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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 3.65 km², 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.
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.

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 3.65km², between 12.01–12.05 ºN and 75.23–75.27 ºE, 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
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 sub-tending 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
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 *Geissasps cristata*, *G. tenella*, *Isachne veldkampii*, *Murdannia ochracea*, *M. semiteres*, *Rotala malabarica*, *R. malampuzhensis*, *Schoenoplectiellia articulata*, *S. lateriflora*, *Blyxa aubertii*, *B. octandra*, *Nymphoides krishnakaresa*, *Echinochloa colona*, *Glypchohloa acumina*, *Utricularia cecili*, *U. graminifolia*, *Drosera indica*, *Fimbriystylis tenera*, *F. aestivalis*, *F. ferruginea*, *Ericaulon cuspidatum*, *E. reductum*, *E. eurypeplon*, *Coelachne madayensis*, *Neonotis subtilis*, *Dopatrium junceum*, *Oryza rufipogon*, *Rhizophorcarpa longiflora*, *Wiesneria triandra*, *Hydrilla verticillata*, *Monochoria vaginalis*, and *Lindernia hyssopoides*. 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
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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 0.005km² 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 (3.65km²), 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 madayiparense (Ratheesh Narayanan et al., 2012), Coelachne madayensis (Pramod et al. 2012), Parasopubia hofmannii (Pradeep & Pramod, 2013), Parasopubia hofmannii var. albiflora (Pradeep & Pramod, 2013), Fimbriystis 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 taminodensis 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 harbor 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.                         | Aug–Jan      |           |          |                |
| ARISTOLOCHIACEAE     | Aristolochia indica L.               | TS           | Jul–Mar   |          |                |
| MAGNOLIACEAE         | Magnolia champaca (L.) Baill. ex Pierre | TS           | Mar–Jul   |          |                |
| ANNONACEAE           | Mililua tomentosa (Roxb.) Finet & Gagnep. | TS           | Oct–May   | SI & SL  |                |
|                      | Polyalthia korinti (Dunal) Thwaites   | TS           | Apr–Jun   | SI & SL  |                |
|                      | Uvaria narum (Dunal) Blume           | Nov–Jun      | SI & SL   |          |                |
| LAURACEAE            | Alseodaphne semecarpifolia var. semecarpifolia | TS           | Feb–Apr   | PI & SL  |                |
|                      | Cinnamomum verum J.Presl             | TS           | Mar–Apr   | SWI & SL |                |
|                      | Litsea deccanensis Gamble            | Nov–Dec      | SI & SL   |          |                |
|                      | L. glutinosa (Lour.) C.B.Rob.         | Apr–May      |           |          |                |
| ARAEAE               | Amorphophallus hohenackeri (Schott) Engl. & Gehrm. | TS           | Jun–Aug   | WG       |                |
|                      | A. paeonifolius (Dennst.) Nicolson   | May–Jun     | LC        |          |                |
|                      | Ariopsis peltato Nimmo                | Jun–Aug     |           |          |                |
|                      | Arisaeum neglectum Schott            | Apr–Jul     | WG        |          |                |
|                      | Caladium bicolor (Aiton) Vent.       | Dec–Jan     |           |          |                |
|                      | Colocasia esculenta (L.) Schott      | May–Oct     | LC        |          |                |
|                      | Cryptoocoryne spiralis (Retz.) Fisch. ex Wydler | SC           | Oct–Apr   | I        |                |
|                      | Pista stratiotes L.                  | Oct–Mar     | LC        |          |                |
|                      | Pothos scandens L.                   | Oct–Nov     |           |          |                |
|                      | Rhaphidophora pertusa (Roxb.) Schott | Aug–Sep     | I & SL    |          |                |
|                      | Theriophanum infasatum N.E.Br.       | Jul–Sep     | SWG       |          |                |
| ALISMATACEAE         | Wiesneria triandra (Dalzell) Micheli | SP           | Aug–Nov   | PI       | LC             |
| HYDROCHARITACEAE     | Blyxa auberti Rich.                  | SP           | Jun–Sept  | 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.               | Sep–Oct     |           |          |                |
|                      | D. pentaphylla L.                    | Sep–Dec     |           |          |                |
| SMILACACEAE          | Smilax zeylanica L.                  | TS           | Oct–Nov   | LC       |                |
| 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 diphylia (Nimmo) Dalzell   | Sep–Nov     |           |          |                |
| HYPOXIDACEAE         | Curculigo orchidoides Gaertn.         | SC           | Jun–Dec   |          |                |
| AMARYLLIDACEAE       | Crinum viiparum (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     |          |                |
|               | *Cyanotheca* (L.) D.Oon 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* Wild.           | SC           | Aug–Oct     | LC       |                |
| ERIOCALUCAEE  | *Eriocaulon c.spodatum* Dalzell    | SP           | Aug–Jan     | WG       | LC             |
|               | *E. euryeplon* Körn.              | SP           | Jul–Dec     | PI       | LC             |
|               | *E. goaolakrisnaum* K.Rashmi & G. Krishnak. | SC | Aug–Dec     | SI (K)   |                |
|               | *E. kollapurense* 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. iir L.*                        | SC           | Nov–Dec     | LC       |                |
|               | *C. javanicus* Hoult.              | 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     |          |                |
|               | *Eleochoris 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. dipsacace* (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       |                |                |
|            | Furena ciliaris (L.) Roxb.                    | SC           | Oct–Mar       |                | LC             |
|            | Kyllinga brevifolia Rottb. var. brevifolia    | SC           | Jul–Nov       |                | LC             |
|            | K. brevifolia var. stellulata (Valck.Sur.)    | SC           | Jul–Nov       |                | LC             |
|            | K. bulbosa P.Beauv.                           | SC           | Jun–Dec       |                | LC             |
|            | Lipocarpha squarrosa (L.) Goetgh.             | SC           | Aug–Dec       |                |                |
|            | Pycrusus 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             |
|            | Schoenoplectus lithosperma (L.) Sw. var.      | TS           | Jan–Dec       |                |                |
|            | Schroederiella squarrosa (L.) Goetgh.         | SC           | Aug–Dec       |                |                |
| POACEAE    | Alloteropsis cimicina (L.) Stapf              | SC           | Jul–Nov       |                |                |
|            | Apocopsis mangalorensis (Hochst. ex Steud.) Henrard | SC       | Oct–Feb       | PI             |                |
|            | Arundinella cannanarica 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 (Staud.) A.Camus       | SC           | Oct–Nov       |                |                |
|            | Chloris barbata Sw.                           | SC           | Mar–Dec       |                |                |
|            | Chrysopogon narayanae 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       |                |                |
|            | Cyndodon dactylon (L.) Pers.                  | SC           | Mar–Oct       |                |                |
|            | Cyrtococcum trigonum (Retz.) A.Camus          | SC           | Sep–Oct       |                |                |
|            | Dactylolentum 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             |                |

*Endemism Codes: SWG (K) = Statewide or Kerala, SI = State, PI = Province/Indian, I = Threatened, SL = Vulnerable, LC = Lower Risk*
| Family         | Taxa                                      | Microhabitat | Flowering   | Endemism | IUCN RL Status |
|---------------|-------------------------------------------|--------------|-------------|----------|----------------|
|              | *D. thwaitesii* Hack. in A.DC. & C.DC.    | SC/RC        | Sep–Dec     | I & SL   |                |
|              | *Echinochloa colonia* (L.) Link            | SP           | Jan–Dec     | LC       |                |
|              | *Eleusine indica* (L.) Gaertn.             | SC           | Jan–Dec     | LC       |                |
|              | *Eragrostis amabilis* (L.) Wight & Arn.   | SC           | Jul–Nov     |          |                |
|              | *E. atrovirens* (Desf.) Trin. ex Steud.   | SC           | Jan–Dec     |          |                |
|              | *E. gangetica* (Roxb.) Steud.             | SC           | Jun–Dec     | LC       |                |
|              | *E. unioloides* (Retz.) Nees ex Steud.    | SC           | Jan–Dec     | LC       |                |
|              | *Eulalia trispicata* (Schult.) Henrard    | SC           | Oct–Mar     |          |                |
|              | *Glypnochloa acuminata* (Hack.) Clayton   | SC/SP/RC     | Oct–Feb     | PI       |                |
|              | *G. acuminata* var. *woodrowii* (Bor)     | RC           | Oct–Dec     | SI       |                |
|              | *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult. | SC | Oct–Dec |          |                |
|              | *Isachne globosa* (Thunb.) Kurzze         | SC           | Jan–Dec     | LC       |                |
|              | *I. miliaecea* Roth                        | SC           | Jan–Dec     |          |                |
|              | *I. velildampii* K.G.Bhat & Nagendran     | SP           | Aug–Oct     | SI       | CR             |
|              | *Ischaemum barbatum* Retz.                | SP           | Oct–Jan     |          |                |
|              | *I. cannanorense* Sreek., V.I.Nair & N.C.Nair | RC  | Sep–Dec     | SI (K)   |                |
|              | *I. ciliare* Retz.                        | SC           | Oct–Nov     |          |                |
|              | *I. keralense* Sreek., V.I.Nair & N.C.Nair| SC           | Oct–Dec     | SWG (K)  |                |
|              | *I. lanatum* Ravi, N.Mohanani & Shaju     | TS           | Oct–Jan     | SWG (K)  |                |
|              | *I. rangocharianum* C.E.C.Fisch.          | SP           | Sep–Dec     | SI & SL  |                |
|              | *Limnoana meeboldii* (C.E.C.Fisch.)       | SP           | Sep–Nov     | SI (K)   | EN             |
|              | *Melinis repens* (Wild.) Ziska             | SC           | Mar–Aug     |          |                |
|              | *Oplismenus burmannii* (Retz.) P.Beauv.   | TS           | Sep–Nov     |          |                |
|              | *Oryza rufipogon* Griff.                  | SP           | Sep–Mar     | LC       |                |
|              | *O. sativa* L.                           | SC           | Sep–Jun     | LC       |                |
|              | *Panicum repens* L.                       | SC           | Jul–Sep     | LC       |                |
|              | *Paspalidium geminatum* (Forsk.) 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     |          |                |
|              | *Pseudanthistrum umbellata* (Hack.) Hook.f. | TS  | Nov–Dec     | PI & SL  |                |
|              | *Saccilepis interrupta* (Wild.) 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* Forsk.                 | SC           | Oct–Jan     |          |                |
| MENISPERMACEAE | *Anamirta cacculus* (L.) Wight & Arn.     | TS           | Aug–Dec     |          |                |
|              | *Cyclea petalata* (Lam.) Hook.f. & Thomson| TS | Apr–May     | I & SL   |                |
|              | *Diplocisca glaucescens* (Blume) Diels    | TS           | Mar–Aug     |          |                |
|              | *Tinospora cordifolia* (Wild.) 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. scorbaraeoides (L.) Thouars                                       | SC           | Sep–Jan     | LC       |                |
|                     | Calopogonium mucunoides Desv.                                         | SC           | Aug–Dec     |          |                |
|                     | Convolvulus gladiata (Jacq.) DC.                                      | TS           | Jul–Dec     |          |                |
|                     | Centrosema molle Benth.                                               | TS           | Sep–Jan     |          |                |
|                     | Clitorea ternatea L. var. ternatea                                    | SC           | Jul–Oct     |          |                |
|                     | Crotalaria evolutuloides Wight ex Wight & Arn.                         | SC           | Oct–Feb     | PI & SL  |                |
|                     | C. pallida Alton 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      |                |
|                     | 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       |                |
|                     | Pseuderanthus viscidula (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     |          |                |
| Family                  | Taxa                              | Microhabitat | Flowering   | Endemism | IUCN RL Status |
|------------------------|-----------------------------------|--------------|-------------|----------|----------------|
| S. saluginea Hance     | SC/TS                             | Oct–Nov      | PI          |          |                |
| S. sensitiva Aiton     | SC                                | Aug–Dec      |             | LC       |                |
| Stylosanthes frutcosa (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: Caesalpinioidae** |                                |              |             |          |                |
| 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. nictiann 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 Bentham. | TS                         | Jan–Dec      | LC         |          |                |
| A. caesia (L.) Willd.  | TS                                | Oct–Dec      | LC         |          |                |
| A. mangium Willd.      |TS                                | Jul–Feb      |             |          |                |
| A. pennato (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      | 1 & SL  | LC        |                |
| Leucaena leucocephala (Lam.) de Wit | TS                        | Nov–Apr      |             |          |                |
| Mimosa diplatricha C.Wight ex Sauvalle var. diplatricho | SC                     | Nov–Mar      |             |          |                |
| M. puding L.           | SC                                | Jul–Jan      | LC         |          |                |
| **POLYGALACEAE**       | Polygala elongata Klein ex Willd. | SC/RC        | Jul–Jan     | 1 & SL  |                |
| **RHAMNACEAE**         | Salomonia ciliata (L.) DC.        | SC           | Oct–Dec     |          |                |
| Ziziphus mauritiana Lam. | TS                              | Feb–Jul      |             |          |                |
| Z. oenopota (L.) Mill. |TS                                | Nov–Mar      |             |          |                |
| Z. rugosa Lam.         |TS                                | Nov–May      |             |          |                |
| **ULMACEAE**           | Holoptelea integrifolia (Roxb.) Planch. | TS       | Dec–Mar     |          |                |
| **CANNABACEAE**        | Celtis timoresiensis Span.        | TS           | Jan–Mar     |          |                |
| Trema orientalis (L.) Blume | TS                              | Sep–Dec      |             |          |                |
| **MORACEAE**           | Artocarpus heterophyllus Lam.     | TS           | Nov–Apr     |          |                |
| Ficus arnottiana (Miq.) | TS                               | Dec–Apr      | 1 & SL     |          |                |
| F. benghalensis L. var. benghalensis | TS                          | May–Aug      | 1          |          |                |
| Family           | Taxa                                                   | Microhabitat | Flowering  | Endemism | IUCN RL Status |
|------------------|--------------------------------------------------------|--------------|------------|----------|----------------|
| F. callosa Wild. | 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. tinctora 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  |                |
| Curcus sativus f. hardwickii (Royle) W.J.de Wilde & Duyfjes | TS     | Nov–May    |          |          |                |
| Diplcyclos palmatus (L.) C.Jeffrey | TS                                   | Nov–Jan     |          |          |                |
| Muskia 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      | Connaruss paniculatus Roxb.                           | TS           | Oct–May    |          |                |
| Rourea minor (Gaertn.) Alston | TS   | Dec–Aug    |            |          |                |
| OXALIDACEAE      | Biophytum reinwardii (Zucc.) Klotzsch.                | SC           | Jul–Dec    |          |                |
| RHIZOPHORACEAE   | Carallia brachiata (Lour.) Merr.                      | TS           | Oct–Apr    |          |                |
| EUPHORBIACEAE    | Agrostistachys indica Dalzell                         | TS           | Feb–Mar    | C & PI   |                |
| Croton cuspidatus Geiseler | TS | Mar–May |            |          |                |
| Euphorbia decanensis 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. thymaloides L. | SC                                                     | Apr–Aug      |            |          |                |
| Falconeria insignis Royle | TS   | Jan–Feb |            |          |                |
| Jatropha gossypifolia L. | SC | Jul–Sep |            |          |                |
| Macaranga peltata (Roxb.) Müll.-Arg. | TS | Jan–Feb | I & SL |          |                |
| Mallotus Philippens (Lam.) Müll.-Arg. | TS | Oct–Mar |          |          |                |
| M. repandus (Rottler) Müll.-Arg. | TS | Nov–Jan |          |          |                |
| Micrococa mercurialis (L.) Benth. | SC | Jun–Dec |            |          |                |
| Microstachys chamoeala (L.) Müll.-Arg. | SC | Jul–Dec |          |          |                |
| Tragia involucrata L. | SC/Ts | Jul–Dec | I & SL |          |                |
| OCHNACEAE        | Gongphia serrata (Gaertn.) Kanis                      | TS           | Jan–Dec    |          | LC            |
| PHYLLANTHACEAE   | Antidesma ghaoembilla Gaertn.                         | TS           | Jul–Dec    |          |                |
| Family              | Taxa                                             | Microhabitat | Flowering   | Endemism | IUCN RL Status |
|---------------------|--------------------------------------------------|--------------|-------------|----------|----------------|
| A. montanum        | Blume                                           | TS           | Dec–Apr     |          |                |
| Aporosa cardioplerma (Gaertn.) Merr. | TS | Dec–Jun  | PI & SL     |          |                |
| Breynia viti-idaea (Burm.f.) C.E.C.Fisch. | TS | Feb–Aug  | I & SL      |          |                |
| Briddia retusa (A.Juss.) | TS         | Aug–Dec     |             |          |                |
| B. stipularis (L.) Blume | TS              | Dec–Feb     | PI          |          |                |
| Flueggea leucyurus | Wild.                                           | 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     |          |                |
| Saururus androgynus (L.) Merr. | TS       | Aug–Dec     |             |          |                |
| S. quadrangularis (Willd.) MÜLL.-Arg. | TS | Jan–Dec     |             |          |                |
| MALPIGHIACEAE       | Aspísdópterys canarensis Dalzell | TS           | Feb–May     | WG       |                |
| PASSIFLORACEAE      | Passiflora foetida L. var. foetida | TS           | Jul–Dec     |          |                |
| P. foetida var. hispida | (DC. ex Tríana & Planch.) Killip | TS           | Nov–Mar     |          |                |
| Turneria ulmifolia | L.                                              | TS           | May–Dec     |          |                |
| VIOLACEAE           | Flácoruta indica (Burm.f.) Merr. | TS           | Nov–Mar     |          |                |
| Violáceae           | Hybanthus enneaspermus (L.) F.Muell. | SC          | Jul–Nov     |          |                |
| ACHARIACEAE         | Hydnócorus pentandrosum (Buch.-Ham.) Oken | TS         | Dec–May     | WG       |                |
| LINACEAE            | Hugonia mystax L.                               | TS           | Aug–Oct     | I & SL   |                |
| CLUSIACEAE          | Garçinia gummi-gutta (L.) N.Robson var. | SC/TS       | Jan–Sep     | SI & SL  |                |
| COMBRETACEAE        | Calycópeteris floribunda (Roxb.) Lam. ex Poir. | TS           | Jan–May     |          |                |
| C. indicum | DeFilippis                                      | 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          |          |                |
| LYTHERACEAE         | Ammónnia baccafera L. subsp. baccifera          | SP           | Sep–Dec     | LC       |                |
| Lagerstroemia speciosa (L.) Pers. | TS | Mar–Nov     |             |          |                |
| Lawsonia inermis L. | TS                                               | Dec–May      |             |          |                |
| Rotala indica | (Wild.) Koehne | SP          | Jul–Dec     | LC       |                |
| R. macandra 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          | Ludwígia hyssopifolia (G.Don) Exell | SP/SC         | Aug–Dec     | LC       |                |
| MYRTACEAE           | Syzygium caryophyllatum (L.) Alston | TS           | Feb–Jun     | EN       |                |
| S. cuminí (L.) Skeels | TS         | Dec–Apr     |             |          |                |
| S. jambos (L.) Alston | TS          | Oct–Jan     |             |          |                |
| MELASTOMATACEAE     | Melastoma malabathricum L.                       | TS           | Jan–Dec     |          |                |
| Family          | Taxa                                      | Microhabitat | Flowering   | Endemism | IUCN RL Status |
|-----------------|-------------------------------------------|--------------|-------------|----------|----------------|
| ANACARDIACEAE   | 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             |
| SAPINDACEAE     | Anacardium occidentale L.                  | TS           | Nov–Apr     |          |                |
|                 | Holigarna amottiana Hook.f.               | TS           | Jan–Jul     | SWG      |                |
|                 | Lannea caramandelaica (Hautt.) Merr.      | TS           | Jan–May     |          |                |
|                 | Mangifera indica L.                       | TS           | Jan–May     | DD       |                |
|                 | Nothopegia heyneana (Hook.f.) Gamble      | TS           | May–Jun     | WG       | NT             |
| RUTACEAE        | *Spondias pinnata* (L.f.) Kurz              | TS           | Mar–Dec     |          |                |
|                 | *Allophylus cobbe* (L.) Raesusch.          | TS           | Jul–Nov     |          |                |
|                 | *A. serratus* (Roxb.) Kurz                | TS           | Jul–Oct     | I & SL   |                |
|                 | *Cardiospermum holicocabum* L.             | TS           | Jul–Feb     |          |                |
|                 | *Sapindus trifolius* L.                   | TS           | Dec–Apr     |          |                |
|                 | *Schleichera oleosa* (Lour.) Oken         | TS           | Mar–Jun     |          |                |
| SIMAROUBACEAE   | *Aegle marmelos* (L.) Correa               | TS           | Mar–May     | I & SL   |                |
|                 | *Glycosmis mauritana* (Lam.) Tanaka        | TS           | Oct–May     |          |                |
|                 | *G. pentaphylla* (Retz.) DC.               | TS           | Sep–Apr     |          |                |
| MEIACEAE        | *Melicope lun-ankendo* (Gaertn.) T.G.Hartley | TS           | May–Jul     |          |                |
|                 | *Murraya koenigii* (L.) Spreng.           | TS           | Mar–Jul     |          |                |
|                 | *Zanthoxylum rhetsum* (Roxb.) DC.         | TS           | Mar–Nov     |          |                |
| MALVACEAE       | *Alliaria petiolata* Wight & Arn.          | TS           | Aug–Dec     | LC       |                |
|                 | *Aglaia elaeagnoides* (A.Juss.) Benth.    | TS           | Aug–Sep     |          |                |
|                 | *Azadirachta indica* A.Juss.              | TS           | Sep–Sep     |          |                |
|                 | *Naregamia alata* Wight & Arn.            | SC/TS        | Aug–Dec     | PI       |                |
|                  | *Corchorus aetosans* L.                   | SC           | Aug–Feb     |          |                |
|                  | *Grewia capsularis* L.                    | SC           | Jul–Nov     |          |                |
|                  | *Grewia nervosa* (Laur.) Panigrahi        | TS           | Aug–Apr     |          |                |
|                  | *Triumfetta rhomboidea* Jacq.             | TS/SC        | Aug–Feb     |          |                |
|                  | *Byttneria indica* L.                     | SC           | Jul–Apr     |          |                |
|                  | *Waltheria indica* L.                     | SC           | Oct–Jan     |          |                |
|                  | *Sterculia guttata* Roxb. ex DC.          | TS           | Sep–Mar     |          |                |
|                  | *Pterospermum diversifolium* Blume        | TS           | Dec–Apr     |          |                |
|                  | *P. rubiginosum* B.Heyne ex Wight & Arn.  | TS           | Nov–Apr     | SWG      |                |
|                  | *Sterculia isora* L.                      | TS           | Sep–Mar     |          |                |
|                  | *Malvaceae*                               | 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. sabbatirina* 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. mysoresensis* Wight & Arn.            | SC           | Oct–Feb     |          |                |
|                  | *Urena sinuata* L.                        | SC           | Aug–Dec     |          |                |
| Family               | Taxa                          | Microhabitat | Flowering     | Endemism | IUCN RL Status |
|----------------------|-------------------------------|--------------|---------------|----------|----------------|
| 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       |          |                |
| OPILIAEAE            | Cansjera rheedei J.F.Gmel.    | TS           | Nov–Feb       |          |                |
| SANTALACEAE          | Santalum album L.             | TS           | Nov–Dec       | VU       |                |
| LORANTHACEAE         | Dendrophthoe fokata (L.f.) Ettingsh. var. falcata | TS | Dec–May |          |                |
|                      | Helianthes elastica (Desr.) Danser | TS | Dec–Mar |          | WG         |
|                      | Helianthera 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       |                |
| ANISTROCLADACEAE     | Ancistroclados heyeanus Wall. ex J.Graham | TS | Mar–Apr |          | SI & SL    |
| CARYOPHYLLACEAE      | Polycarpacea carymbosa (L.) Lam. | RC | Aug–Dec |          |                |
|                      | Polycarpus prostratum (Forssk.) Asch. & Sehwein. | SC | Jan–Mar |          |                |
| AMARANTHACEAE        | Achyroctes aspera L.          | TS           | Oct–Mar       |          |                |
|                      | Aerva lanata (L.) Juss. ex Schult. | TS | Sep–Apr |          |                |
|                      | Alternanthera brasi liana (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 prastrata (L.) Blume | TS           | Sep–Apr       |          |                |
|                      | Gomphrena globosa L.          | SC           | Aug–Jun       |          |                |
|                      | G. serrata L.                 | SC           | Jul–Nov       |          |                |
| ALZIACEAE            | Trianthema portulacastrum L.  | SC           | Apr–Jun       |          |                |
| NYCTAGINACEAE        | Boerhavia diffusa L.          | SC           | Aug–Dec       |          |                |
|                      | Bougainvillea globra Choisy    | TS           | Nov–Jun       |          |                |
|                      | Mirabilis jalapa L.           | SC           | Aug–Apr       |          |                |
| MOLLUGINACEAE        | Gilius oppositifolius (L.) Aug.DC. | SC | Feb–Apr |          |                |
|                      | Mollugo stricta L.            | SC           | Sep–Dec       |          |                |
| PORTULACACEAE        | Portulaca oleracea L.         | SC           | Jun–Sep       |          |                |
| CACTACEAE            | Cereus hildmannianus Lem.     | SC           | Apr–Jun       |          |                |
|                      | Opuntia ficus-indica (L.) Mill. | SC | Nov–Mar |          | DD         |
| CORNACEAE            | Ailanthus saulifolium subsp. hexapetalum (Lam.) Wangerin | TS | Mar–Aug |          |                |
| BALSAMINACEAE        | impatiens balsamina L.        | SC           | Mar–Oct       |          |                |
| Family          | Taxa                               | Microhabitat | Flowering | Endemism | IUCN RL Status |
|-----------------|------------------------------------|--------------|-----------|----------|----------------|
| LECITHIDACEAE   | Coreya arborea Roxb.               | TS           | Feb–Jul   | PI       |                |
| SAPOTACEAE      | Chrysophyllum cainito L.           | TS           | Jul–Sep   |          |                |
|                 | Madhuca longifolia (J.Koenig ex L.) J.F. Matbr. | TS           | Mar–Jun   |          |                |
|                 | Mimusops elengi L.                | TS           | Dec–Aug   |          |                |
| EBENACEAE       | Diospyros candelanea Wight        | TS           | Apr–Mar   | PI       |                |
| ICACINACEAE     | Sarcostigma kleinii Wight & Arn.  | TS           | Feb–Jun   |          |                |
| RUBIACEAE       | Argostemma courtallense Arn.      | TS/RC        | Jul–Sep   |          |                |
|                 | Benkara malabarica (Lam.) Tirveng. | TS           | Jan–May   | PI & SL  |                |
|                 | Conthium 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   |          |                |
|                 | 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 parefolia (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       |                |
|                 | Neonotis 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. herbaceae (L.) Roxb.           | RC/SC        | Jul–Dec   |          |                |
|                 | Pavetta indica L. var. indica     | TS           | Apr–Jul   |          |                |
|                 | Spermacoce articularis L.f.       | SC           | Oct–Dec   |          |                |
|                 | S. lattifolia Aubl.               | SC           | Aug–Oct   |          |                |
|                 | S. ocymoides Burk.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             |
| LOGANACEAE      | 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 | IUCN RL Status |
|-------------------------|-----------------------------|--------------|-----------|----------------|
| APOCYNACEAE             | *Alstonia scholaris* (L.) R.Br. | TS           | Oct–Feb   | LC             |
|                         | *Catharanthus pusillus* (Murray) G.Don | SC          | Apr–Oct   | I & SL         |
|                         | *Kametta coryophyllata* (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        |
|                         | *Holostemma ada-kodien* Schult. | SC         | Sep–Nov   | I & SL         |
|                         | *Tylophora capparidifolia* Wight & Arn. | TS          | Mar–Jun   | SWG            |
|                         | *T. indica* (Burm.f.) Merr. var. indica | TS          | Feb–Jul   |                |
| Asclepiadoideae         | *Calotropis gigantea* (L.) W.T.Aiton | SC         | Jan–Dec   |                |
|                         | *Cosmostigma racemosum* (Roxb.) Wight | TS          | Apr–Jun   |                |
|                         | *Holostemma ada-kodien* Schult. | SC         | Sep–Nov   | I & SL         |
|                         | *Merremia umbellata* (L.) Hallier f. | TS          | Jan–Apr   |                |
|                         | *Merremia 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   |                |
| BORAGINACEAE            | *Coldenia procumbens* L.    | SC           | Mar–May   |                |
|                         | *Cordia obliqua* Wild.      | TS           | Mar–Aug   |                |
|                         | *Heliotropium keralense* Sivar. & Manilal | SC         | Mar–May   | SWG            |
|                         | *H. manifolium* RC/SC       | SC           | Apr–Aug   | PI & SL        |
| CONVOLVULACEAE          | *Argyrea nervosa* (Burm.f.) Bojer | TS          | Dec–Jun   |                |
|                         | *Bonamia semidigyna* (Roxb.) Hallier f. | TS          | Nov–Mar   |                |
|                         | *Erycibe paniculata* Roxb.  | TS           | Nov–Mar   |                |
|                         | *Evolvulus alsinoides* (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   |                |
|                         | *Neurapetelis 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    | Hydrilla zeylanica (L.) Vahl | SP | Aug–Jan | LC |   |
| OLEACEAE        | Jasminum coecatum 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 |   |
| Limnothila repens (Benth.) Bent. | SC | Jul–Dec | LC |   |
| Microcarpea 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 (Colas.) Spreng. | SC | Jun–Oct |   |
| B. oppositifolia (Retz.) Spreng. | SC | Jul–Oct | PI |   |
| Lindernia hyssopoides (L.) Haines | SP | Mar–Sep |   |
| L. madayiparensis Ratheesh, Sunil & Nandakumar | SP | Oct–Dec | SI (K) |   |
| L. maniliana Sivar. | SC | Aug–Dec | SI (K) | EN |   |
| L. taminladensis 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       | Symphoremata involucratum Roxb. | TS | Mar–Apr |   |
| Viticoidae      | Gmelina arborea Roxb. | TS | Jan–Jun |   |
| Premna serratifolia L. | TS | May–Nov |   |
| Vitis altissima L.f. | TS | Mar–Jul |   |
| V. negundo L. | SC | Feb–Jul |   |
| V. trifolia L. | SC | May–Jul |   |
| Ajugoideae      | Clerodendrum calaminosum L. | SC | Jan–Dec |   |
| C. indicum (L.) Kuntze | SC | Sep–Dec |   |
| C. infurtatum 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 camosus (L.f.) Wall. | RC | Sep–Dec |   |
| Hyptis suaveolens (L.) Poit. | SC/TS | Aug–Feb |   |
## Flowering plant diversity of Madayippara, Kerala

Pramod & Pradeep

| Family | Taxa | Microhabitat | Flowering | Endemism | IUCN RL Status |
|--------|------|--------------|-----------|----------|----------------|
| Lamiaceae: Incertae sedis | Ocimum tenuiflorum L. | SC | Jan–Dec | | |
| | 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 Pramod & Pradeep 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. cecii 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 | | |
| | B. prionitis L. subsp. prionitis | SC | Aug–Mar | | |
| | Crossandra infundibuliformis (L.) Nees | SC | Dec–Mar | I & SL | |
| | Dicliptera paniculata (Forsk.) I.Darbysh. | TS | Dec–Feb | | |
| | Ecbolium viride (Forsk.) Alston var. viride | TS | Nov–Feb | | |
| | Eranthemum capense L. | TS | Jan–Mar | PI & SL | |
| | Haploanthodes 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. nappurensis 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 (Forsk.) 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 (Daleell) Kuntze | TS | Dec–Mar | WG | |
| | Thunbergia erecta (Benth.) T.Anderson | TS | Jan–Dec | | |
| BIGNONIACEAE | Millingtonia hortensis L.f. | TS | Mar–Aug | | |
| | Poinelid longifolia (Willd.) K.Schum. | TS | Jan–Jun | | |
| Family           | Taxa                                                                             | Microhabitat | Flowering    | Endemism | IUCN RL Status |
|------------------|---------------------------------------------------------------------------------|--------------|--------------|----------|----------------|
| VERBENACEAE      | Stereospermum tetragonum DC.                                                    | TS           | Feb–Oct      |          |                |
|                   | Lantana camara L.                                                              | TS           | Apr–Jun      |          |                |
|                   | Phylo nodiflora (L.) Greene                                                     | SC           | Nov–Dec      | LC       |                |
|                   | Stachyterpheta jamaicensis (L.) Vahl                                            | SC/TS        | Jun–Dec      |          |                |
| CAMPANULACEAE    | Lobelia alsonioides Lam.                                                       | SC           | Aug–Oct      | LC       |                |
| MENYANTHACEAE    | Nymphoides indica (L.) Kunze                                                    | SP           | Jan–Dec      | LC       |                |
|                   | N. krishnakasera K.T. Joseph & Sivar.                                          | SP           | Aug–Nov      | SWG (K)  | EN              |
| ASTERACEAE       | Acanthospermum hispidum DC.                                                    | SC           | Jan–Jun      |          |                |
|                   | Acmeila 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. oxyoalta 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      |          |                |
|                   | Cosmas caudatus Kunth                                                           | SC           | Aug–Feb      |          |                |
|                   | C. sulphureus Cav.                                                              | SC           | Feb–Nov      |          |                |
|                   | Crossosepalum crepidoides (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      |          |                |
|                   | Ezolites 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      |          | WG              |
|                   | Tricholepis amplicaulis C.B.Clarke                                              | SC           | Oct–Feb      |          |                |
|                   | 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
- SL—southern India
- SL—I—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 madayiparense. © 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.
Flowering plant diversity of Madayippara, Kerala

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

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

Euphorbia deccanensis grows with its roots firmly attached to the humus-rich small cavities and fissures of lateite 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 attributed to be a general phenomenon and is explained in different plateaus in the Western Ghats region by various authors (Joshi & Janarthanam 2004; Porembski & Watte 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).

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%                              |

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 madiyiparense, 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 lateite 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.
Flowering plant diversity of Madayippara, Kerala

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Lateritic plateaus 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 at least 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 plateaus of southwestern India has been already recognized (Wathe & 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.

REFERENCES

Anonymous (2019). Wastelands Atlas of India. Department of Land Resources, Ministry of Rural Development, Government of India, New Delhi & National Remote Sensing Centre, Indian Space Research Organisation, Dept. of Space, Govt. of India, Hyderabad, 243pp.

Ansari, R., V.J. Nair & N.C. Nair (1982). Two new taxa of Curcuma Linn. (Zingiberaceae) from Cannanore District, Kerala, India. Current Science 51(6): 293–294.

APG IV (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society 181: 1–20.

Balakrishnan, V.C., M.J. Palot & K.P. Rajesh (2011). Observations on the Flora of Madayipara, a midland laterite hill in Kannur District, Kerala. Malabar Trogon 8(2&3): 14–29.

Bhat, K.G. & C.R. Nagendran (1983). A new species of Isachne (Poaceae) from Karnataka, India. Current Science 52(6): 258–259.

Bhattarai, U., P. Tetali & S. Kelso (2012). Contributions of vulnerable hydrogeomorphic habitats to endemic plant diversity on the Kas Plateau, Western Ghats. SpringerPlus 1–25. https://doi.org/10.1186/2193-1801-1-25

Biju, P., E.J. Josekutty & J. Augustine (2016a). Blyxa kascaragodiensis, a new species of Hydrocharitaceae from the ponds in the laterite plateau of Malabar Coast, Kerala, India. Webbia 71(1): 61–67. https://doi.org/10.1080/00837792.2016.1160648

Biju, P., E.J. Josekutty & J. Augustine (2016b). A new species of Lobelia L. (Campanulaceae: Lobelioideae) from the lateritic plateau of northern Kerala, India. Webbia 71(2): 183–186. https://doi.org/10.1080/00837792.2016.1175734

Biju P., E.J. Josekutty, K.A.R.M. Haneef & J. Augustine (2016c). A new species of Nymphoides Séguier (Menyanthaceae) from the...
Swapna, M.M., K.P. Rajesh, C.N. Manju & R. Prakashkumar (2012). *Eriocaulon madayiparense* (Eriocaulaceae) – A new species from the foot hills of the Western Ghats of India. *Phytotaxa* 10: 19–23.

Varghese, T. & G. Byju (1993). *Laterite soils*. Technical Monograph No. 1. State Committee on Science, Technology and Environment, Government of Kerala.

Watve, A. (2013). Status review of Rocky plateaus in the Northern Western Ghats and Konkan region of Maharashtra, India with recommendations for conservation and management. *Journal of Threatened Taxa* 5(5): 3935–3962. https://doi.org/10.11609/JoTT.o3372.3935-62

Watve, A. & S. Thakur (2006). Ecological Studies of Lateritic Plateau Habitats in Northern Western Ghats, pp. 22–28. In: Pandey, H.N. & S.K. Barik (eds.), *Ecology, Diversity and Conservation of Plants and Ecosystems in India*. Regency Publications, New Delhi.

Yadav, S.R. & M.K. Janarthanam (1994). Hydatellaceae: a new family to Indian flora with a new species. *Rheedea* 4(1): 17–20.

Yadav, S.R., V.M. Nilesh & A.N. Chandore (2010). *Rotala belgaumensis* sp. nov. (lythraceae) from Western Ghats, India. *Nordic Journal of Botany* 28: 499-500. https://doi.org/10.1111/j.1756-1051.2009.00612.x

Yadav, S.R., G.G. Potdar, A. Kumar, A.M. Otaghvari & A. Sonkar (2008). *Eriocaulon epedunculatum*, a new species of *Eriocaulaceae* from the Western Ghats, India. *Kew Bulletin* 63: 503–505. https://doi.org/10.1007/s12225-008-9041-y.

Yadav, S.R., M. M. Lekhak & A.N. Chandore (2009). A new species of *Eleocharis* (Cyperaceae) from Western Ghats, India. *Rheedea* 19(1&2): 37–40.
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