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COMMUNICATION

FLORISTIC DIVERSITY OF ANJANERI HILLS, MAHARASHTRA, INDIA

Sanjay Gajanan Auti, Sharad Suresh Kambale, Kumar Vinod Chhotupuri Gosavi & Arun Nivrutti Chandore

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COMMUNICATION

Floristic diversity of Anjaneri Hills, Maharashtra, India

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Abstract: High altitude plateaux are found throughout northern Western Ghats. These plateaux harbor a great diversity of monsoon flora and endemism but are highly neglected due to the seasonality and harsh climatic conditions. Anjaneri Hill is an important rock outcrop in northern Western Ghats. It is the type locality of *Ceropegia anjanerica*. As an attempt to make a floristic inventory of an important area, a preliminary study was undertaken. A total of 385 flowering plants from 68 families have been reported from Anjaneri protected area in the present study, of these 114 are endemics. Out of these 114 species, 81 are endemic to India while 33 taxa are endemic to the Western Ghats. Anjaneri rock outcrop shows great floral diversity due to varied microhabitats. The observations on phenology and adaptive traits were recorded. The data on geology and geomorphology is presented in order to understand the geological nature of the rock outcrop. Intensive study on varied microhabitat is needed for the documentation of floral diversity existing on the Anjaneri Hill.

Keywords: *Ceropegia anjanerica*, endemic species, flowering plants, microhabitats, Nashik District, phenology, plateau, protected area, rock outcrop, Western Ghats.

Marathi Abstract: उत्तर-पश्चिम घाटामध्ये जास्त उंचीची पठारे खूप मोठ्या प्रमाणात आढळतात. पावसाळ्यात त्यांवर वपिूल प्रमाणात वनस्पतींची ववििधता आढळते. तेथे प्रदेशनष्ठि वनस्पतींची संख्याही जास्त आहे. येथे वर्षाभरात ठरावकि ऋतूंमध्ये वनस्पती आढळून येतात आणि येथील प्रतकिूल हवामानामुळे ही पठारे अभ्यासकांकडून तशी दुर्लक्षति झालेली आहेत. अंजनेरी पर्वत हा उत्तर-पश्चिम घाटातील एक महत्त्वाचे खडकाळ पठार आहे. सेरोपेजिया अंजनेरिका या प्रदेशनष्ठि वनस्पतीची पहलिी नोंद येथे झाली आहे. अशा महत्त्वपूर्ण पठारावरील सपुष्प वनस्पतींचा अभ्यास करून 68 कुळातील एकूण 385 वनस्पतींची नोंद प्रस्तूत अभ्यासात केलेली आहे त्यातील 114 प्रजाती या प्रदेशनष्ठि असून 81 वनस्पती या भारतात आणि 33 प्रजाती या पश्चिम घाटापुरत्या प्रदेशनष्ठि आहेत. येथील वनस्पतींच्या ववििधतेचे कारण आहे, सूक्ष्म अधविासांची ववििधता. या अभ्यासदरम्यान वनस्पतींना फुले येण्याचा कालावधी आणि अनुकूलन यावरील नरीक्षणे नोंदवली गेलेली आहेत. भूवज्ञिान आणि भूगोलशास्त्र यांच्या आधारे अंजनेरी पर्वताचे भौगोलकि वैशष्ट्यि समजून घेऊन त्याची अभ्यासपूर्ण माहतिी येथे सादर केलेली आहे. अंजनेरीवर असलेल्या सपुष्प वनस्पतींच्या ववििधतेचे दस्तावेजीकरण करण्यासाठी येथील ववििध सूक्ष्म अधविासांचा अभ्यास करणे आवश्यक आहे

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INTRODUCTION

The Western Ghats are amongst well-known global hotspots recognized for its biodiversity and endemism (Daniels & Vencatesan 2008). Most conservation attention has been focused on the forests of the Western Ghats due to loss of plant species and intense habitat loss (Panigrahy et al. 2010). Southern Western Ghats shows great diversity of taxa especially trees and shrubs due to heavy rainfall, edaphic heterogeneities, and high mountain ranges, while the northern Western Ghats provides varieties of the unique habitats, e.g., forts, caves, cliffs, slopes, and plateaux which support diversity of herbaceous vegetation.

Northern Western Ghats also encompass higher plateaux or tablelands that have received less conservation attention (Porembski et al. 1994, 2000; Watve 2013), although studies suggest these ecological subsets of the Western Ghats mega-hotspot provide their own noteworthy and unique biological components. Many researchers have reported about the floral diversity of plateaux in northern Western Ghats. Report on two basaltic plateaux of northern Western Ghats has been provided by Rahangdale & Rahangdale (2014, 2018). Their documentation chiefly focuses on flowering plant diversity from Durgawadi Plateaux (600 taxa) and Naneghat Plateaux (249 taxa). Uncommon vegetation (Lekhak & Yadav 2012), a new species (Malpure et al. 2006; Malpure & Yadav 2009) and endemism (Joshi & Janarthanam 2004) were reported from lateritic plateaux.

Plateaux in Western Ghats lack proper substrate (soil) and exhibit extreme climatic conditions. Their environment usually shares a series of stressful characteristics, such as UV exposure, daily thermal variation, constant winds, high evapo-trasnspiration, low water retention, and impermeable soils (Porembski & Barthlott 2000). Plant communities of the plateaux are edaphically controlled and show adaptation for water accumulation, such as succulence *Cyanotis concanensis*, *Ceropegia lawii*, and poikilohydry, carnivory in response to the lack of nutrients (N, P, and S) in the soil and the presence of subterranean organs (bulbs, corms, tubers, and rhizomes) to overcome extreme temperature during summer. Despite the rich floral diversity and varied microhabitat, these plateaux are highly neglected, due to extreme conditions e.g., high temperature, altitude, and remote locations.

Watve (2007, 2010) reported that climatic and microclimatic (soil, rock, air, temperature, and humidity) conditions on rocky plateaux and their diurnal variation affected the vegetation on the plateaux. The microenvironment of the rocky plateaux tend to be extreme, from xeric to water logged, highly acidic (4.5–6.0), and rich in organic carbon.

Soil moisture has been recognized as the primary determinant of plant phenology in the Western Ghats (Joshi & Janarthanam 2004), and the plant diversity on the plateaux is only apparent while monsoon moisture persists.

The present study was carried out to document the diversity of flowering plants of the Anjaneri rock outcrop. The data generated in this study will help in planning for conservation of endemic and threatened plants.

MATERIALS AND METHODS

Study area

Anjaneri Hill (19.919^{0}N & 73.571^{0}E) (Fig. 1, 2) is a basalt mesa, a flat-topped hill with steep cliff edges. It is one of a cluster of five hills, together known as 'Tryambak Range' of the northern Western Ghats. Anjaneri Plateau is located 20km west of Nashik, towards Tryambakeshwar. Anjaneri Hills is an ancient mountain pass, from the period of Yadava, Satvahana Kings (approximately 700 CE). Historical references are also found from the regime of Peshava.

The elevations of the adjoining peaks are less than the highest point on the plateau (1,300m). Anjaneri Hill is a reserved forest (RF) area and has been given the status of medicinal plant conservation area (MPCA) in 2009–2010 and reserve area conservation committee has been constituted (April 2017) for the conservation of endemic plants from the plateau.

Data collection

Extensive and repeated field surveys were carried out during 2010 to 2016 to cover all the seasons of the year. A comprehensive checklist of plants was prepared altitude-wise in order to understand the range of distribution of species, ecological variations, and types of adaptation. Occurrence of the taxa was recorded based on the visual observations during field work. During the field surveys, types of vegetation, habit, habitat, morphological characters, associated species, adaptation, and phenology were documented.

Plant specimens were collected and identified using Flora of Nashik (Lakshminarasimhan & Sharma 1991) and regional floras (Sharma et al. 1996; Singh & Karthikeyan 2000; Singh et al. 2001). The data on endemism has been taken from Singh et al. (2015). The species documented

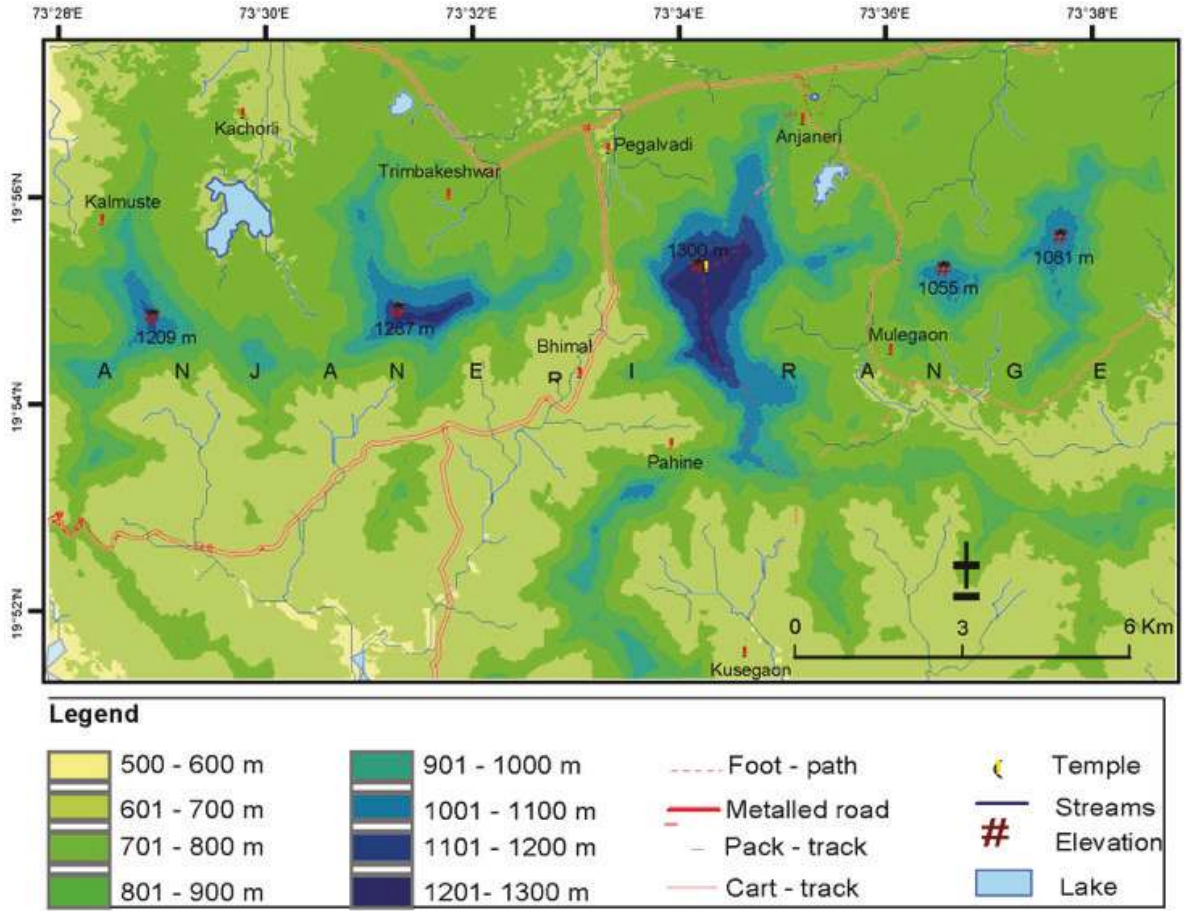


Figure 1. The Anjaneri range and its surroundings.

are listed in Table 1 as per APG IV (2016).

Geology and geomorphological studies

The present study is based on the data collected from primary and secondary sources. Primary data was procured by visiting the study area. Secondary data were obtained through Survey of India topographical maps. In addition to these, quantification of a number of geographical features for the area under study were made possible by means of the analyses of digital elevation model (DEM) of ca. 30m resolution advance space borne thermal emission and reflection radiometer (ASTER) data. The digital elevation data was used to extract information with the help of standard procedures in ArcGIS 9.3 (Kale & Shejwalkar 2008; Dehbozorgi et al. 2010).

Geology

Geologically, the study area is underlain by horizontally bedded Cretaceous-Eocene Deccan volcanic basalts. It is a part of the Deccan Volcanic Province (DVP) covering 5×10^5 km^2 area of central and western India, ranks as one of the largest flood basalt provinces on Earth (Brown et al. 2011). The lava flows of the Anjaneri Plateaux belong to Kalsubai subgroup of DVP, although the details of the lava flows at Anjaneri Plateaux is not known. The Bramhgiri Hill (1,287m), located close to Anjaneri Plateaux, exposes a 620.5m thick pile of a few compound pahoehoe flows, varying 40–96 m in thickness and one 9m thick flow, which occurs at 716m level. The area under study is characterized by two prominent dykes, through which basaltic lava was intruded. The dykes appear in the form of lineaments that are zones of weakness.

Geomorphology

Geomorphologically, the highest point of Anjaneri Plateaux is 1,300m with an area of 5.7km^2. The maximum local relief of the plateaux is 660m to the south-west. The plateaux are bordered by high cliffs from almost all the sides. The lower slopes of Anjaneri Plateaux are concave in nature with semi-evergreen vegetative growth particularly in the form of trees. The profiles reveal that the Anjaneri area maintains the

classical characteristics of the plateaux.

Climate: The Anjaneri Plateaux do not have any official or unofficial weather station. Therefore, it is not possible to describe the climate of the study area, however, some information is available for Tryambakeshwar, which is located close to the study area. The region experiences extreme weather, i.e., very hot summers and very cold winters. Summer and monsoon is a feature of the area. Therefore, the climate of the area is divided into three distinct seasons, namely, (a) summer season (March to May) are hot with a maximum average temperature reaching up to 40°C, (b) monsoon season (June to October) is likely to offer average annual rainfall around 2,000mm particularly on Anjaneri Plateaux, and (c) winter season (November to February) is mostly pleasant with a minimum and maximum temperature between 7°C and 34°C, respectively. It is likely to have higher temperatures on the top of the plateaux than the surrounding region particularly in the summer season. It is evident by occurrence of succulents like *Ceropegia anjanerica*, *Drimia polyantha*, *Euphorbia khandallensis* and the spinescent *Lepidagathis cuspidata.*

Ecosystem services

The steep hill slopes give rise to many cascades and streams that supply water to major dams like Vaitarana Dam and three minor reservoirs. At the end of monsoon, the plateaux have grass cover providing stuff for local cattle. Natural and man-made ponds are also present on the plateaux. The area has medicinal plant species and local people regularly collect these species. It has been declared as a medicinal plant conservation area (MPCA) by the forest department and special protection has been provided against exploitation.

Floristic composition

A total of 385 species are recorded from the Anjaneri Hills. These plants are distributed in 68 families: Poaceae (59), Leguminosae (48), Asteraceae (40), Acanthaceae (21), and Lamiaceae (15) are dominant families. These five families represent 183 species of the total flora. In comparison with lateritic plateaux like Kaas, Satara (41 endemics) (3.26km^2) and Barki, Kolhapur (six endemics) (3.75km^2) (Lekhak & Yadav 2012 and Shenai et al. 2013), and basaltic rock outcrops Durgawadi, Pune (150 endemics) (2.8793km^2) (Rahangdale & Rahangdale 2018) and Naneghat, Junnar (seven endemics) (0.7524km^2) (Rahangdale & Rahangdale 2014) Anjaneri outcrop (5. 6963km^2) harbors 385 flowering plants of which 114 are endemic species. Endemism given for Kaas and Barki are restricted to the plateaux and not the whole area, while the endemics from Durgawadi, Naneghat, and Anjaneri are from entire area.

Anjaneri outcrop shows high endemism and commonly shared taxa are relatively low (31.21%) indicating that the Anjaneri outcrop is floristically and in terms of habitats is very diverse. It is the type locality of *Ceropegeia anjanerica* (Malpure et al., 2006) and supports varied habitats for many endemic plants (Table 1). The reason for the species richness and high endemism of Anjaneri outcrop might be in its geographical location, climatic conditions, specific basaltic nature, and high altitude. A few species which occur on Kaas, Barki, Dugarwadi, and Naneghat plateau, e.g., *Dipcadi ursulae*, *Aponogeton satarensis*, *Ceropegia jainii*, and *Eriocaulon epedunculatum* were not found in the present study area may be due to lack of required specific habitats.

Anjaneri rock outcrop shows three levels (flat areas) at 800–850 m, 1,150–1,200 m and 1,300m and large slopes. Each level and slope is unique in terms of soil deposition and water content. Basal level (800–850 m) has a good amount of soil and water, supported species from Lamiaceae (*Colebrookea oppositifolia*, *Pogostemon deccanensis*), Solanaceae (*Solanum anguivi*), and Asteraceae (*Senecio bombayensis*) and trees like *Mangifera indica*, *Terminalia tomentosa*, *Bridelia retusa*, *Syzygium cumini*, *Sterculia guttata*, *Schleichera oleosa*, and *Falconeria insignis*. Good populations of *Gloriosa superba* and *Paracalyx scariosus* were recorded.

Middle level (1,150–1,200 m) contains 1–1.5 cm of soil dominated by grasses like *Chrysopogon fulvus*, *Cymbopogon martini*, and *Dichanthium assimile*. A number of shallow water bodies are formed during the monsoon season which provide habitat for *Lindernia parviflora*, *Rotala rosea*, *Ammannia baccifera*, and *Hygrophila serpyllum*. At 1,100–1,150 m small tree cover occurs on the soil-rich areas of the plateaux. This cover includes plants like *Elaeagnus conferta*, *Ziziphus rugosa*, *Terminalia chebula*, *Trema orientalis*, *Acacia pennata*, and *Kydia calycina*. Little above the middle plateau (1,200m), a small natural pond exists. It supports hydrophytes like *Persicaria glabra*.

Uppermost level (1,250–1,300 m) shows large number of herbaceous, ephemeral flush and grasses. In some areas of this level little soil deposition occur, this area shows a large population of *Strobilanthes reticulata* and *Curcuma neilgherrensis*. Various taxa like *Polygala arvensis*, *Habenaria brachyphylla*, and *Haplanthodes verticellata* were associated with *Strobilanthes* population. The species like *Impatiens dalzellii* (Image 3H) (above 1,150m), *Drosera indica* (1,250m), *Crinum*



Image 1. Major habitat of Anjaneri Hill: A—Top elevation plateau | B—Middle elevation plateau | C—Slope | D—Steep and hanging rocks | E—Black boulders with seasonal stream | F—Seasonal pond at top plateau. © Dr. K.V.C. Gosavi.

latifolium (1,300m), *Ceropegia anjanerica* (1,300m), *Euphorbia khandallensis* (1,275m), *Sonerila scapigera* (Image 4G) (1,175m), *Cyathocline lutea* (1,300m) were reported. During monsoon a large number of small shallow puddles are formed, supporting herbaceous plants like *Pogostemon deccanensis*, *Eriocaulon tuberiferum*, *Exacum lawii*, and *Utricularia praeterita*. Apart from above habitats, rocky outcrops provide various habitats like boulders, exposed rock surfaces, small ephemeral pool, and soil covered areas.

Slopes of all three levels show variation in their species composition. Slope from middle to upper level were covered with a huge population of *Strobilanthes callosa*, *Chlorophytum glaucum*, *Pimpinella wallichiana*, *Lepidagathis cuspidata*, *Gynura bicolor*, *Alysicarpus bupleurifolius*, *Desmodiastrum racemosum* var. *rotundifolium*, *Smithia* species and middle slope with various herbaceous plants like *Commelina* species, *Neanotis foetida*, *Neanotis montholonii*, *Cynarospermum*, and *Canscora diffusa*.

Study area shows dominance of lithophytes due to their greater ability to survive under disadvantageous environmental conditions (Porembski & Barthlott 2000). Due to their short life-cycle and high reproduction rate, they are well-adapted to extreme environments and high levels of disturbances. Most of the plants survive



Image 2. Seasonal changes of top plateau: A—Dried plants in the month of May | B—Dominated *Curcuma neilgherrensis* after first shower in the first week of June | C—Dominant *Habenaria grandifloriformis* in the first week of July | D—*Pinda concanensis*, *Senecio bombaiensis* appear in August | E—Mix population of many outcrops species appears in September | F—Outcrops species are drying from October to November. © Dr. K.V.C. Gosavi.

the dry spell as dormant seeds or tuber.

Due to the absence of large accumulations of soil over the plateaux little rainwater is stored, but most of the water is lost as runoff. The loss of water due to run-off is due to steep slopes.

Seasonal succession and phenology

Plant communities on the Anjaneri outcrop are gradually changing temporally with specific interval (approximately 10 days) due to changing environmental conditions. The growing season starts with the dominance of ephemerals and this is later replaced by perennials. Both the number of species and the number of individuals declined after a peak at the beginning of the growing season. Such seasonal or phenological phenomena with respect to basaltic plateaux in northern Western Ghats have been studied by Rahangdale & Rahangdale (2014, 2018) and lateritic plateaux by Joshi & Janarthanam (2004), Bhattarai et al. (2012) and Lekhak & Yadav (2012). Similar pattern to the one seen on the Anjaneri outcrop was observed by Lekhak & Yadav (2012) and Rahangdale & Rahangdale (2014). Based on the phenology of the plants four phases can be recognized: 1. The pre-monsoon phase (June–July) is characterized by the growth of grasses and ground orchids on the plateaux. The grass species which are quite common are *Eragrostis unioloides*, *Isachne elegans*, and *Paspalum canarae* var. *fimbriatum* along with *Curculigo orchioides*, *Ceropegia lawii*, *Habenaria grandifloriformis*, *Arisaema murrayi*, *Crinum latifolium*, and *Curcuma neilgherrensis*; 2. The monsoon phase (August–September) mainly geophytes such as *Ceropegia anjanerica*, *C. media*, *Eriocaulon tuberiferum*, *Habenaria suaveolens*, *H. grandifloriformis*, *Hypoxis aurea*, and members of the ephemeral vegetation such as *Glyphochloa maharashtraensis*, *Fimbristylis lawiana*, *Utricularia* spp., *Murdannia nimmoniana*, *Eriocaulon* spp., and *Smithia hirsuta* come in flowering. This is



Image 3. Endemic plants: A—*Strobilanthes callosa* Nees | B—*Pancratium nairii* Sasikala & Reema Kumari | C—*Pinda concanensis* (Dalzell) P.K. Mukh. & Constance | D—*Ceropegia anjanerica* Malpure, M.Y.Kamble & S.R.Yadav | E—*Ceropegia media* (Huber) Ansari | F—*Frerea indica* Dalzell | G—*Arisaema murrayi* (J.Graham) Hook. | H—*Impatiens dalzellii* Hook.f. & Thomson | I—*Cyathocline lutea* Law ex Wight. © Dr. K.V.C. Gosavi.



Image 4. Endemic plants: A—*Adelocaryum malabaricum* (C.B.Clarke) Brand | B—*Cyanotis concanensis* Hassk. | C—*Pogostemon deccanensis* (Panigrahi) Press | D—*Desmodiastrum racemosum* var. *rotundifolium* (Baker) A.Pramanik & Thoth. | E—*Indigofera santapaui* Sanjappa | F—*Smithia purpurea* Hook. | G—*Sonerila scapigera* Dalzell | H—*Habenaria heyneana* Lindl. | I—*Dichanthium armatum* (Hook.f.) Blatt. & McCann. © Dr. K.V.C. Gosavi.

Table 1. Plants of Anjaneri Hill.

	Plant species	Family	Location
1*	*Amorphophallus commutatus* (Schott) Engl.	Araceae	MP, UP
2	*Ariopsis peltata* Nimmo	Araceae	UP
3$	*Arisaema murrayi* (J.Graham) Hook.	Araceae	MP,UP
4	*Arisaema tortuosum* (Wall.) Schott	Araceae	MP,UP
5	*Remusatia vivipara* (Roxb.) Schott	Araceae	Slope between MP and UP
6	*Sauromatum venosum* (Dryand. ex Aiton) Kunth	Araceae	UP
7	*Dioscorea bulbifera* L.	Dioscoreaceae	Slope UP
8	*Dioscorea pentaphylla* L.	Dioscoreaceae	Slope UP
9	*Gloriosa superba* L.	Colchicaceae	BP
10*	*Dendrobium barbatulum* Lindl.	Orchidaceae	MP
11	*Dendrobium herbaceum* Lindl.	Orchidaceae	MP
12$	*Dendrobium microbulbon* A.Rich.	Orchidaceae	MP
13$	*Habenaria brachyphylla* (Lindl.) Aitch.	Orchidaceae	UP
14$	*Habenaria foetida* (Geyer ex Hook.) S.Watson	Orchidaceae	UP
15$	*Habenaria foliosa* A.Rich.	Orchidaceae	MP,UP
16$	*Habenaria grandifloriformis* Blatt. & McCann	Orchidaceae	UP, MP
17$	*Habenaria heyneana* Lindl.	Orchidaceae	BP, UP
18$	*Habenaria suaveolens* Dalzell	Orchidaceae	UP
19	*Curculigo orchioides* Gaertn.	Hypoxidaceae	MP
20	*Hypoxis aurea* Lour.	Hypoxidaceae	MP
21	*Crinum latifolium* L.	Amaryllidaceae	UP
22*	*Pancratium nairii* Sasikala & Reema Kumari	Amaryllidaceae	UP
23	*Agave americana* L.	Asparagaceae	MP
24$	*Chlorophytum borivilianum* Santapau & R.R.Fern.	Asparagaceae	Slopes of foot hills
25$	*Chlorophytum glaucum* Dalzell	Asparagaceae	UP
26*	*Drimia polyantha* (Blatt. & McCann) Stearn	Asparagaceae	UP
27	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	BP
28	*Commelina benghalensis* L.	Commelinaceae	MP,UP, Slope MP,UP
29*	*Commelina paleata* Hassk.	Commelinaceae	In shady places along slopes
30*	*Cyanotis concanensis* Hassk.	Commelinaceae	Slope MP,UP
31	*Cyanotis fasciculata* (B.Heyne ex Roth) Schult. & Schult.f.	Comelinaceae	Slope MP,UP
32	*Murdannia nimmoniana* (J.Graham) Bole & M.R.Almeida	Commelinaceae	UP
33*	*Murdannia nimmoniana* var. *sahyadrica* (Ancy & Nampy) Nandikar	Commelinaceae	In shady places along slopes
34$	*Ensete superbum* (Roxb.) Cheesman	Musaceae	MP
35$	*Curcuma neilgherrensis* Wight	Zingiberaceae	UP
36	*Eriocaulon heterolepis* Steud.	Eriocaulaceae	UP
37$	*Eriocaulon sedgwickii* Fyson	Eriocaulaceae	UP
38*	*Eriocaulon tuberiferum* A.R.Kulk. & Desai	Eriocaulaceae	UP
39	*Cyperus difformis* L.	Cyperaceae	MP,UP
40	*Eleocharis atropurpurea* (Retz.) J.Presl & C.Presl	Cyperaceae	MP,UP
41$	*Fimbristylis lawiana* (Boeckeler) J.Kern	Cyperaceae	MP,UP
42	*Kyllinga bulbosa* P.Beauv.	Cyperaceae	MP,UP
43	*Pycreus flavidus* (Retz.) T.Koyama	Cyperaceae	MP,UP
44	*Apluda mutica* L.	Poaceae	Slopes

	Plant species	Family	Location
45	*Arthraxon hispidus var. hispidus* (Thunb.) Makino	Poaceae	MP
46*	*Arthraxon jubatus* Hack.	Poaceae	MP
47	*Arthraxon lanceolatus* var. *lanceolatus* (Roxb.) Hochst.	Poaceae	UP,MP
48*	*Arthraxon lanceolatus* var. *meeboldii* (Stapf) Welzen	Poaceae	MP
49	*Arthraxon lancifolius* (Trin.) Hochst.	Poaceae	MP
50$	*Arundinella ciliata* (Roxb.) Nees ex Miq.	Poaceae	UP
51	*Arundinella pumila* (Hochst. ex A. Rich.) Steud.	Poaceae	UP, MP
52	*Chloris virgata* Swartz	Poaceae	UP, MP
53	*Chrysopogon fulvus* (Spreng.) Chiov.	Poaceae	UP,MP
54	*Coix gigantea* Koen. ex Roxb.	Poaceae	MP
55	*Cymbopogon martini* (Roxb.) Wats.	Poaceae	MP, UP
56	*Cynodon dactylon* (L.) Pers.	Poaceae	MP,UP
57	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae	MP
58	*Dactyloctenium aegyptium* (L) P. Beauv.	Poaceae	MP, UP
59*	*Dicanthium paranjapyeanum* (Bhide) Clayton	Poaceae	UP
60	*Dichanthium annulatum* (Forssk.) Stapf	Poaceae	MP, UP
61*	*Dichanthium armatum* (Hook.f.) Blatt. & McCann	Poaceae	MP
62	*Dichanthium assimile* (Steud.) Deshpande	Poaceae	MP,UP
63	*Dichanthium caricosum* (L.) A.Camus	Poaceae	MP, UP
64	*Dichanthium odoratum* Jain & Deshpande	Poaceae	UP
65*	*Dichanthium oliganthum* (Hochst. ex Steud.) T.A.Cope	Poaceae	UP
66	*Digitaria ciliaris* (Retz.) Koel.	Poaceae	UP
67	*Echinochloa colonum* (L.) Link	Poaceae	MP
68	*Eragrostiella bifaria* (Vahl) Bor	Poaceae	MP
69	*Eragrostis unioloides* (Retz.) Nees ex Steud	Poaceae	MP
70	*Eragrostis viscosa* (Retz.) Trin.	Poaceae	MP
71	*Euclasta clarkei* (Hack.) T.A.Cope	Poaceae	MP
72	*Eulalia trispicata* (Schult.) Henr.	Poaceae	MP,UP
73$	*Garnotia arborum* Stapf ex T.Cooke	Poaceae	MP, UP
74	*Garnotia tenella* (Arn. ex Miq.) Jan.	Poaceae	UP
75*	*Glyphochloa maharashtraensis* Potdar & S.R.Yadav	Poaceae	UP
76$	*Glyphochloa forficulata* (C.E.C.Fischer) W.D.Clayton	Poaceae	UP
77	*Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.	Poaceae	UP
78$	*Indopoa paupercula* (Stapf) Bor	Poaceae	UP
79$	*Isachne elegans* Dalzell	Poaceae	UP
80$	*Isachne gracilis* C.E.Hubb.	Poaceae	UP
81	*Ischaemum impressum* Hack.	Poaceae	UP
82	*Ischaemum indicum* (Houtt.) Merr.	Poaceae	MP
83$	*Ischaemum raizadae* Hemadri & Billore	Poaceae	UP, MP
84	*Jansenella griffithiana* (C.Muell.) Bor	Poaceae	MP,UP
85*	*Jansenella neglecta* S.R.Yadav, Chivalkar & Gosavi	Poaceae	MP,UP
86	*Oplismenus burmannii* f. *cristata* (J.Presl) Hier. ex Peter	Poaceae	MP
87	*Oplismenus compositus* (L.) P.Beauv.	Poaceae	MP
88$	*Paspalum canarae* var. *fimbriatum* (Bor) Veldk.	Poaceae	UP
89	*Pennisetum pedicellatum* Trin.	Poaceae	MP

	Plant species	Family	Location
90*	*Pogonachne racemosa* Bor	Poaceae	UP
91$	*Pseudanthistiria heteroclita* (Roxb.) Hook.f.	Poaceae	UP
92*	*Pseudodichanthium serrafalcoides* (T.Cooke & Stapf) Bor	Poaceae	UP
93	*Sehima nervosum* (Rottl.) Stapf	Poaceae	UP
94	*Setaria pumila* Roem. & Schult.	Poaceae	UP, MP
95$	*Spodiopogon rhizophorus* (Steud.) Pilger	Poaceae	MP, UP
96	*Sporobolus indicus* (Buse) Baaijens	Poaceae	MP
97	*Themeda quadrivalvis* (L.) O.Ktze.	Poaceae	MP, UP
98$	*Triplopogon ramosissimus* (Hack.) Bor	Poaceae	MP,UP
99	*Tripogon bromoides* Roth	Poaceae	UP
100	*Tripogon capillatus* Jaub. & Spach.	Poaceae	MP
101$	*Tripogon jacquemontii* Stapf	Poaceae	MP
102$	*Tripogon lisboae* Stapf	Poaceae	MP, UP
103	*Cocculus hirsutus* (L.) W.Theob.	Menispermaceae	MP, UP
104	*Cyclea peltata* (Lam.) Hook.f. & Thomson	Menispermaceae	UP
105	*Clematis gouriana* Roxb. ex DC.	Ranunculaceae	UP
106$	*Clematis hedysarifolia* DC.	Ranunculaceae	UP
107	*Acacia auriculiformis* Benth.	Leguminosae	MP
108	*Acacia pennata* (L.) Willd.	Leguminosae	MP
109	*Acacia nilotica* ssp. *indica* (Benth.) Brenan	Leguminosae	MP
110	*Aeschynomene indica* L.	Leguminosae	UP
111	*Albizia lebbek* (L.) Benth.	Leguminosae	BP
112	*Albizia odoratissima* (L.f.) Benth.	Leguminosae	BP
113	*Alysicarpus bupleurifolius* (L.) DC.	Leguminosae	Slope UP
114	*Alysicarpus vaginalis* (L.) DC.	Leguminosae	Slope UP
115	*Bauhinia racemosa* Lam.	Leguminosae	BP
116	*Butea monosperma* (Lam.) Taub.	Leguminosae	BP
117$	*Cajanus sericeus* (Benth. ex Baker) Maesen	Leguminosae	Slope MP
118	*Canavalia gladiata* (Jacq.) DC.	Leguminosae	Slope MP
119	*Cassia fistula* L.	Leguminosae	Slope MP
120	*Chamaecrista mimosoides* (L.) Greene	Leguminosae	MP
121$	*Clitoria annua* J.Graham	Leguminosae	MP
122$	*Crotalaria filipes* Benth.	Leguminosae	Slope UP, UP
123	*Crotalaria hebecarpa* (DC.) Rudd	Leguminosae	Slope UP
124	*Crotalaria medicangea* Lam.	Leguminosae	Slope UP
125	*Crotalaria mysorensis* Roth	Leguminosae	Slope UP
126	*Crotalaria nana* Burm.f.	Leguminosae	Slope UP
127	*Crotalaria pallida* Aiton	Leguminosae	Slope UP
128	*Crotalaria retuse* L.	Leguminosae	Slope UP
129	*Crotalaria triquetra* Dalzell	Leguminosae	Slope UP
130	*Crotalaria vestita* Baker	Leguminosae	Slope UP
131$	*Desmodiastrum belgaumense* (Wight) A.Pramanik & Thoth.	Leguminosae	Slope UP
132$	*Desmodiastrum racemosum* var. *rotundifolium* (Baker) A.Pramanik & Thoth.	Leguminosae	Slope MP
133	*Desmodium laxiflorum* DC.	Leguminosae	Slope UP
134	*Dolichos robustus* Bolus	Leguminosae	MP

	Plant species	Family	Location
135	*Dolichos trilobus* L.	Leguminosae	Slope UP
136	*Erythrina stricta* Roxb.	Leguminosae	MP
137	*Flemingia strobilifera* (L.) W.T.Aiton	Leguminosae	MP
138	*Geisaspis cristata* Wight & Arn.	Leguminosae	Slope UP
139*	*Geissaspis tenella* Benth.	Leguminosae	Slope UP
140	*Indigofera cordifolia* B.Heyne ex Roth	Leguminosae	Slope MP
141	*Indigofera linifolia* L.f. Retz.	Leguminosae	Slope MP
142*	*Indigofera santapaui* Sanjappa	Leguminosae	MP
143	*Indigofera trifoliata* L.	Leguminosae	Slope MP
144	*Mucuna pruriens* (L.) DC.	Leguminosae	Slope MP
145	*Paracalyx scariosus* (Roxb.) Ali (as 'scariosa')	Leguminosae	Slope MP
146	*Smithia bigemina* Dalzell	Leguminosae	MP, UP
147$	*Smithia hirsuta* Dalzell	Leguminosae	MP, UP
148$	*Smithia purpurea* Hook.	Leguminosae	UP
149	*Smithia sensitiva* Aiton	Leguminosae	MP, UP
150*	*Smithia setulosa* Dalzell	Leguminosae	MP, UP
151	*Teramnus labialis* (L.f.) Spreng.	Leguminosae	Slope UP
152	*Vigna dalzelliana* (Kuntze) Verdc.	Leguminosae	Slope UP
153$	*Vigna khandalensis* (Santapau) Sundararagh. & Wadhwa	Leguminosae	Slope UP
154*	*Vigna sahyadriana* Aitwade, K.V. Bhat & S.R.Yadav	Leguminosae	Slopes MP
155	*Polygala arvensis* Willd.	Polygalaceae	Slopes
156	*Polygala persicariifolia* DC.	Polygalaceae	Slopes
157	*Elaeagnus conferta* Roxb.	Elaeagnaceae	MP
158	*Ziziphus rugosa* Lam.	Rhamnaceae	MP
159	*Ziziphus mauritiana* Lam.	Rhamnaceae	MP
160	*Trema orientalis* (L.) Blume	Ulmaceae	MP
161	*Ficus arnottiana* (Miq.) Miq.	Moraceae	MP
162	*Ficus exasperata* Vahl	Moraceae	MP
163	*Ficus racemosa* L.	Moraceae	MP
164	*Ficus tinctoria ssp. gibbosa* (Blume) Corner	Moraceae	MP
165	*Boehmeria macrophylla* Hornem.	Urticaceae	Slope MP
166	*Girardinia diversifolia* (Link) Friis	Urticaceae	Slope MP
167	*Laportea interrupta* (L.) Chew	Urticaceae	MP
168	*Lecanthus peduncularis* (Wall. ex Royle) Wedd.	Urticaceae	UP
169	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	MP
170$	*Cucumis setosus* Cogn.	Cucurbitaceae	MP
171	*Diplocyclos palmatus* (L.) C.Jeffrey	Cucurbitaceae	Slope MP,UP
172	*Momordica cymbalaria* Fenzl ex Naudin	Cucurbitaceae	Slope UP
173	*Momordica dioica* Roxb. ex Willd.	Cucurbitaceae	Slope UP
174$	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae	Slope UP
175	*Trichosanthes tricuspidata* Lour.	Cucurbitaceae	MP
176	*Zehneria perpusilla* (Blume) Bole & M.R.Almeida	Cucurbitaceae	MP
177	*Begonia crenata* Dryand.	Begoniaceae	BP,MP
178	*Celastrus paniculatus* Willd.	Celastraceae	Slope MP
179	*Maytenus rothiana* Lobr.-Callen	Celastraceae	MP, Slope UP

	Plant species	Family	Location
180	*Oxalis corniculata* L.	Oxalidaceae	MP
181$	*Euphorbia khandallensis* Blatt. & Hallb.	Euphorbiaceae	MP, UP
182	*Euphorbia ligularia* Roxb.	Euphorbiaceae	UP
183*	*Euphorbia pycnostegia* Boiss.	Euphorbiaceae	Slope UP
184	*Falconeria insignis* Royle	Euphorbiaceae	Along slopes of BP
185	*Jatropha curcas* L.	Euphorbiaceae	MP
186	*Mallotus philippensis* (Lam.) Müll.Arg.	Euphorbiaceae	MP, Slope UP
187	*Securinega leucopyrus* (Willd.) Muell.-Arg.	Euphorbiaceae	MP
188	*Bridelia retusa* (L.) A.Juss.	Phyllanthaceae	BP, MP
189$	*Glochidion hohenackeri* (Müll.Arg.) Bedd.	Phyllanthaceae	MP
190	*Phyllanthus urinaria* L.	Phyllanthaceae	MP
191	*Linum mysorense* B.Heyne ex Wall.	Linaceae	Slope MP
192	*Terminalia chebula* Retz.	Combretaceae	BP , MP
193	*Terminalia tomentosa* Wight & Arn.	Combretaceae	BP
194	*Ammannia baccifera* L.	Lythraceae	UP
195$	*Lagerstroemia microcarpa* Wight	Lythraceae	Foothills
196*	*Rotala malampuzhensis* R.V.Nair ex C.D.K.Cook	Lythraceae	UP,MP
197	*Rotala rosea* (Poir.) C.D.K.Cook	Lythraceae	UP, MP
198	*Rotala serpyllifolia* (Roth) Bremek.	Lythraceae	UP
199	*Woodfordia fruticosa* (L.) Kurz	Lythraceae	BP
200	*Ludwigia octovalvis* (Jacq.) P.H.Raven	Onagraceae	UP
201	*Syzygium cumini* (L.) Skeels	Myrtaceae	BP
202*	*Sonerila scapigera* Dalzell	Melastomataceae	UP
203	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	UP
204	*Mangifera indica* L.	Anacardiaceae -	BP , MP
205	*Schleichera oleosa* (Lour.) Oken	Sapindaceae	MP
206	*Abelmoschus manihot* (L.) Medik.	Malvaceae	MP
207	*Abutilon persicum* (Burm.f.) Merr.	Malvaceae	MP
208$	*Eriolaena quinquelocularis* (Wight & Arn.) Wight	Malvaceae	MP
209	*Helicteres isora* L.	Malvaceae	BP
210	*Kydia calycina* Roxb.	Malvaceae	MP
211	*Sida acuta* Burm.f.	Malvaceae	BP
212	*Sida cordata* (Burm.f.) Borss.Waalk.	Malvaceae	BP
213	*Sida rhomboidea* Roxb. ex Fleming	Malvaceae	BP
214	*Sterculia guttata* Roxb. ex G.Don	Malvaceae	Slope MP
215	*Thespesia lampas* (Cav.) Dalzell	Malvaceae	MP
216	*Thespesia populnea* (L.) Sol. ex Correa	Malvaceae	Foothills
217	*Triumfetta annua* L.	Malvaceae	MP
218	*Triumfetta rhomboidea* Jacq.	Malvaceae	MP
219$	*Cleome simplicifolia* Hook.f. & Thomson	Cleomaceae	Slope UP
220	*Cardamine trichocarpa* Hochst. ex A.Rich.	Brassicaceae	Slope MP
221	*Roripa indica* (L.) Hiern	Brassicaceae	MP
222	*Dendrophthoe falcata* (L.f.) Ettingsh.	Loranthaceae	MP
223	*Persicaria glabra* (Willd.) M.Gomez	Polygonaceae	MP
224	*Polygonum plebeium* R.Br.	Polygonaceae	MP

	Plant species	Family	Location
225	*Drosera indica* L.	Droserceae	UP
226	*Achyranthes aspera* L.	Amaranthaceae	MP
227	*Alternanthera ficoidea* (L.) Sm.	Amaranthaceae	BP
228	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae	Bp
229	*Celosia argentea* L.	Amaranthaceae	BP
230	*Gomphrena celosioides* Mart.	Amaranthaceae	MP
231	*Nothosaerva brachiata* (L.) Wight	Amaranthaceae-	Slope between MP and UP
232	*Glinus lotoides* L.	Aizoaceae	MP
233	*Impatiens balsamina* L.	Balsaminaceae	Slopes
234*	*Impatiens dalzellii* Hook.f. & Thomson	Balsaminaceae	Slopes along UP
235	*Impatiens minor* (DC.) Bennet	Balsaminaceae	MP
236	*Impatiens oppositifolia* L.	Balsaminaceae	MP
237	*Careya arborea* Roxb.	Lecythidaceae	MP
238	*Diospyros montana* Roxb.	Ebenaceae	MP
239	*Anagallis arvensis* L.	Primulaceae	MP
240	*Anagallis pumila* Sw.	Primulaceae	MP
241	*Embelia tsjeriam-cottam* (Roem. & Schult.) A.DC.	Primulaceae	MP
242	*Catunaregam spinosa* (Thunb.) Tirveng.	Rubiaceae	MP
243	*Meyna laxiflora* Robyns	Rubiaceae	MP
244$	*Neanotis foetida* (Dalzell) W.H.Lewis	Rubiaceae	Slope, UP, UP
245	*Neanotis montholonii* (Hook.f.) W.H.Lewis	Rubiaceae	MP
246	*Oldenlandia corymbosa* L.	Rubiaceae	UP
247	*Pavetta indica* L.	Rubiaceae	MP
248	*Spermadictyon suaveolens* Roxb.	Rubiaceae	MP
249	*Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult.	Gentianaceae	Slopes MP
250	*Canscora pauciflora* Dalzell	Gentianaceae	Slope UP
251$	*Centaurium meyeri* (Bunge) Druce	Gentianaceae	MP
252$	*Exacum lawii* C.B.Clarke	Gentianaceae	Slope UP, UP
253	*Exacum petiolare* Griseb.	Gentianaceae	Slope UP, UP
254$	*Swertia minor* T.Cooke	Gentianaceae	Slope UP, UP
255	*Calotropis procera (*Aiton) Dryand.	Apocynaceae	BP
256	*Carissa congesta* Wight	Apocynaceae	MP
257*	*Ceropegia anjanerica* Malpure, M.Y.Kamble & S.R.Yadav	Apocynaceae	UP
258	*Ceropegia bulbosa* var. *bulbosa* Roxb.	Apocynaceae	UP
259*	*Ceropegia lawii* Hook.f.	Apocynaceae	MP, UP
260*	*Ceropegia media* (Huber) Ansari	Apocynaceae	Slopes
261	*Cryptolepis buchananii* Roem. & Schult.	Apocynaceae	UP
262	*Cynanchum callialatum* Buch.-Ham. ex Wight	Apocynaceae	Slope between MP and UP
263$	*Frerea indica* Dalzell	Apocynaceae	Along steep boulders
264	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Apocynaceae	BP
265$	*Heterostemma alatum* Wight & Arn.	Apocynaceae	UP
266	*Nerium oleander* L.	Apocynaceae	MP
267	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Apocynaceae	BP
268$	*Tylophora dalzellii* Hook.f.	Apocynaceae	MP
269$	*Adelocaryum coelestinum* (Lindl.) Brand	Boraginaceae	Slope of UP

	Plant species	Family	Location
270$	*Adelocaryum malabaricum* (C.B.Clarke) Brand	Boraginaceae	Slope of UP
271	*Cordia dichotoma* G.Forst.	Boraginaceae	BP
272	*Cynoglossum wallichii* G.Don	Boraginaceae	UP
273	*Heliotropium indicum* L.	Boraginaceae	MP
274	*Heliotropium supinum* L.	Boraginaceae	Slope of MP
275	*Trichodesma inaequale* Edgew.	Boraginaceae	MP
276*	*Argyreia involucrata* C.B.Clarke	Convolvulaceae	BP
277	*Dinetus racemosus* (Roxb.) Buch.-Ham. ex Sweet	Convolvulaceae	MP
278	*Ipomoea hederifolia* L.	Convolvulaceae	MP
279	*Ipomoea illustris* (C.B.Clarke) Prain	Convolvulaceae	MP
280	*Ipomoea nil* (L.) Roth	Convolvulaceae	BP
281	*Ipomoea obscura* (L.) Ker Gawl.	Convolvulaceae	MP
282	*Ipomoea triloba* L.	Convolvulaceae	BP
283	*Rivea hypocrateriformis* Choisy	Convolvulaceae	MP
284	*Rivea ornata* Choisy	Convolvulaceae	MP
285	*Solanum anguivi* Lam.	Solanaceae	MP
286	*Jasminum arborescens* Roxb.	Oleaceae	MP
287	*Olea dioica* Roxb.	Oleaceae	MP
288	*Lindenbergia muraria* (Roxburgh ex D. Don) Brühl	Plantaginaceae	MP, UP
289	*Mecardonia procumbens* (Mill.) Small	Plantaginaceae	MP
290	*Lindernia ciliata* (Colsm.) Pennell	Linderniaceae	UP
291	*Lindernia nummulariifolia (*D.Don) Wettst.	Linderniaceae	UP
292	*Lindernia parviflora* (Roxb.) Haines	Linderniaceae	UP
293	*Torenia indica* C.J.Saldanha	Linderniaceae	UP
294$	*Nepeta hundostana* var. *woodrowii* (T.Cooke) Santapau	Lamiaceae	Slope UP
295	*Anisochilus carnosus* (L.f.) Wall.	Lamiaceae	MP
296$	*Anisomeles heyneana* Benth.	Lamiaceae	Slope UP
297	*Colebrookea oppositifolia* Sm.	Lamiaceae	BP
298	*Lantana camara* L.	Lamiaceae	BP
299$	*Lavandula bipinnata* (Roth) Kuntze	Lamiaceae	Slope MP
300	*Leucas lavandulaefolia* Rees	Lamiaceae	MP, UP
301	*Leucas martinicensis* (Jacq.) R.Br.	Lamiaceae	UP, MP Slope
302	*Leucas stelligera* Wall. ex Benth.	Lamiaceae	MP,UP
303	*Plectranthus mollis* (Aiton) Spreng.	Lamiaceae	MP
304	*Pogostemon benghalensis* (Burm.f.) Kuntze	Lamiaceae	BP
305$	*Pogostemon deccanensis* (Panigrahi) Press	Lamiaceae	UP
306	*Rotheca serrata* (L.) Steane & Mabb.	Lamiaceae	Slope UP
307	*Tectona grandis* L.f.	Lamiaceae	BP
308	*Vitex negundo* L.	Lamiaceae	MP
309	*Parasopubia delphiniifolia* (L.) H.-P. Hofm. & Eb. Fisch.	Orobanchaceae	MP
310*	*Rhamphicarpa longiflora* Benth.	Orobanchaceae	MP
311	*Striga gesnerioides* (Willd.) Vatke	Orobanchaceae	UP
312$	*Utricularia janarthanamii* S.R.Yadav, Sardesai & S.P.Gaikwad	Lentibulariaceae	UP
313 $	*Utricularia praeterita* P.Taylor	Lentibulariaceae	UP
314	*Utricularia striatula* Sm.	Lentibulariaceae	MP and UP

	Plant species	Family	Location
315	*Asystasia dalzeliana* Santapau	Acanthaceae	MP
316$	*Barleria lawii* T.Anderson	Acanthaceae	Slope between BP and MP
317*	*Cynarospermum asperrimum* (Nees) Vollesen	Acanthaceae	Slope between UP and MP
318	*Dicliptera leonotis* Dalzell ex C.B.Clarke	Acanthaceae	MP
319$	*Eranthemum roseum* (Vahl.) R.Br.	Acanthaceae	Slopes
320$	*Haplanthodes verticellata* (Roxb.) R.B.Majumdar	Acanthaceae	UP
321$	*Hemigraphis crenata* (Benth.) Bremek.	Acanthaceae	Slope between MP and UP
322$	*Hemigraphis latebrosa* (Roth) Nees	Acanthaceae	Slope between MP and UP
323	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae	MP
324$	*Hygrophila serpyllum* (Nees) T.Anderson	Acanthaceae	MP
325	*Justicia betonica* L.	Acanthaceae	Slope between MP and UP
326	*Justicia japonica* Thunb.	Acanthaceae	Slope between MP and UP
327	*Justicia procumbens* L.	Acanthaceae	Slope between MP and UP
328$	*Lepidagathis cuspidata* Nees	Acanthaceae	MP and Slope between MP and UP
329$	*Lepidagathis trinervis* Nees	Acanthaceae	UP
330$	*Neuracanthus sphaerostachys* Dalzell	Acanthaceae	MP
331	*Peristrophe bicalyculata* (Retz.) Nees	Acanthaceae	Slope between MP and UP
332$	*Rungia elegans* Dalzell & A.Gibson	Acanthaceae	Slope between MP and UP
333	*Rungia pectinata* (L.) Nees	Acanthaceae	Slope between MP and UP
334$	*Strobilanthes callosa* Nees	Acanthaceae	Slope between MP and UP , UP
335$	*Strobilanthes reticulata* Stapf	Acanthaceae	UP
336$	*Heterophragma quadriloculare* (Roxb.) K.Schum.	Bignoniaceae	BP
337	*Lantana camara* L.	Verbenaceae	BP
338	*Martynia annua* L.	Martyniaceae	MP
339	*Lobelia heyneana* Schult.	Campanulaceae	Slope UP, UP
340	*Lobelia nicotianifolia* Roth ex Schult.	Campanulaceae	Slope UP,UP
341	*Acmella paniculata* (Wall. ex DC.) R.K.Jansen	Asteraceae	MP
342	*Ageratum conyzoides* L.	Asteraceae	MP
343	*Bidens biternata* (Lour.) Merr. & Sherff	Asteraceae	MP, BP
344$	*Blumea eriantha* DC.	Asteraceae	Slope between BP & UP
345$	*Blumea malcolmii* Hook.f.	Asteraceae	Slope between BP & UP
346	*Blumea mollis* (D.Don) Merr.	Asteraceae	MP
347$	*Caesulia axillaris* Roxb.	Asteraceae	Slope between BP & UP
348	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	Slope between MP & UP
349	*Cosmos caudatus* Kunth	Asteraceae	Slope between BP & UP
350	*Cyanthillium cinereum* (L.) H.Rob.	Asteraceae	BP
351$	*Cyathocline lutea* Law ex Wight	Asteraceae	UP
352	*Cyathocline purpurea* (Buch.-Ham. ex D.Don) Kuntze	Asteraceae	MP
353	*Eclipta prostrata* (L.) L.	Asteraceae	BP
354	*Elephantopus scaber* L.	Asteraceae	MP, UP
355	*Emilia sonchifolia* (L.) DC. ex DC.	Asteraceae	Slope between MP & UP
356	*Erigeron trilobus* (Decne.) Boiss.	Asteraceae	Slope between BP & UP
357	*Galinsoga parviflora* Cav.	Asteraceae	Slope between MP & UP
358	*Gnaphalium pulvinatum* Delile	Asteraceae	Slope between MP & UP

	Plant species	Family	Location
359	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Slope between MP & UP
360	*Gynura bicolor* (Roxb. Ex Willd.) DC.	Asteraceae	Slope between MP & UP
361	*Kleinia grandiflora* (Wallich ex DC.) N.Rani	Asteraceae	Slope between MP & UP
362	*Lagascea mollis* Cav.	Asteraceae	BP
363	*Laphangium luteoalbum* (L.) Tzvelev	Asteraceae	Slope between MP & UP
364	*Launaea procumbens* (Roxb.) Ramayya & Rajagopal	Asteraceae	BP
365*	*Nanothamnus sericeus* Thomson	Asteraceae	Slope between MP & UP
366	*Pentanema cernuum* (Dalzell) Ling	Asteraceae	MP, UP
367	*Pentanema indicum* (L.) Ling	Asteraceae	MP,UP
368$	*Phyllocephalum scabridum* (DC.) K.Kirkman	Asteraceae	Slope between MP & UP
369	*Pluchea senecioides* (DC.) W.Theob.	Asteraceae	UP
370$	*Senecio bombayensis* N.P.Balakr.	Asteraceae	MP, UP
371*	*Senecio dalzellii* C.B.Clarke	Asteraceae	MP,UP
372	*Sigesbeckia orientalis* L.	Asteraceae	UP
373	*Sonchus oleraceus* (L.) L.	Asteraceae	UP
374	*Sphaeranthus indicus* L.	Asteraceae	BP
375	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	MP
376$	*Tricholepis amplexicaulis* C.B.Clarke	Asteraceae	MP
377	*Tridax procumbens* L.	Asteraceae	BP
378	*Vernonia anthelmintica* (L.) Willd.	Asteraceae	BP
379	*Vernonia divergens* (DC.) Edgew.	Asteraceae	BP
380	*Xanthium strumarium* L.	Asteraceae	BP
381*	*Heracleum grande* (Dalzell & A. Gibson) Mukhop.	Apiaceae	UP
382$	*Pimpinella adscendens* Dalzell	Apiaceae	UP
383$	*Pimpinella wallichiana* (Miq.) Gandhi	Apiaceae	Slopes
384*	*Pinda concanensis* (Dalzell) P.K. Mukh. & Constance	Apiaceae	UP and Slopes
385	*Trachyspermum roxburghianum* (DC.) H.Wolff	Apiaceae	UP

$—Endemic to India | *—Endemic to Western Ghats | MP—Middle plateau | BP—Basal plateau | UP—Upper plateau.

the peak flowering period on the plateau; 3. In the post monsoon phase (October–December) *Arundinella ciliata*, *Indopoa paupercula*, *Dimeria* spp., and *Striga gesnerioides* come in flowering; 4. The fourth phase (January–May) is the dry period during which only a few species such as *Blumea eriantha*, *Blumea malcolmii*, *Lepidgathis cuspidata* flower in January–February. *Drimia polyantha*, *Euphorbia khandallensis*, and *Pancratium nairii* flowers in March. Observations on the phenology of the plants revealed that maximum number of species complete their reproductive cycle between July and December.

Middle slopes of Anjaneri Hill exhibit small patch of evergreen trees, shrubs, and herbaceous flora due to retention of some amount of soil. Surrounding plants also affected the climatic condition of the plateaux, which favors the herbaceous flora, e.g., the forest undergrowth.

Threats

Anjaneri Hill is utilized for grazing, resource extraction, and tourism. Relatively easy road access, trampling, trails, and tourist services, could have direct or indirect impacts on floristic diversity. We have reported the shifting of few plant species and decrease in population from middle level e.g., *Pinda concanensis*, *Pancratium nairii*, *Drimia polyantha*, *Polygala arvensis*, and few species of *Smithia* to upper plateaux due to drastic seasonal changes in moisture content, amount and time of rainfall. Heavy rainfall for longer duration causes vegetative growth and delay in initiation of flowering in *Pogostemon deccanensis*.

Adaptive traits

Plants on this plateau experience harsh environmental conditions, e.g., drought, high temperature and

light intensities and nutrient deficiency, which cause development of certain traits in plants of plateaux, which allow them to overcome environmental adversities. A detailed account on the adaptation/eco-physiology of vascular plants of rock outcrops is provided by Kluge & Brulfert (2000). Some well-known adaptive traits that have been observed in the vascular plants on the plateaux are mentioned below (modified after Biedinger et al. 2000).

1. Carnivory: It is a means to overcome the scarcity of Nitrogen, Phosphorous and Sulphur in the soil. Carnivorous plants are extremely calcifuge and need acidic and wet soils (Kluge & Brulfert 2000). *Drosera indica*, *Utricularia prateirata* are the common carnivores on the plateaux. These species comprise ephemeral vegetation where soil deposition is negligible.

2. Succulence: Succulence is a 'desiccation avoidance strategy' in xeric habitats. Typical leaf succulents of the plateau are *Cyanotis concanensis* Hassk. and *Euphorbia khandallensis*.

3. Poikilohydry: These are plants in which water content varies with the varying humidity in the environment. Desiccation tolerance is mainly a protoplasmic property, e.g., *Tripogon lisboae.*

4. Subterranean perennating organs: This is yet another adaptive strategy of the plants of the

plateau in the form of underground perennation organs like corms, rhizomes, bulbs, and tubers, e.g., geophytes like *Ceropegia anjanerica*, *C. lawii*, *Curcuma neilgherrensis*, *Cyanotis fasciculata*, *C. concanensis*, *Eriocaulon tuberiferum*, *Euphorbia khandallensis*, *Habenaria* spp., and *Hypoxis aurea*.

5. Vegetative propagation: Vegetative propagules such as bulbs and bulbils formed at the leaf tips are an adaptation of some plants of the plateaux, e.g., *Curculigo orchioides*

CONCLUSIONS

Anjaneri a basaltic outcrop is unique due to great diversity (385 species), high endemism (114 taxa) and as type locality of *Ceropegia anjanerica*. Outcrop exhibited different habitats due to its distinct geographical location, climatic condition and edaphic nature. Due to adverse climatic conditions and extreme micro-environments, plants have developed unique morphological, physiological and life cycle adaptations.

The environmental uniqueness, high diversity, IUCN assessment studies, high anthropogenic activities and rapid destruction of these ecosystems make Anjaneri outcrop a "hotspeck". Systematic approaches are required to conserve various unique habitats, which supported great diversity of existing plant species and for the conservation of *Ceropegia anjanerica.*

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Author contribution: SAG done the preliminary survey of the area, planned the field tours and documented the Plants through Video Camera, wrote the first raw draft of the MS. SSK analyzed the data, identified the dicotyledonous plants and confirmed their identity. KVCG worked on the monocotyledonous plants especially on the grasses and photographed the plants. ANC documented and confirmed the identities of the monocotyledonous plants especially Cyperaceae.

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