salsuginea Hance	SC/ TS	Oct–Nov	PI	
	S. sensitiva Aiton	SC	Aug–Dec		LC
	Stylosanthes fruticosa (Retz.) Alston	SC	Sep–Jan		
	S.guianensis (Aubl.) Sw.	SC	Jul–Nov		
	Tephrosia purpurea (L.) Pers.	SC	Oct–Dec		
	Vigna trilobata (L.) Verdc.	SC	Jul–Dec		
	Zornia gibbosa Span.	SC	Sep–Jan		
FABACEAE: Caesalpinioideae	*Bauhinia purpurea* L.	TS	Sep–Dec		LC
	B. scandens var. *anguina* (Roxb.) Ohashi	TS	Sep–Mar		
	Caesalpinia mimosoides Lam.	TS	Jan–Mar		
	Cassia fistula L.	TS	Feb–May		
	Chamaecrista mimosoides (L.) Greene	SC	Jul–Dec		
	C. nictitans subsp. *patellaria* var. *glabrata* (Vogel) H.S.Irwin & Barneby	SC/RC	Aug–Oct		LC
	Delonix regia (Bojer) Raf.	TS	Feb–Jul		LC
	Peltophorum pterocarpum (DC.) Backer ex K.Heyne	TS	Jan–Dec		
	Senna alata (L.) Roxb.	SC	Sep–Jan		
	S. hirsuta (L.) H.S.Irwin & Barneby	SC	Sep–Dec		
	S. occidentalis (L.) Link	SC/ TS	Jul–Dec		
	S. siamea (Lam.) H.S.Irwin & Barneby	TS	Oct–Mar		
	S. tora (L.) Roxb.	SC	Aug–Dec		
	Tamarindus indica L.	TS	Sep–Apr		
FABACEAE: Mimosoideae	*Acacia auriculiformis* A.Cunn. ex Benth.	TS	Jan–Dec		LC
	A. caesia (L.) Willd.	TS	Oct–Dec		LC
	A. mangium Willd.	TS	Jul–Feb		
	A. pennata (L.) Willd.	TS	Oct–Jan		
	Adenanthera pavonina L.	TS	Jan–Sep		
	Albizia chinensis (Osbeck) Merr.	TS	Mar–Jul		
	A. lebbeck (L.) Benth.	TS	Mar–Dec		
	A. saman (Jacq.) F.Muell.	TS	Mar–May		
	Dichrostachys cinerea (L.) Wight & Arn.	SC	Oct–Jan	I & SL	LC
	Leucaena leucocephala (Lam.) de Wit	TS	Nov–Apr		
	Mimosa diplotricha C.Wight ex Sauvalle var. *diplotricha*	SC	Nov–Mar		
	M. pudica L.	SC	Jul–Jan		LC
POLYGALACEAE	*Polygala elongata* Klein ex Willd.	SC/RC	Jul–Jan	I & SL	
	Salomonia ciliata (L.) DC.	SC	Oct–Dec		
RHAMNACEAE	*Ziziphus mauritiana* Lam.	TS	Feb–Jul		
	Z. oenopolia (L.) Mill.	TS	Nov–Mar		
	Z. rugosa Lam.	TS	Nov–May		
ULMACEAE	*Holoptelea integrifolia* (Roxb.) Planch.	TS	Dec–Mar		
CANNABACEAE	*Celtis timorensis* Span.	TS	Jan–Mar		
	Trema orientalis (L.) Blume	TS	Sep–Dec		
MORACEAE	*Artocarpus heterophyllus* Lam.	TS	Nov–Apr		
	Ficus arnottiana (Miq.) Miq.	TS	Dec–Apr	I & SL	
	F. benghalensis L. var. *benghalensis*	TS	May–Aug	I	

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	F. callosa Willd.	TS	Mar–Apr		
	F. exasperata Vahl	TS	Feb–Apr		
	F. heterophylla L.f.	SC	Sep–Dec		
	F. hispida L.f.	TS	Sep–May		
	F. racemosa L.	TS	Feb–May		
	F. religiosa L.	TS	Nov–Feb		
	F. tinctoria subsp. *parasitica* (Koen. ex Willd.) Corner	TS	Mar–Apr		
	Morus alba L.	SC	Jan–Dec		
URTICACEAE	*Laportea interrupta* (L.) Chew	SC	Aug–Sep		
	Pilea microphylla (L.) Liebm.	SC/RC	Aug–Nov		
	Pouzolzia zeylanica (L.) Benn.	SC	Aug–Dec		
CUCURBITACEAE	*Coccinia grandis* (L.) Voigt	SC	Dec–Apr	PI & SL	
	Cucumis sativus f. *hardwickii* (Royle) W.J.de Wilde & Duyfjes	TS	Nov–May		
	Diplocyclos palmatus (L.) C.Jeffrey	TS	Nov–Jan		
	Mukia maderaspatana (L.) M.Roem.	TS	Jan–Dec		
	Solena amplexicaulis (Lam.) Gandhi	TS	Jul–Jan		
	Trichosanthes cucumerina L.	TS	Dec–May		
	T. tricuspidata var. *tomentosa* (Heyne ex C.B.Clarke) Kumari	TS	Dec–Jan	SWI & SL	
BEGONIACEAE	*Begonia crenata* Dryand.	TS	Aug–Nov	WG	
CELASTRACEAE	*Glyptopetalum zeylanicum* Thwaites	TS	Jul–Dec	PI & SL	
	Loeseneriella arnottiana (Wight) A.C.Sm.	TS	Feb–Mar	SI & SL	
	Salacia chinensis L.	TS	Feb–Mar		
	S. fruticosa Heyne ex M.A.Lawson	TS	Feb–May	WG	
CONNARACEAE	*Connarus paniculatus* Roxb.	TS	Oct–May		
	Rourea minor (Gaertn.) Alston	TS	Dec–Aug		
OXALIDACEAE	*Biophytum reinwardtii* (Zucc.) Klotzsch.	SC	Jul–Dec		
RHIZOPHORACEAE	*Carallia brachiata* (Lour.) Merr.	TS	Oct–Apr		
EUPHORBIACEAE	*Agrostistachys indica* Dalzell	TS	Feb–Mar	C & PI	
	Croton caudatus Geiseler	TS	Mar–May		
	Euphorbia deccanensis V.S.Raju	RC	Jul–Dec	SI (K)	
	E. heterophylla L.	SC	Jun–Aug		
	E. hirta L.	SC	Jan–Dec		
	E. thymifolia L.	SC	Nov–May		
	E. tithymaloides L.	SC	Apr–Aug		
	Falconeria insignis Royle	TS	Jan–Feb		
	Jatropha gossypiifolia L.	SC	Jul–Sep		
	Macaranga peltata (Roxb.) Müll.-Arg.	TS	Jan–Feb	I & SL	
	Mallotus philippensis (Lam.) Müll.-Arg.	TS	Oct–Mar		
	M. repandus (Rottler) Müll.–Arg.	TS	Nov–Jan		
	Micrococca mercurialis (L.) Benth.	SC	Jun–Dec		
	Microstachys chamaelea (L.) Müll.-Arg.	SC	Jul–Dec		
	Tragia involucrata L.	SC/TS	Jul–Dec	I & SL	
OCHNACEAE	*Gomphia serrata* (Gaertn.) Kanis	TS	Jan–Dec		LC
PHYLLANTHACEAE	*Antidesma ghaesembilla* Gaertn.	TS	Jul–Dec		

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	A. montanum Blume	TS	Dec–Apr		
	Aporosa cardiosperma (Gaertn.) Merr.	TS	Dec–Jun	PI & SL	
	Breynia vitis-idaea (Burm.f.) C.E.C.Fisch.	TS	Feb–Aug	I & SL	
	Bridelia retusa (L.) A.Juss.	TS	Aug–Dec		
	B. stipularis (L.) Blume	TS	Dec–Feb	PI	
	Flueggea leucopyrus Willd.	TS	Jun–Sep		
	F. virosa (Roxb. ex Willd.) Royle	SC	Mar–Sep		
	Phyllanthus airy-shawii Jean F.Brunel & J.P.Roux	SC	Jul–Jan	PI & SL	
	P. amarus Schumach. & Thonn.	SC	Jul–Oct		
	P. emblica L.	TS	Jul–Feb		
	P. reticulatus Poir.	SC/TS	Aug–Dec		
	P. urinaria L.	SC	Jul–Oct		
	P. virgatus var. *virgatus* G.Forst.	SC/RC	Jan–Dec		
	Sauropus androgynus (L.) Merr.	TS	Aug–Dec		
	S. quadrangularis (Willd.) Müll.-Arg.	TS	Jan–Dec		
MALPIGHIACEAE	*Aspidopterys canarensis* Dalzell	TS	Feb–May	WG	
PASSIFLORACEAE	*Passiflora foetida* L. var. *foetida*	TS	Jul–Dec		
	P. foetida var. *hispida* (DC. ex Triana & Planch.) Killip	TS	Nov–Mar		
	Turnera ulmifolia L.	TS	May–Dec		
SALICACEAE	*Flacourtia indica* (Burm.f.) Merr.	TS	Nov–Mar		
VIOLACEAE	*Hybanthus enneaspermus* (L.) F.Muell.	SC	Jul–Nov		
ACHARIACEAE	*Hydnocarpus pentandrus* (Buch.-Ham.) Oken	TS	Dec–May	WG	
LINACEAE	*Hugonia mystax* L.	TS	Aug–Oct	I & SL	
CLUSIACEAE	*Garcinia gummi-gutta* (L.) N.Robson var. *gummi-gutta*	TS	Jan–Sep	SI & SL	
COMBRETACEAE	*Calycopteris floribunda* (Roxb.) Lam. ex Poir.	TS	Jan–May		
	Combretum indicum (L.) DeFilipps	TS	Jul–Mar		
	C. latifolium Blume	TS	Dec–Apr		
	Terminalia bellirica (Gaertn.) Roxb.	TS	Dec–Jan		
	T. catappa L.	TS	Mar–Jan		
	T. paniculata Roth	TS	Aug–Feb	PI	
LYTHRACEAE	*Ammannia baccifera* L. subsp. *baccifera*	SP	Sep–Dec		LC
	Lagerstroemia speciosa (L.) Pers.	TS	Mar–Nov		
	Lawsonia inermis L.	TS	Dec–May		
	Rotala indica (Willd.) Koehne	SP	Jul–Dec		LC
	R. macrandra Koehne	SP	Sep–Jan	WG	LC
	R. malabarica Pradeep, K.T.Joseph & Sivar.	SP	Jul–Sep	SI (K)	CR
	R. malampuzhensis R.V.Nair ex C.D.K.Cook	SP	Jul–Sep	WG	LC
	R. rosea(Poir.) C.D.K.Cook	SP	Aug–Feb		LC
ONAGRACEAE	*Ludwigia hyssopifolia* (G.Don) Exell	SP/SC	Aug–Dec		LC
MYRTACEAE	*Syzygium caryophyllatum* (L.) Alston	TS	Feb–Jun		EN
	S. cumini (L.) Skeels	TS	Dec–Apr		
	S. jambos (L.) Alston	TS	Oct–Jan		
MELASTOMATACEAE	*Melastoma malabathricum* L.	TS	Jan–Dec		

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	Memecylon randerianum S.M.Almeida & M.R.Almeida	TS	Feb–May	SWG	
	M. umbellatum Burm.f.	TS/SC	Feb–Mar	PI & SL	
	Osbeckia muralis Naudin	SC	Sep–Dec	WG	
ANACARDIACEAE	*Anacardium occidentale* L.	TS	Nov–Apr		
	Holigarna arnottiana Hook.f.	TS	Jan–Jul	SWG	
	Lannea coromandelica (Houtt.) Merr.	TS	Jan–May		
	Mangifera indica L.	TS	Jan–May		DD
	Nothopegia heyneana (Hook.f.) Gamble	TS	May–Jun	WG	NT
	Spondias pinnata (L.f.) Kurz	TS	Mar–Dec		
SAPINDACEAE	*Allophylus cobbe* (L.) Raeusch.	TS	Jul–Nov		
	A. serratus (Roxb.) Kurz	TS	Jul–Oct	I & SL	
	Cardiospermum halicacabum L.	TS	Jul–Feb		
	Sapindus trifoliatus L.	TS	Dec–Apr		
	Schleichera oleosa (Lour.) Oken	TS	Mar–Jun		
RUTACEAE	*Aegle marmelos* (L.) Correa	TS	Mar–May	I & SL	
	Glycosmis mauritiana (Lam.) Tanaka	TS	Oct–May		
	G. pentaphylla (Retz.) DC.	TS	Sep–Apr		
	Melicope lunu-ankenda (Gaertn.) T.G.Hartley	TS	May–Jul		
	Murraya koenigii (L.) Spreng.	TS	Mar–Jul		
	Zanthoxylum rhetsum (Roxb.) DC.	TS	Mar–Nov		
SIMAROUBACEAE	*Ailanthus triphysa* (Dennst.) Alston	TS	Dec–Jul		
MELIACEAE	*Aglaia elaeagnoidea* (A.Juss.) Benth.	TS	Aug–Dec		LC
	Azadirachta indica A.Juss.	TS	Feb–Sep		
	Naregamia alata Wight & Arn.	SC/TS	Aug–Dec	PI	
MALVACEAE	*Corchorus aestuans* L.	SC	Aug–Feb		
Grewioideae	*C. capsularis* L.	SC	Jul–Nov		
	Grewia nervosa (Lour.) Panigrahi	TS	Aug–Apr		
	Triumfetta rhomboidea Jacq.	TS/SC	Aug–Feb		
Byttnerioideae	*Melochia corchorifolia* L.	SC	Jul–Apr		
	Waltheria indica L.	SC	Oct–Jan		
Sterculioideae	*Sterculia guttata* Roxb. ex DC.	TS	Sep–Mar		
Dombeyoideae	*Pterospermum diversifolium* Blume	TS	Dec–Apr		
	P. rubiginosum B.Heyne ex Wight & Arn.	TS	Nov–Apr	SWG	
Helecteroideae	*Helicteres isora* L.	TS	Sep–Mar		
Malvoideae	*Abelmoschus angulosus* var. *grandiflorus* Thwaites	SC/TS	Aug–Dec	SI & SL	
	Abutilon indicum (L.) Sweet var. *indicum*	SC	Sep–Apr		
	Fioria vitifolia (L.) Mattei	TS	Apr–Dec		
	Hibiscus hispidissimus Griff.	TS	Sep–Mar		
	H. sabdariffa L.	TS	Dec–Feb		
	H. surattensis L.	TS	Oct–Jan		
	Sida acuta Burm.f.	SC	Aug–Oct		
	S. alnifolia L.	SC/TS	Sep–Dec		
	S. mysorensis Wight & Arn.	SC	Oct–Feb		
	Urena sinuata L.	SC	Aug–Dec		

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Bombacoideae	*Bombax ceiba* L.	TS	Jan–Apr		
	Ceiba pentandra (L.) Gaertn.	TS	Feb–Jun		
DIPTEROCARPACEAE	*Hopea ponga* (Dennst.) Mabb.	TS	Mar–Jun	SWG	EN
CAPPARACEAE	*Capparis floribunda* Wight	TS	Feb–Jun		
	C. rheedei DC.	TS	Feb–Jun	WG	
	C. zeylanica L.	TS	Mar–May		
CLEOMACEAE	*Cleome monophylla* L.	SC	Feb–Aug		
	C. rutidosperma DC.	SC	May–Nov		
	C. viscosa L.	SC/RC	Mar–Jul		
BRASSICACEAE	*Brassica nigra* (L.) K.Koch.	SC	Mar–May		
OPILIACEAE	*Cansjera rheedei* J.F.Gmel.	TS	Nov–Feb		
SANTALACEAE	*Santalum album* L.	TS	Nov–Dec		VU
LORANTHACEAE	*Dendrophthoe falcata* (L.f.) Ettingsh. var. *falcata*	TS	Dec–May		
	Helicanthes elastica (Desr.) Danser	TS	Dec–Mar	WG	
	Helixanthera intermedia (Wight) Danser	TS	Feb–Jun	SWG	
	Macrosolen parasiticus (L.) Danser	TS	Dec–May	SWI & SL	
PLUMBAGINACEAE	*Plumbago zeylanica* L.	TS	Nov–Mar		
POLYGONACEAE	*Persicaria barbata* (L.) H.Hara	TS	Aug–Mar		LC
DROSERACEAE	*Drosera indica* L.	SC/RC/SP	Jul–Nov		LC
ANCISTROCLADACEAE	*Ancistrocladus heyneanus* Wall. ex J.Graham	TS	Mar–Apr	SI & SL	
CARYOPHYLLACEAE	*Polycarpaea corymbosa* (L.) Lam.	RC	Aug–Dec		
	Polycarpon prostratum (Forssk.) Asch. & Sehweinf.	SC	Jan–Mar		
AMARANTHACEAE	*Achyranthes aspera* L.	TS	Oct–Mar		
	Aerva lanata (L.) Juss. ex Schult.	TS	Sep–Apr		
	Alternanthera brasiliana (L.) Kuntze	TS/SC	Jan–Dec		
	A. sessilis (L.) R.Br. ex. DC.	SC	Jan–Dec		LC
	A. tenella Colla var. *tenella*	SC	Jun–Dec		
	Amaranthus spinosus L.	SC	Jun–Dec		
	A. viridis L.	SC	Jul–Dec		
	Celosia argentea L. var. *argentea*	RC/SC	Nov–Dec		
	Cyathula prostrata (L.) Blume	TS	Sep–Apr		
	Gomphrena globosa L.	SC	Aug–Jun		
	G. serrata L.	SC	Jul–Nov		
AIZOACEAE	*Trianthema portulacastrum* L.	SC	Apr–Jun		
NYCTAGINACEAE	*Boerhavia diffusa* L.	SC	Aug–Dec		
	Bougainvillea glabra Choisy	TS	Nov–Jun		
	Mirabilis jalapa L.	SC	Aug–Apr		
MOLLUGINACEAE	*Glinus oppositifolius* (L.) Aug.DC.	SC	Feb–Apr		
	Mollugo stricta L.	SC	Sep–Dec		
PORTULACACEAE	*Portulaca oleracea* L.	SC	Jun–Sep		
CACTACEAE	*Cereus pterogonus* Lem.	SC	Apr–Jun		
	Opuntia ficus-indica (L.) Mill.	SC	Nov–Mar		DD
CORNACEAE	*Alangium salviifolium* subsp. *hexapetalum* (Lam.) Wangerin	TS	Mar–Aug		
BALSAMINACEAE	*Impatiens balsamina* L.	SC	Mar–Oct		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	I. flaccida Arn.	SC	Jul–Oct	SI & SL	
	I. minor (DC.) Bennet	SC/RC	Aug–Dec	PI	
LECYTHIDACEAE	*Careya arborea* Roxb.	TS	Feb–Jul		
SAPOTACEAE	*Chrysophyllum cainito* L.	TS	Jul–Sep		
	Madhuca longifolia (J.Koenig ex L.) J.F. Macbr.	TS	Mar–Jun		
	Mimusops elengi L.	TS	Dec–Aug		
EBENACEAE	*Diospyros candolleana* Wight	TS	Apr–Mar	PI	
ICACINACEAE	*Sarcostigma kleinii* Wight & Arn.	TS	Feb–Jun		
RUBIACEAE	*Argostemma courtallense* Arn.	TS/RC	Jul–Sep	I	
	Benkara malabarica (Lam.) Tirveng.	TS	Jan–May	PI & SL	
	Canthium coromandelicum (Burm.f.) Alston	TS	Apr–Jun		
	C. rheedei DC.	TS	Mar–Jun	PI	
	Catunaregam spinosa (Thunb.) Tirveng.	TS	Apr–Dec		
	Chassalia curviflora var. *ophioxyloides* (Wall.) Deb & B.Krishna	TS	Jul–Feb		
	Dentella repens (L.) J.R.Forst. & G.Forst. var. *repens*	SC	Mar–Apr		LC
	Discospermum sphaerocarpum Dalzell ex Hook.f.	TS	Apr–Jun	WG & SL	
	Ixora brachiata Roxb.	TS	Jan–May	WG	
	I. coccinea L.	TS	Jan–Dec	PI & SL	
	I. javanica (Blume) DC.	SC	Nov–Jul		
	I. malabarica (Dennst.) Mabb.	TS	Oct–Mar	SWG	VU
	Mitracarpus hirtus (L.) DC.	SC	Jul–Dec		
	Mitragyna parvifolia (Roxb.) Korth.	TS	Mar–Dec		
	Morinda citrifolia L.	TS	Jul–Nov		
	M. pubescens J.E.Smith	TS	Mar–Jun		
	Mussaenda frondosa L.	TS	Sep–Mar	PI	
	Neanotis rheedei (Wall. ex Wight & Arn.) W.H. Lewis	RC	Sep–Dec	WG	
	N. subtilis (Miq.) Govaerts ex Punekar & Lakshmin.	RC/SC	Aug–Dec	SI	
	Oldenlandia auricularia (L.) K.Schum.	TS	Oct–Dec		
	O. corymbosa L. var. *corymbosa*	SC	Apr–Sep		
	O. herbacea (L.) Roxb.	RC/SC	Jul–Dec		
	Pavetta indica L. var. *indica*	TS	Apr–Jul		
	Spermacoce articularis L.f.	SC	Oct–Dec		
	S. latifolia Aubl.	SC	Aug–Oct		
	S. ocymoides Burm.f.	SC	Nov–Dec		
	S. pusilla Wall.	SC	Oct–Nov		
GENTIANACEAE	*Canscora pauciflora* Dalzell	SC	Jul–Nov	WG	
	Canscorinella stricta (Sedgw.) Nampy & Shahina	RC	Aug–Feb	SI	
	Hoppea fastigiata (Griseb.) C.B.Clarke	SC	Sep–Oct		LC
LOGANIACEAE	*Mitrasacme indica* Wight	SC	Sep–Oct		
	M. pygmaea var. *malaccensis* (Wight) Hara	SC	Jun–Aug		
	Strychnos minor Dennst.	TS	Sep–Oct		
	S. nux–vomica L.	TS	Mar–Dec		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
APOCYNACEAE Rauvolfioideae	*Alstonia scholaris* (L.) R.Br.	TS	Oct–Feb		LC
	Catharanthus pusillus (Murray) G.Don	SC	Apr–Oct	I & SL	
	Kamettia caryophyllata (Roxb.) Nicolson & C.R.Suresh	TS	Sep–Jan	SWG	
	Plumeria rubra L.	TS	Nov–Apr		
	Rauvolfia serpentina (L.) Benth. ex Kurz	TS	Apr–Oct		
	Tabernaemontana alternifolia L.	TS	Apr–Oct	SWG	
	T. divaricata (L.) R.Br. ex Roem. & Schult.	SC	Jan–Dec		
Apocynoideae	*Aganosma cymosa* (Roxb.) G.Don	TS	Apr–Dec	PI & SL	
	Holarrhena pubescens (Buch.–Ham.) Wall. ex G. Don	TS	Apr–Oct		LC
	Ichnocarpus frutescens (L.) W.T.Aiton	TS	Aug–Mar		
	Wrightia tinctoria (Roxb.) R.Br.	TS	Feb–Nov		
Periplocoideae	*Gymnema sylvestre* Roem. & Schult.	TS	Mar–Aug		
	Cryptolepis buchananii (Retz.) R.Br. ex Sm.	TS/SC	Jul–Jan	PI & SL	
	Hemidesmus indicus (L.) R.Br.	TS	Aug–Dec	I & SL	
Asclepiadoideae	*Calotropis gigantea* (L.) W.T.Aiton	SC	Jan–Dec		
	Cosmostigma racemosum (Roxb.) Wight	TS	Apr–Jun		
	Holostemma ada-kodien Schult.	SC	Sep–Nov		
	Tylophora capparidifolia Wight & Arn.	TS	Mar–Jun	SWG	
	T. indica (Burm.f.) Merr. var. *indica*	TS	Feb–Jul		
	Wattakaka volubilis (L.f.) Stapf	TS	Mar–Jul		
BORAGINACEAE	*Coldenia procumbens* L.	SC	Mar–May		
	Cordia obliqua Willd.	TS	Mar–Aug		
	Heliotropium keralense Sivar. & Manilal	SC	Mar–May	SWG	
	H. marifolium Retz.	RC/SC	Apr–Aug	PI & SL	
CONVOLVULACEAE	*Argyreia nervosa* (Burm.f.) Bojer	TS	Dec–Jun		
	Bonamia semidigyna (Roxb.) Hallier f.	TS	Nov–Mar		
	Erycibe paniculata Roxb.	TS	Nov–Mar		
	Evolvulus alsinoides (L.) L. var. *alsinoides*	RC/SC	Mar–Aug		
	E. nummularius (L.) L.	SC	Jan–Dec		
	Ipomoea hederifolia L.	TS	Oct–Dec		
	I. marginata (Desr.) Manitz f. *marginata*	TS/SC	Dec–Mar		
	I. mauritiana Jacq.	TS	Aug–Sep		
	I. nil (L.) Roth	TS	Nov–Jan		
	I. obscura (L.) Ker Gawl.	TS	Oct–Mar		
	I. pes-caprae (L.) R.Br. subsp. *pes-caprae*	SC	Nov–Mar		
	I. quamoclit L.	SC	Oct–Dec		
	I. triloba L.	TS	Sep–Mar		
	Merremia umbellata (L.) Hallier f.	TS	Jan–Apr		
	M. vitifolia (Burm.f.) Hallier f.	TS/SC	Nov–Feb		
	Neuropeltis malabarica Ooststr.	TS	Nov–Mar	SWG (K)	
	Xenostegia tridentata subsp. *hastata* (Desr.) Panigrahi & Murti	TS/SC	Sep–Mar		
	X. tridentata (L.) D.F.Austin & Staples subsp. *tridentata*	RC/SC	Nov–Jan		
SOLANACEAE	*Datura stramonium* L.	SC	Jul–Sep		
	Physalis angulata L.	SC	Jul–Dec		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	Solanum americanum Mill.	SC	Mar–Nov		
	S. melongena var. *insanum* Prain	TS	Aug–Mar		
	S. torvum Sw.	SC	Jul–Mar		
HYDROLEACEAE	*Hydrolea zeylanica* (L.) Vahl	SP	Aug–Jan		LC
OLEACEAE	*Jasminum coarctatum* Roxb.	TS	Jan–Jun	PI & SL	
	J. flexile Vahl	TS	Oct–Mar	PI & SL	
	J. malabaricum Wight	TS	Mar–Nov	WG	
	Olea dioica Roxb.	TS	Nov–Apr	I	
GESNERIACEAE	*Rhynchoglossum notonianum* (Wall.) B.L. Burtt	TS	Jul–Dec	SWI & SL	
PLANTAGINACEAE	*Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth.	SP	Aug–Oct		LC
	Limnophila repens (Benth.) Benth.	SC	Jul–Dec		LC
	Microcarpaea minima (K.D.Koenig ex Retz.) Merr.	SC	Aug–Dec		LC
	Scoparia dulcis L.	SC	Jan–Dec		
	Stemodia verticillata (Mill.) Hassl.	SC	May–Sep		
LINDERNIACEAE	*Bonnaya antipoda* (L.) Druce	SC	Aug–Oct		
	B. ciliata (Colsm.) Spreng.	SC	Jun–Oct		
	B. oppositifolia (Retz.) Spreng.	SC	Jul–Oct	PI	
	Lindernia hyssopioides (L.) Haines	SP	Mar–Sep		
	L. madayiparensis Ratheesh, Sunil & Nandakumar	SP	Oct–Dec	SI (K)	
	L. manilaliana Sivar.	SC	Aug–Dec	SI (K)	EN
	L. tamilnadensis M.G.Prasad & Sunojk.	SC	Oct–Mar	SI	
	Torenia crustacea (L.) Cham. & Schltdl.	SC	Aug–Nov		
	T. lindernioides C.J.Saldanha	SC	Jul–Mar	SWG	
	Vandellia micrantha (D.Don) Eb. Fisch.	SC	Jul–Dec		
	V. pusilla (Willd.) Merr.	SC	Aug–Oct		
PEDALIACEAE	*Sesamum indicum* subsp. *malabaricum* (Burm.) Bedigian	SC	Jan–Sep	I	
LAMIACEAE Symphorematoideae	*Symphorema involucratum* Roxb.	TS	Mar–Apr		
Viticoideae	*Gmelina arborea* Roxb.	TS	Jan–Jun		
	Premna serratifolia L.	TS	May–Nov		
	Vitex altissima L.f.	TS	Mar–Jul		
	V. negundo L.	SC	Feb–Jul		
	V. trifolia L.	SC	May–Jul		
Ajugoideae	*Clerodendrum calamitosum* L.	SC	Jan–Dec		
	C. indicum (L.) Kuntze	SC	Sep–Dec		
	C. infortunatum L.	TS	Dec–Feb		
	C. paniculatum L.	SC	Jul–Dec		
	Rotheca serrata (L.) Steane & Mabb.	TS	Aug–Dec		
Lamioideae	*Leucas lavandulifolia* Sm.	SC	Jul–Oct		
	Pogostemon deccanensis (Panigrahi) Press	SP	Sep–Dec	SI	
	P. paniculatus (Willd.) Benth.	TS	Oct–Feb		
	P. quadrifolius (Benth.) F.Muell.	SC	Aug–Dec	I	DD
Nepetoideae	*Anisochilus carnosus* (L.f.) Wall.	RC	Sep–Dec		
	Hyptis suaveolens (L.) Poit.	SC/TS	Aug–Feb		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	Ocimum tenuiflorum L.	SC	Jan–Dec		
Lamiaceae: Incertae sedis	*Tectona grandis* L.f.	TS	May–Jan		
OROBANCHACEAE	*Aeginetia indica* L.	TS	Aug–Sep		
	Centranthera nepalensis D.Don	SC	Sep–Dec	SI	
	C. tranquebarica (Spreng.) Merr.	SC	Sep–Nov		LC
	Parasopubia hofmannii Pradeep & Pramod var. *hofmannii*	RC/SC	Jun–Oct	SI	
	P. hofmannii var. *albiflora* Pradeep & Pramod	RC/SC	Jun–Oct	SI	
	Rhamphicarpa longiflora (Arn.) Benth.	SC/SP	Aug–Nov	I	
	Striga angustifolia (D.Don) C.J.Saldanha	SC	Aug–Dec		
	S. asiatica (L.) Kuntze	SC	Jul–Sep		
	S. gesnerioides (Willd.) Vatke	SC	Aug–Nov		
LENTIBULARIACEAE	*Utricularia aurea* Lour.	SP	Aug–Dec		LC
	U. cecilii P.Taylor	SP	Aug–Oct	WG	EN
	U. graminifolia Vahl	SP	Aug–Oct		LC
	U. lazulina P.Taylor	SC	Aug–Oct	WG	LC
	U. uliginosa Vahl	SC	Aug–Nov		
ACANTHACEAE	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	SC/TS	Mar–Dec	PI & SL	
	Asystasia dalzelliana Santapau	TS	Sep–Jan		
	A. gangetica (L.) T.Anderson subsp. *gangetica*	TS	Sep–Mar		
	Barleria courtallica Nees	TS	Dec–May	I & SL	
	B. prionitis L. subsp. *prionitis*	SC	Aug–Mar		
	Crossandra infundibuliformis (L.) Nees	SC	Dec–Mar	I & SL	
	Dicliptera paniculata (Forssk.) I.Darbysh.	TS	Dec–Feb		
	Ecbolium viride (Forssk.) Alston var. *viride*	TS	Nov–Feb		
	Eranthemum capense L.	TS	Jan–Mar	PI & SL	
	Haplanthodes neilgherryensis (Wight) R.B.Majumdar	SC/TS	Jan–Mar	WG	
	Hygrophila ringens (L.) Steud.	SC	Oct–Mar		
	Justicia adhatoda L.	SC	Jan–Dec		
	J. ekakusuma Pradeep & Sivar.	RC/SC	Aug–Sep	SI (K)	
	J. japonica Thunb.	SC	Aug–Feb		
	J. nagpurensis V.A.W.Graham	SC/RC	May–Nov	SWI	
	Lepidagathis cuspidata Nees	SC	Feb–Jun	I	
	L. incurva Buch.-Ham. ex D.Don var. *incurva*	TS	Feb–Apr		
	L. keralensis Madhus. & N.P.Singh	RC/SC	Dec–Apr	SI (K)	
	Phaulopsis imbricata (Forssk.) Sweet	SC/TS	Nov–Mar		LC
	Pseuderanthemum malabaricum (C.B.Clarke) Gamble	TS	Dec–Mar	PI & SL	
	Ruellia prostrata Poir.	TS	Oct–Apr	I	
	Rungia pectinata (L.) Nees	SC/TS	Nov–Feb		
	Strobilanthes integrifolia (Dalzell) Kuntze	TS	Dec–Mar	WG	
	Thunbergia erecta (Benth.) T.Anderson	TS	Jan–Dec		
BIGNONIACEAE	*Millingtonia hortensis* L.f.	TS	Mar–Aug		
	Pajanelia longifolia (Willd.) K.Schum.	TS	Jan–Jun		

Family	Taxa	Microhabitat	Flowering	Endemism	IUCN RL Status
	Stereospermum tetragonum DC.	TS	Feb–Oct		
VERBENACEAE	*Lantana camara* L.	TS	Apr–Jun		
	Phyla nodiflora (L.) Greene	SC	Nov–Dec		LC
	Stachytarpheta jamaicensis (L.) Vahl	SC/TS	Jun–Dec		
CAMPANULACEAE	*Lobelia alsinoides* Lam.	SC	Aug–Oct		LC
MENYANTHACEAE	*Nymphoides indica* (L.) Kuntze	SP	Jan–Dec		LC
	N. krishnakesara K.T.Joseph & Sivar.	SP	Aug–Nov	SWG (K)	EN
ASTERACEAE	*Acanthospermum hispidum* DC.	SC	Jan–Jun		
	Acmella ciliata (Kunth) Cass.	SC	Aug–Sep		
	A. radicans (Jacq.) R.K.Jansen	SC	Oct–Mar		
	Ageratum conyzoides L.	SC	Aug–Dec		
	Blumea axillaris (Lam.) DC.	SC/TS	Jan–Nov		
	B. barbata DC.	SC/TS	Dec–Mar	SI & SL	
	B. oxyodonta DC.	SC	Oct–May		
	Centratherum punctatum Cass.	SC	Aug–Jan		
	Chromolaena odorata (L.) R.M.King & H.Rob.	TS	Nov–May		
	Conyza stricta Willd.	SC	Sep–Oct		
	Cosmos caudatus Kunth	SC	Aug–Feb		
	C. sulphureus Cav.	SC	Feb–Nov		
	Crassocephalum crepidioides (Benth.) S.Moore	SC	Aug–Dec		
	Cyanthillium cinereum (L.) H.Rob.	SC/TS	Jan–Dec		
	Eclipta prostrata (L.) L.	SC	Jan–Dec		DD
	Elephantopus scaber L.	SC/TS	Oct–Jan		
	Emilia sonchifolia (L.) DC.	SC	Jul–Dec		
	Epaltes divaricata (L.) Cass.	SC	Dec–Apr		LC
	Grangea maderaspatana (L.) Poir.	SC	Mar–Jul		LC
	Mikania micrantha Kunth	TS	Feb–Apr		
	Sphagneticola trilobata (L.) Pruski	SC	May–Sep		
	Synedrella nodiflora (L.) Gaertn.	SC/TS	Jan–Dec		
	Tithonia diversifolia (Hemsl.) A.Gray	SC	Sep–May		
	Tricholepis amplexicaulis C.B.Clarke	SC	Oct–Feb	WG	
	Tridax procumbens L.	SC	Jan–Dec		
APIACEAE	*Pimpinella heyneana* (DC.) Benth.	SC	Oct–Feb		

Microhabitat: RC—Exposed rock surfaces and crevices | SC—Soil covered areas and grassy plains and slopes | SP—Seasonal ponds and small ephemeral pools | TS—Tree cover and scrub patches.
Endemism: C&PI—central and peninsular India | I—India | K—Kerala | PI—Peninsular India | SI—southern India | SL—Sri Lanka | SWG—southern Western Ghats | SWI—southwestern India | WG—Western Ghats.
IUCN Status: CR—Critically Endangered | DD—Data Deficient | EN—Endangered | LC—Least Concerned | NT—Near Threatened | VU—Vulnerable | Blank—not assessed.

Image 3. Recent discoveries from southern Indian lateric plateaus: A—*Justicia ekakusuma* | B—*Lepidagathis keralensis* | C—*Ceropegia nampyana* | D—*Eriocaulon gopalakrishnanum* | E—*Eriocaulon kannurense* | F—*Eriocaulon madayiparense* | G—*Euphorbia deccanensis* | H—*Canscorinella bhatiana* | I—*Lindernia madayiparensis*. © Pramod C.

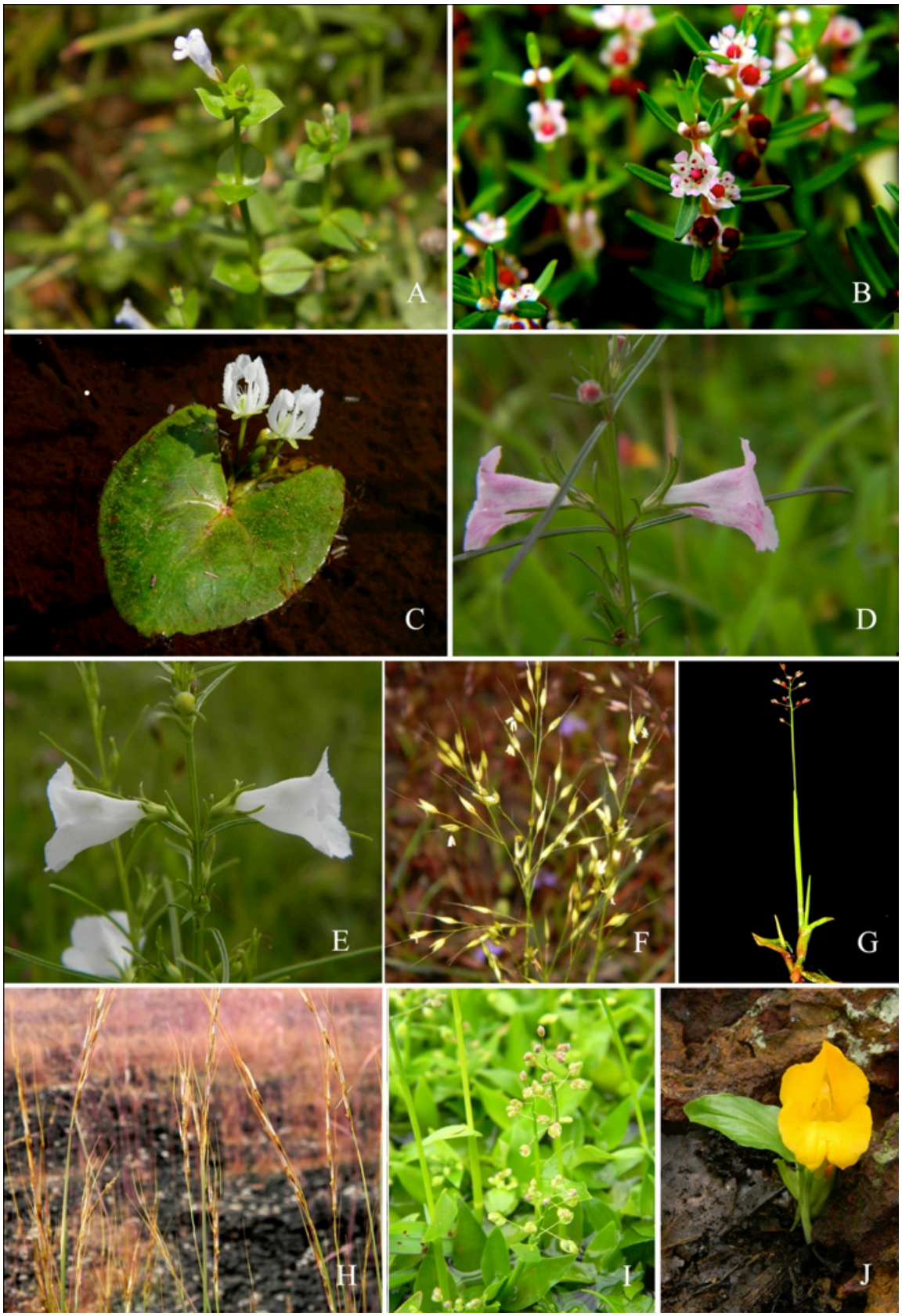

Image 4. Recent discoveries from southern Indian lateric plateaus: A—*Lindernia tamilnadensis* | B—*Rotala malabarica* | C—*Nymphoides krishnakesara* | D—*Parasopubia hofmannii* | E—*Parasopubia hofmannii* var. *albiflora* | F—*Arundinella cannanorica* | G—*Coelachne madayensis* | H—*Chrysopogon tadulingamii* | I—*Isachne veldkampii* | J—*Curcuma cannanorensis.* © Pramod C.

Table 2. List of novel taxa described from Madayippara Lateritic Plateau

	Taxa	Family	Year of Publication	Reference
1	*Rotala malabarica*	Lythraceae	1990	Pradeep, A.K., K.T. Joseph & V.V. Sivarajan, *Botanical Bulletin of Academia Sinica* 31: 59–61.
2	*Nymphoides krishnakesara*	Menyanthaceae	1990	Joseph, K.T. & V.V. Sivarajan, *Nordic Journal of Botany* 10(3): 281–284.
3	*Justicia ekakusuma*	Acanthaceae	1991	Pradeep, A.K. & V.V. Sivarajan, *Rheedea* 1(1&2): 40–43.
4	*Lepidagathis keralensis*	Acanthaceae	1992	Madhusoodanan, P.V. & N.P. Singh, *Kew Bulletin* 47(2): 301–303.
5	*Eriocaulon madayiparense*	Eriocaulaceae	2012	Swapna, M.M., K.P. Rajesh, C.N. Manju & R. Prakashkumar, *Phytokeys* 10: 19–23.
6	*Coelachne madayensis*	Poaceae	2012	Pramod, C., A.K. Pradeep & J.F. Veldkamp, *Gardens' Bulletin Singapore* 64(2): 289–292.
7	*Parasopubia hofmannii*	Orobanchaceae	2013	Pradeep, A.K. & C. Pramod, *Candollea* 68(1): 115–122.
8	*Parasopubia hofmannii* var. *albiflora*	Orobanchaceae	2013	Pradeep, A.K. & C. Pramod, *Candollea* 68(1): 115–122.
9	*Fimbristylis pokkudaniana*	Cyperaceae	2016	Sunil, C.N., M.K. Ratheesh Narayanan, M. Sivadasan, V.V. Naveenkumar, A.H. Alfarhan, V. Abdul Jaleel & M.H. Sameh, *Botany Letters* 164 (1): 19–22.
10	*Chrysopogon narayaniae*	Poaceae	2017	Sunil, C.N., M.K. Ratheesh Narayanan, M. Sivadasan, T. Shaju, V.V. Naveen Kumar & A.H. Alfarhan, *Phytotaxa* 307(4): 245–253.

Table 3. Number of species, endemics and threatened species in different microhabitats.

Microhabitat	Number of species recorded	Number of endemic species	Percentage of endemic species	Number of threatened species	Percentage of threatened species
Exposed rock surfaces and crevices (RC)	40	25	63%	1	3%
Seasonal ponds and small ephemeral pools (SP)	47	20	43%	5	11%
Soil covered areas and grassy plains and slopes (SC)	297	56	19%	3	1%
Tree cover and scrub patches (TS)	308	86	28%	5	2%

Euphorbia deccanensis grows with its roots firmly attached to the humus-rich small cavities and fissures of laterite rocks and species of *Utricularia* in seasonal pools or shallow soil areas with high moisture content. The high diversity and endemism of the plateaus is attributted to be a general phenomenon and is explained in different plateaus in the Western Ghats region by various authors (Joshi & Janarthanam 2004; Porembski & Watve 2005; Bhattarai et al. 2012; Lekhak & Yadav 2012). Of the 10 taxa described from the study area by different authors, five species, viz., *Rotala malabarica*, *Justicia ekakusuma*, *Fimbristylis pokkudaniana*, *Coelachne madayensis*, and *Chrysopogon narayaniae* are endemic to this plateau.

The microhabitats, viz., soil covered areas and grassy plains and slopes (SC) and tree cover and scrub patches (TS) hold largest numbers of species and endemics, since they occupy bulk of the total habitat with favorable environmental conditions. Though the number of species including endemics are comparatively less in the other two microhabitats, viz., exposed rock surfaces and crevices (RC) and seasonal ponds and small ephemeral pools (SP), their percentage of endemics is very high (Table 3).

Out of the available 120 species, as per IUCN ver. 3 (IUCN 2012), a total of 14 species falls under different IUCN threat categories. Seven species, viz., *Dimeria hohenackeri*, *Limnopoa meeboldii*, *Syzygium caryophyllatum*, *Hopea ponga*, *Lindernia manilaliana*, *Utricularia cecilii*, and *Nymphoides krishnakesara* are endangered. The species *Eriocaulon kolhapurense*, *Pterocarpus marsupium*, *Santalum album*, and *Ixora malabarica* are Vulnerable. The species *Isachne veldkampii* and *Rotala malabarica* are Critically Endangered and the species *Nothopegia heyneana* is Near Threatened. Most of the endemic species occurring on the plateau are not yet assessed for the conservation status, many of which are narrow endemics.

Threats and Conservation

The highly specialized habitats and rare biodiversity of the coastal lateritic plateaus and hills, parallel to the Western Ghats, have been neglected by scientists and policymakers, until recently. The laterite biodiversity is an unexplored treasure that is being endangered due

Image 5. Various threats to the microhabitats of Madayippara: A—mining for clay | B—construction work | C—tourism | D—summer fire | E—exotic weeds | F—grazing | G—waste dumping | H—land filling. © Pramod C.

to a multitude of anthropogenic activities. The lateritic plateus of northern Kerala, together with their rich flora and microhabitats are subjected to varied types of pressures such as large scale clay and brick mining, construction works, land filling, seasonal fire, tourism, waste dumping, together with biotic pressures such as invasion of exotic weeds and grazing. As pointed out by Muraleedharan (2011), degradation of lateritic plateaus results in the simultaneous destruction of atleast three ecosystems: lateritic plateaus, valleys and wetlands, which may eventually adversely affect ground water availability.

The discovery of many plant species and high degree of endemism made Madayippara lateritic plateau a 'micro hot spot' for conservation. The conservation efforts in the southern Western Ghats region are mostly restricted to the forested areas, totally neglecting the biodiversity rich lateritic plateaus. The rich biodiversity together with the threats associated with the area (Image 5) demands the need for conserving the area on a war footing. Priority of conservation should be given to endemic species which are short-lived and habitat specific; otherwise, they will be lost forever. The high conservation value of lateritic plateus of southwestern India has been already recognized (Watve & Thakur 2006; Lekhak & Yadav 2012; Bhattarai et al. 2012; Watve 2013). The open areas with herbaceous vegetation and grasses are of importance to bird populations including a large number of rare and migratory species, as they provide better visibility for being vigilant to predators and free movement for food gathering (Desai & Shanbhag 2012). Few afforestation efforts, that are in progress in the plateau are to be discouraged, as the tree species might affect the native herbaceous species because of their dense canopy and allelopathic effect.

The present study recommends conservation of this plateau and similar habitats of northern Kerala, in a similar way as proposed by Chandran et al. (2012), to declare Bhatkal and Mugali laterite plateaus of Uttara Kannada of Karnataka State under 'Conservation Reserves'. The Government should formulate strict rules for the restriction of mining and construction activities in the laterite areas. There is a need to create greater awareness of the importance of laterite hills and their biodiversity among the local community, tourists and policy and decision makers. Extensive floristic studies in similar habitats of northern Kerala are very likely to yield many more new and interesting species.

CONCLUSION

Lateritic plateaus are unique due to the nature of substratum and the extreme environmental conditions. Various microhabitats support a rich floral diversity with a large number of rare and endemic species. Though Madayippara represents an area of less than 0.01% of the total area documented in the Flora of Cannanore District, it harbors about 59% represented in the district flora. The species richness of this area is contributed by the presence of many specialized microhabitats and associated flora. Various microclimatic conditions play a collective role in the development of a particular plant community in a microhabitat. Madayippara lateritic plateau, which is the type locality of 10 taxa, and home for many endemic and threatened species, is highly threatened and urgent measures are to be taken for its conservation. Any slight disturbance in the micro ecosystems can easily take away a number of short-lived herbaceous species which cannot be easily conserved outside its natural habitat. For the conservation of the rich diversity and microhabitats of the plateau, in situ conservation of the entire habitat is the only answer as ex situ conservation measures cannot provide complex microclimatic requirements artificially.

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