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COMMUNICATION

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COMMUNICATION

Floristic enumeration of Torna Fort (Western Ghats, India): a storehouse of endemic plants

Mayur D. Nandikar [1], Priyanka T. Giranje [2] & Durga C. Jadhav [3]

[1,2,3] Naoroji Godrej Centre for Plant Research, 431, Lawkim Campus, Shindewadi, Shirwal, Satara, Maharashtra 412801, India
[1] mnandikar@gmail.com, nandikar@godrej.com (corresponding author), [2] priyagiranje24@gmail.com, [3] durgacjadhav@gmail.com

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Abstract: The forts on hilltops of the Sahyadri (northern Western Ghats) have seen a turbulent historical past and are famous for their architectural style and cultural heritage. Besides this, these hilltops are home to an incredible plant diversity. One of the highest hilltop forts (ca. 1,403m) the Torna, has been explored since 2012 for floral assessment. The study documented ca. 399 plant species of which about 28% are endemic to the Western Ghats and 16 monotypic species were recorded. A brief account of the immense floristic diversity and new findings from Torna fort are summarized in the present article.

Keywords: Endemism, hilltop forts, flowering plants, northern Western Ghats.

Marathi Abstract: मराठी सारांश: सह्याद्री डोंगररांगांवर (उत्तर पश्चिम घाट) वसलेले उंच गडकोट किल्ले हे त्यांच्या बुलंद इतिहासासोबत स्थापत्य शैली आणि सांस्कृतिक वारसा जपतात. यासोबतच हया डोंगररांगा अविश्वसनिय अशी वनस्पती वैभवता आणि विविधता जोपासतात. अशाच उंच डोंगररांगांवर वसलेला गडकोट तोरणा किल्ला (समुद्रसपाटी पासून १४०३ मीटर उंच) हा त्याच्या वनस्पती वैभवासाठी सन २०१२ पासून अभ्यासला गेला. अभ्यासाअंती जवळपास ३९९ सपुष्प वनस्पती नोंद करण्यात आल्या, त्यापैकी साधारणत: २८ % वनस्पती या स्थानिक असून फक्त पश्चिम घाटातच आढळतात, सोबत त्यातील १६ वनस्पती या जगभर फक्त एकाच प्रजातीने ओळखल्या जातात. सदरच्या अहवालात तोरणा डोंगरावरील वनस्पती नोंदीसह त्यांच्या विविधतेबद्दलची माहिती, नवीन वनस्पतींची नोंद, त्यांचे महत्व आणि संवर्धन यांची सविस्तर मांडणी केली आहे.

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Author Details: Dr. Mayur D. Nandikar - presently working in the area of plant taxonomy and conservation as a Scientist and Head at Naoroji Godrej Centre for Plant Research (NGCPR) Shirwal. Ms. Priyanka T. Giranje - research fellow at NGCPR, working in biosystematics studies on the genus *Ledebouria* in India and also studying the endemic plants from the northern Western Ghats. Ms. Durga C. Jadhav - research fellow at NGCPR, studying the genus *Salacia* in India and also engaged in documentation of local flora from Satara District.

Author Contribution: MDN - Project design, proposal, implementation, plant collection, photography, data interpretation, editing. PTG - Plant collection, endemic plant enumeration, herbarium preparation, manuscript writing. DCJ - Plant collection, data processing, herbarium preparation, manuscript writing.

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INTRODUCTION

India is one of the megabiodiverse countries of the world. It has diverse biogeography, and consists of about 18,000 plant species, which is almost 11% of total species in the world (Singh et al. 2015). One of the global biodiversity hotspots, the Western Ghats consist more than 7,400 plant species of which 1,270 are endemic (Nayar et al. 2014). Mountain ranges of the northern Western Ghats are commonly known as Sahyadri. These ranges are very diverse in the habitats, flora and fauna.

The northern Western Ghats spreads from Tapti (Gujarat) to Goa with an average elevation of 900m. Torna hilltop with an altitude 1,403m is one of the tallest peaks in Maharashtra and highest peak in Pune District. It is one of the renowned historical forts, which served as the capital of Maratha dynasty for 25 years and lies 50km southwest of Pune City in Velhe Tehsil.

Hilltop forts in Sahyadri are famous for their architectural style, cultural heritage and for being witness to the turbulent historical past. In addition, these forts and adjoining areas possess specific habitats like flat summits, rocky flanks, crevices, precipitous slopes, which shelter extremely rich plant diversity. Previous documentation of these centres of floristic diversity includes Sinhagad, Purandar and Khandala (Santapau 1951, 1957, 1967), Torna Hills, Katraj Ghats and Rajgad Fort (Vartak 1953, 1960, 1965), Harishchandragad (Billore & Hemadri 1969), and the enumeration of vegetation from hilltops near Pune and adjoining areas (Cooke 1901–1908; Razi 1952). Moreover, new species and new additions to the state flora have been published from these hilltops during the last century. Detailed study on the endemism from these hilltops has not been done so far and therefore, the present study on floristic assessment and endemism is the beginning of this endeavour.

METHODS

Study area

The study was in and around Torna Fort which is situated between 18.29059722^{0}N and 73.62444444^{0}E, 18.26516389^{0}N and 73.61055556^{0}E, covering a study area of ca. 10,000ha. It ranges from the foot of the mountain at village Velhe, Pune (750m) to the hilltop of Torna Fort situated at 1,403m and about 50km southwest of Pune, Maharashtra (Image 1). Foothill soil is mainly composed of 'moorum' (a soil type, comprising small pieces of disintegrated rock or shale) and red soil while slopes have loose red soil, the plateau top has very shallow soil cover on basalt. Average rainfall during the six months of monsoon is around 900mm (Maharashtra State Gazetteer 1992). Torna Fort is frequently visited by tourists, trekkers, and nature lovers during the monsoon. Hilltop and slopes are used by local inhabitants for grazing and collection of fuel wood. Widening of the tar road have opened a corridor for tourist vehicles up to the middle of the fort and it can be referred to as a possible threat to the habitat.

Data collection

Our study is an outcome of continuous expeditions to the Torna Fort during 2012–2017. Plant materials were collected during regular field visits at different seasons. Bridson & Forman (1999) have been followed for herbarium preparations. The identity of plants was confirmed with the help of floras (Cooke 1901–1908; Lakshminarasimhan 1996; Singh & Karthikeyan 2000,

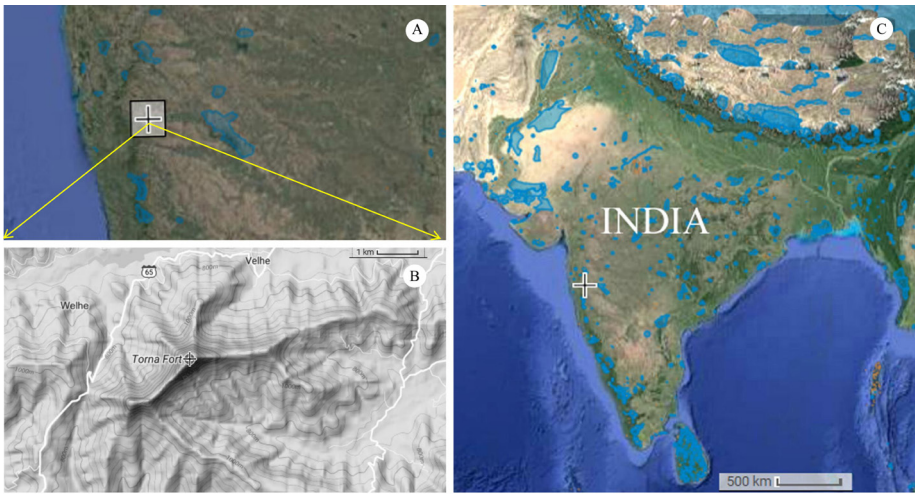

Image 1. Location map of Torna Fort. A - Satellite magnified view from C; B - Terrain view of Torna Fort; C - Satellite view of India ' + ' denotes the locality 'Torna Fort.'

2001). The collected specimens have been deposited at NGCPR with accession details. Besides this Agharkar Research Institute, Pune (AHMA) and Fergusson College Herbarium, Pune have been consulted for the specimens collected by V.D. Vartak from Torna and adjoining area. Endemic statuses of plants were confirmed by using research publications (Tetali et al. 2000; Gaikwad et al. 2014; Nayar et al. 2014; Singh et al. 2015). The families have been arranged alphabetically. Binomials and nomenclature follows the International Plant Name Index (IPNI 2012). The monotypic taxa have been identified (Rana & Ranade 2009). Categorization for threat has followed the IUCN (2017). A glimpse of endemic plants is featured in the images (Images 3–7).

RESULTS

Torna Fort shows a high degree of variation in habitats and in vegetation patterns. The plateau and plains are covered with grasses, sedges, orchids, scrophulariaceae, legumes and other ephemerals, *Strobilanthes*, etc. (Image 2 C & G). Vertical rocky cliffs are covered with liverworts, mosses, ferns, balsams, lithophytic grasses, Begonias, *Senecio edgeworthii* Hook. f., etc. (Image 2E). Vegetation on slopes are dominated by large number of endemic species, viz., *Ceropegia sahyadrica* Ansari & B.G.P.Kulk., *Chlorophytum glaucum* Dalzell, *Neuracanthus sphaerostachys* (Nees) Dalzell, *Adenoon indicum* Dalzell, *Strobilanthes sessilis* Nees, *S. callosus* Nees, *Barleria sepalosa* C.B. Clarke, *Delphinium malabaricum* (Huth) Munz, *Adelocaryum malabaricum* (C.B. Clarke) Brand, *Echinops echinatus* Roxb., and *Thalictrum dalzellii* Hook (Image 2B). Rocky crevices

Image 2. A - Main crest of Torna Fort; B - Slopes with mass flowering of *Strobilanthes callosus*; C - Plains dominated by *Strobilanthes sessilis*; D - Hillslopes with mass flowering of *Strobilanthes sessilis*; E - Vertical rocky cliffs; F - Plains with mixed vegetation of *Echinops echinatus*, *Senecio bombayensis* and *Adelocaryum* spp.; G - Plateaus and plains dominated by grasses and *Conyza stricta*

Table 1. Plant checklist of Torna Fort (in the northern Western Ghats, India)

	Family / Species	Habit, Habitat, Endemism, IUCN status	Phenology	Accession number
	Acanthaceae			
1	*Asystasia dalzelliana* Santapau	H; SL	Nov–Mar	VDV5838
2	*Barleria sepalosa* C.B. Clarke*	S; HS; END MH	Jan–Oct	PTG747/VDV421
3	*Blepharis integrifolia* E. Mey. & Drege ex Schinz	H; RA	Oct–Mar	DCJ720
4	*Calacanthus grandiflorus* (Dalzell) Radlk.*	S; SL; END WG	Oct–Mar	VDV23272
5	*Cynarospermum asperrimum* (Nees) Vollesen*	H; SL; END WG	Oct–Mar	VDV2848
6	*Eranthemum roseum* (Vahl) R. Br.*	S; SL, GL; END WG	Oct–Mar	VDV3535
7	*Haplanthodes verticillatus* R.B. Majumdar*	H; RC; END E. IND, WG	Dec–June	PTG781
8	*Hemigraphis latebrosa* (B. Heyne ex Roth) Nees*	H; B; END WG	Dec–Apr	PTG782
9	*Justicia betonica* L.	S; SL	Sept–Mar	VDV279/DCJ848
10	*Justicia procumbens* L.	H; HS	Oct–Mar	VDV120
11	*Neuracanthus sphaerostachys* (Nees) Dalzell*	H; HS; END WG	Aug–Jan	VDV127/DCJ799
12	*Rhinacanthus nasutus* (L.) Kurz	S; PL	Oct–Apr	KC-T004
13	*Rungia pectinata* (L.) Nees	H; HS	Sept–May	VDV278
14	*Strobilanthes callosa* Nees*	S; HS; END WG	Aug–Dec	PTG750
15	*Strobilanthes sessilis* var. *ritchiei* C.B. Clarke*	S; PT, HS; END WG	Sept–Mar	DCJ829
16	*Thunbergia fragrans* Roxb.	CL; HS	Sept–Dec	VDV3501
17	*Lepidagathis cuspidata* Nees	S; RC	Feb–June	DCJ866
	Aizoaceae			
18	*Mollugo pentaphylla* L.	H; PT	July–Dec	VDV3366
	Amaranthaceae			
19	*Achyranthes aspera* L.	H; PL,WA	Sept–Oct	PTG705
20	*Achyranthes coynei* Santapau*	S; RC; END MH	Sept–Mar	DCJ844
21	*Alternanthera sessilis* (L.) R. Br. ex DC.	H; PL	Throughout	DCJ702
22	*Amaranthus spinosus* L.	H; GL	July–Feb	DCJ703
23	*Celosia argentea* L.	H; C	Aug–Feb	DCJ724
	Anacardiaceae			
24	*Mangifera indica* L.	T; C	Dec–June	VDV1331
	Annonaceae			
25	*Annona squamosa* L.	T; C	Apr–Aug	DCJ706
26	*Artabotrys hexapetalus* (L. f.) Bhandari	SS; C	Aug–Sept	VDV00072
	Apiaceae			
27	*Pimpinella adscendens* Dalzell*	H; GL, PT; END WG MH	Oct–Feb	VDV *s.n*
28	*Pimpinella wallichiana* (Miq. ex Hohen.) Gandhi*	H; HS; END P.IND	Aug–Feb	VDV1261
29	*Pinda concanensis* (Dalzell) P.K. Mukh. & Constance*	H; PT, HS, GL; END WG MH	July–Sept	PTG812
	Apocynaceae *sensu lato*			
30	*Calotropis gigantea* (L.) R. Br.	S; GL	Oct–July	PTG727
31	*Carissa spinarum* L.	S; SL	Dec–June	DCJ722
32	*Ceropegia maccannii* Ansari*	H; HS; END MH	July–Oct	DCJ841
33	*Ceropegia media* (H. Huber) Ansari*	TH; HS; END MH	July–Oct	DCJ842
34	*Ceropegia oculata* Hook.*	TH; HS; END MH, KL	July–Nov	DCJ726
35	*Ceropegia sahyadrica* Ansari & B.G. Kulkarni*	H; HS; END MH	Aug–Oct	DCJ727

	Family / Species	Habit, Habitat, Endemism, IUCN status	Phenology	Accession number
36	*Cryptolepis buchananii* R. Br. ex Roem. & Schult.	CL; SL	Throughout	DCJ731
37	*Frerea indica* Dalzell*	H; RC; END MH; EN	Sept–Jan	PTG774
38	*Hemidesmus indicus* (L.) R. Br.	CL; HG, B	July–May	PTG782
39	*Nerium oleander* L.	S; C	Nov–Mar	DCJ798
40	*Plumeria rubra* L.	S; C	Mar–Sept	PTG815
41	*Tylophora dalzelii* Hook. f.*	CL; B; END WG	Apr–Dec	PTG834
	Araceae			
42	*Arisaema murrayi* (J.Graham) Hook.*	H; RC; END WG	May–Oct	PTG711
43	*Colocasia esculenta* (L.) Schott	H; C	Aug–Oct	PTG742
	Asparagaceae *sensu lato*			
44	*Agave cantala* (Haw.) Roxb.ex Salm Dyck	S; SL	Jan–June	DCJ701
45	*Chlorophytum glaucoides* Blatt.*	H; HS; END MH	Aug–Oct	PTG732
46	*Chlorophytum glaucum* Dalzell*	H; HS; END EG & WG AP, MH	Sept–Oct	DCJ794
47	*Asparagus racemosus* Willd.	CL; SL	June–Oct	DCJ716
	Asteraceae			
48	*Adenoon indicum* Dalzell*	H; SL; END WG	Sept–Dec	VDV3808
49	*Ageratum conyzoides* L.	H; PL	July–Feb	VDV3814
50	*Artemisia japonica* Thunb.	H; HS	Oct–Dec	VDV115
51	*Artemisia nilagirica* (C.B. Clarke) Pamp.*	S; HS; END WG	Sept–Jan	VDV3842
52	*Lamprachaenium microcephalum* (Dalzell) Benth.*	H; HS; END WG	Oct–Nov	DCJ717
53	*Phyllocephalum scabridum* (DC.) K. Kirkman*	H; HS; END WG	Aug–Dec	PTG721
54	*Phyllocephalum tenue* (C.B. Clarke) Narayana	H; HS	Aug–Dec	MDN-T726
55	*Bidens biternata* (Lour.) Merr. & Sherff ex Sherff	H; PL	Aug–Dec	DCJ719
56	*Blumea malcolmii* (C.B. Clarke) Hook. f.*	H; RC, PT; END WG	Oct–May	DCJ718
57	*Blumea lacera* (Burm.f.) DC.	H; PL	Oct–May	MDN-T730
58	*Conyza stricta* Willd.	H; RA	Sept–May	PTG744
59	*Cyathocline purpurea* (Buch.-Ham. ex D. Don) Kuntze	H; PL, PT	Sept–Mar	DCJ738
60	*Echinops echinatus* Roxb.	H; PL, SL	Sept–Jan	VDV415/ MDN-T718
61	*Eclipta prostrata* (L.) L.	H; PL	July–Feb	DCJ751
62	*Emilia sonchifolia* (L.) DC.	H; PL	Aug–Feb	DCJ756
63	*Guizotia abyssinica* (L. f.) Cass.	H; C	Throughout	PTG776
64	*Gynura bicolor* (Roxb. ex. Willd.) DC.	H; PL	Aug–May	PTG777
65	*Lagascea mollis* Cav.	H; RA	June–Dec	PTG795
66	*Launaea intybacea* (Jacq.) Beauverd	H; PL	Dec–June	PTG797
67	*Pentanema cernuum* (Dalzell) Ling	H; PL	Oct–Feb	VDV1694
68	*Pentanema indicum* (L.) Ling	H; GL	Nov–Feb	PTG808
69	*Senecio bombayensis* N. P. Balakr.*	H; GL, RC; END WG	Aug–May	DCJ843
70	*Senecio edgeworthii* Hook. f.*	S; SL, RC; END C. IND	Aug–Nov	DCJ813
71	*Senecio gibsonii* Hook. f.*	H; SL, RC; END WG G, KA, MH	Apr–Dec	KC-T003
72	*Sphaeranthus indicus* L.	H; PL	Nov–May	DCJ823
73	*Spilanthes acmella* (L.) L.	H; PL	Sept–Feb	DCJ824
74	*Tricholepis amplexicaulis* C. B. Clarke*	H; GL, SL; END WG	Sept–Feb	DCJ832
75	*Tridax procumbens* L.	H; C	Throughout	DCJ833
76	*Vernonia cinera* (L.) Less.	H; C	July–Feb	DCJ838
77	*Xanthium indicum* J. Koenig ex Roxb.	H; RA	Jan–May	DCJ855

	Family / Species	Habit, Habitat, Endemism, IUCN status	Phenology	Accession number
	Balsaminaceae			
78	*Impatiens acaulis* Arnott	H; VRC	Mar–Sept	VDV825
79	*Impatiens balsamina* L.	H; GL, SL	July–Sept	VDV830/ MDN-T720
80	*Impatiens dalzellii* Hook. f. & Thomson*	H; GL, SL; END MH	Aug–Oct	VDV864/ MDN-T719
81	*Impatiens oppositifolia* L.	H; GL	July–Oct	VDV14474
	Begoniaceae			
82	*Begonia crenata* Dryand.	H; VRC	Sept–Oct	VDV3344
	Bignoniaceae			
83	*Heterophragma quadriloculare* (Roxb.) K. Schum.*	T; RA; END WG	Jan–June	PTG784
	Boraginaceae			
84	*Adelocaryum coelestinum* (Lindl.) Brand*	H; SL, PT; END	July–Oct	PTG707
85	*Adelocaryum malabaricum* (C.B. Clarke) Brand*	H; HS; END WG	Aug–Nov	PTG708
86	*Cynoglossum zeylanicum* (Vahl ex Hornem.) Thunb. ex Lehm.	H; HS	Aug–Nov	DCJ743
87	*Ehretia aspera* Willd.	T; SL	Mar–June	DCJ752
88	*Ehretia laevis* Roxb.	T; SL	Mar–July	DCJ753
89	*Paracaryopsis lambertiana* (C.B. Clarke) R.R. Mill.*	H; HS; END MH	Sept–Nov	PTG804
90	*Trichodesma indicum* (L.) Lehm.	H; SL	Oct–Feb	VDV140/DCJ831
	Brassicaceae			
91	*Brassica nigra* (L.) W. D. J. Koch	H; C	Sept–May	PTG724
92	*Cardamine trichocarpa* Hochst. ex A. Rich.	H; PL	July–Sept	VDV166631
	Campanulaceae			
93	*Lobelia nicotianifolia* Roth ex Roem. & Schult.	H; SL	Oct–May	DCJ793
94	*Wahlenbergia flexuosa* (Hook. f. & Thomson) Thulin	H; PL	Oct–Mar	PTG836
	Cannaceae			
95	*Canna indica* L.	S; C	Throughout	PTG728
	Capparaceae			
96	*Capparis zeylanica* L.	S; WA, HG, RA	Feb–Apr	VDV219
	Caryophyllaceae			
97	*Polycarpaea corymbosa* (L.) Lam.	H; HS	Aug–Feb	VDV335
	Celastraceae			
98	*Celastrus paniculatus* Willd.	CL; HS	June–Dec	VDV1056
99	*Maytenus emarginata* (Willd.) Ding Hou	S; C	Sept–Feb	VDV1069
	Colchicaceae			
100	*Iphigenia magnifica* Ansari & R.S. Rao*	H; PL, PT END WG KA, MH	Sept–Dec	DCJ846
101	*Gloriosa superba* L.	SH; SL	July–Oct	DCJ773
	Combretaceae			
102	*Terminalia bellirica* (Gaertn.) Roxb.	T; HS	Mar–Nov	VDV2994
103	*Terminalia chebula* Retz.	T; HS	Feb–May	VDV3001
104	*Terminalia elliptica* Willd.	T; HS	Apr–Nov	PTG823
	Commelinaceae			
105	*Commelina benghalensis* L.	H; PL	June–Dec	MDN-T724
106	*Commelina diffusa* Burm.f.	H; PL	July–Feb	MDN-T725
107	*Commelina maculata* Edgew.	H; GL, PL	Aug–Nov	PTG743
108	*Cyanotis tuberosa* (Roxb.) Schult. & Schult. F.	H; RC	June–Oct	DCJ737

	Family / Species	Habit, Habitat, Endemism, IUCN status	Phenology	Accession number
109	*Murdannia nimmoniana* (J. Graham) S.M. Almeida	H; GL, PT, PL	July–Oct	DCJ796
110	*Murdannia spirata* (L.) G. Bruckn.	H; PL	July–Mar	DCJ797
	Convolvulaceae			
111	*Argyreia cuneata* (Willd.) Ker Gawl.*	S; PL, HS; END WG	Aug–Jan	DCJ708
112	*Argyreia nervosa* (Burm. f.) Bojer	T; SL	July–Dec	DCJ867
113	*Evolvulas alsinoides* (L.) L.	H; GL	July–Nov	DCJ765
114	*Ipomoea nil* (L.) Roth	TH; C	Aug–Nov	DCJ868
115	*Ipomoea eriocarpa* R.Br.	TH; FB	July–Aug	DCJ869
	Crassulaceae			
116	*Kalanchoe olivacea* Dalzell & A. Gibson*	H; RC; END WG	Oct–Mar	VDV2937
117	*Bryophyllum pinnatum* (Lam.) Oken	H; RC	Dec–May	VDV2942
	Cucurbitaceae			
118	*Cucumis ritchiei* Ghebret. & Thulin*	CL; HG; END WG	Aug–Oct	PTG757
119	*Cucumis setosus* Cogn.*	CL; SL; END WG	Sept–Oct	DCJ733
120	*Cucurbita maxima* Duchesne	CL; C	Sept–Oct	PTG755
121	*Momordica sahyadrica* Kattuk. & V.T. Antony*	CL; SL; END WG	Sept–Nov	DCJ857
122	*Zehneria scabra* Sond.	CL; SL	Feb–July	DCJ859
	Cyperaceae			
123	*Fimbristylis dichotoma* (L.) Vahl	H; GL	July–Dec	MDN-T729
124	*Cyperus squarrosus* L.	H; PL	Sept–Dec	1376
125	*Cyperus cyperoides* (L.) Kuntze	H; PL	Sept–Dec	1375
	Dioscoreaceae			
126	*Dioscorea alata* L.	CL; SL	Aug–Oct	PTG754
127	*Dioscorea bulbifera* L.	CL; SL	Aug–Oct	DCJ734
128	*Dioscorea hispida* Dennst.	CL; SL	July–Dec	PTG756
129	*Dioscorea oppositifolia* L.	CL; SL	July–Mar	DCJ732
130	*Dioscorea pentaphylla* L.	CL; SL	Aug–Nov	PTG758
	Droseraceae			
131	*Drosera indica* L.	H; GL, WL	Sept–Nov	VDV2950
	Eriocaulaceae			
132	*Eriocaulon* sp.1	H; PL	Aug–Dec	VDV137
133	*Eriocaulon* sp.2	H; PL	Aug–Dec	VDV139
	Euphorbiaceae			
134	*Briedelia retusa* (L.) A. Juss.	S; C	July–Dec	PTG725
135	*Euphorbia elegans* Spreng.*	S; RC; END MH, KA	Aug–Nov	PTG769
136	*Euphorbia hirta* L.	H; Common	July–Dec	PTG770
137	*Euphorbia neriifolia* L.	S; HS	Nov–Apr	DCJ761
138	*Euphorbia pycnostegia* Boiss.*	H; HS, RC; END GU, KA, MH	Sept–Nov	DCJ762
139	*Euphorbia rothiana* Spreng.	H; Along road sides	Sept–Jan	PTG838
140	*Euphorbia thymifolia* L.	H; PL	June–Sept	PTG811
141	*Euphorbia tithymaloides* L.	H; PL	June–Sept	DCJ764
142	*Flueggea virosa* (Roxb. ex Willd.) Royle	S; HS	Apr–Oct	PTG773
143	*Glochidion ellipticum* Wight	T; SL	Feb-Nov	DCJ772
144	*Jatropha curcas* L.	S; HG	Mar–Aug	PTG793
145	*Phyllanthus simplex* Retz.	H; HS	Aug–Apr	DCJ763

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146	*Ricinus communis* L.	S; C	Throughout	DCJ807
	Fabaceae *sensu lato*			
147	*Cassia fistula* L.	T; RA	Mar–Nov	VDV2502
148	*Bauhinia racemosa* Lam.	T; SL	Mar–Dec	VDV2336
149	*Chamaecrista pumila* (Lam.) V. Singh	H; PL	Aug–Dec	DCJ728
150	*Moullava spicata* (Dalzell) Nicolson*	SS; SL; END WG	Nov– Apr	VDV2821
151	*Tamarindus indica* L.	T; C	Feb–May	VDV2810
152	*Senna tora* (L.) Roxb.	H; PL	Aug–Feb	DCJ815
153	*Acacia intsia* (L.) Willd.	SS; HS	Aug–Oct	DCJ769
154	*Acacia leucophloea* (Roxb.) Willd.	T; HS	July–Feb	PTG704
155	*Acacia catechu* (L.f.) Willd	T; HS	July–Feb	DCJ 847
156	*Abrus precatorius* L.	CL; HG	Aug–Mar	VDV1347
157	*Alysicarpus monilifer* (L.) DC.	H; GL	Aug–Oct	VDV1388
158	*Alysicarpus vaginalis* (L.) DC.	H; GL, HS	July–Jan	VDV274/DCJ849
159	*Butea monosperma* (Lam.) Taub.	T; HS	Dec–June	VDV1467
160	*Cajanus sericeus* (Bth.ex Baker) Vander Maesen	S; SL	Oct–Apr	VDV1433/ MDN-T713
161	*Crotalaria calycina* Schrank	H; GL	Sept–Dec	VDV1492/ MDN-T715
162	*Crotalaria filipes* Benth var. *filipes* *	H; HS; END GU, MH, G, KA	Aug–Feb	KC-T002
163	*Crotalaria hebecarpa* (DC.) Rudd	H; GL	Feb–June	PTG745
164	*Crotalaria retusa* L.	H; SL	Sept–Mar	VDV571
165	*Desmodiastrum belgaumense* (Wight) A. Pramanik & Thoth.*	H; GL; END WG	Sept–Dec	VDV276/ MDN-T714
166	*Desmodiastrum racemosum* var. *rotundifolium* (Baker) A. Pramanik & Thoth.*	H; SL; END WG	Sept–Dec	PTG771
167	*Desmodium triflorum* (L.) DC.	H; GL	June–Jan	VDV383
168	*Erythrina stricta* Roxb.	T; PL	Jan–May	DCJ852
169	*Flemingia rollae* (Billore & Hemadri) Anand Kumar*	H; HS, RC; END WG, MH	Sept–Oct	PTG772
170	*Geissaspis cristata* Wight & Arnott	H; GL, PT, PL	Sept–Mar	VDV1822
171	*Indigofera cassioides* Rottler ex DC.	S; PT	Sept–Apr	VDV1859
172	*Indigofera glandulosa* J. C. Wendl.	S; C	Aug–Dec	VDV1880
173	*Mucuna pruriens* (L.) DC.	CL; PL	Aug–Jan	DCJ856
174	*Pongamia pinnata* (L.) Pierre	T; PL	Dec–June	VDV106
175	*Smithia agharkarii* Hemadri*	H; GL, PL; END MH	Apr–Dec	PTG816
176	*Smithia bigemina* Dalzell	H; PL	Apr–Sept	DCJ860
177	*Smithia blanda* Wall. ex Wight & Arnott	S; SL	Aug–Dec	VDV2049
178	*Smithia hirsuta* Dalzell*	H; PL, SL; END WG; LC	Jul–Nov	VDV101/PTG738
179	*Smithia purpurea* Hook.*	H; PT; END WG	Sept–Feb	DCJ807
180	*Smithia pycnantha* Benth. ex Baker*	H; GL; END WG	Aug–Nov	VDV654
181	*Smithia setulosa* Dalzell*	H; HSV; END WG	Aug–Dec	VDV273/ MDN-T716
182	*Tephrosia purpurea* (L.) Pers.	H; HS	Throughout	VDV107
183	*Vigna khandalensis* (Santapau) Sundararagh. & Wadhwa*	H; HS; END WG; NT	Sept–Oct	VDV143/ MDN-T717
184	*Vigna sahyadriana* Aitwade, K. V. Bhat & S. R. Yadav*	CL; HS; END MH	Aug–Nov	VDV2182
185	*Vigna unguiculata* (L.) Walp.	CL; C	Aug–Dec	DCJ839
186	*Vigna vexillata* (L.) A. Rich.	CL; C	Aug–Dec	PTG818
187	*Zornia diphylla* (L.) Pers.	H; GL	Aug–Oct	VDV2208
	Gentianaceae			
188	*Canscora diffusa* (Vahl) R. Br. ex Roem. & Schult.	H; PL	Sept–Apr	PTG729

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189	*Centaurium meyeri* (Bunge) Druce*	H; GL; END WG	Feb–May	DCJ725
190	*Exacum pumilum* Griseb.*	H; SL, PL; END WG	Aug–Oct	DCJ845
191	*Exacum tetragonum* Roxb.*	H; PT; END WG	Aug–Feb	DCJ766
192	*Swertia minor* (Griseb.) Knobl.*	H; PL, PT, GL; END WG	Aug–Sept	DCJ830
	Gesneriaceae			
193	*Rhynchoglossum obliquum* Blume	H; SL	Sept–Oct	VDV2452
	Hypoxidaceae			
194	*Hypoxis aurea* Lour.	H; PL	Aug–Sept	DCJ851
195	*Curculigo orchioides* Gaertn.	H; HS	June–Sept	DCJ735
	Lamiaceae			
196	*Anisomeles heyneana* Beth.*	S; SL; END WG	Oct–Mar	DCJ705
197	*Colebrookea oppositifolia* Sm.	S; HS	Nov–May	PTG741
198	*Isodon coetsa* (Buch.-Ham ex D. Don) Kudo	S; RA	Nov–Feb	DCJ788
199	*Isodon lophanphoides* (Buch.-Ham. ex. D. Don)	H; RA	Sept–Nov	VDV271
200	*Lavandula gibsonii* J. Graham*	H; HS; END WG	Oct–Mar	PTG798
201	*Leucas stelligera* Wall. ex Benth.	H; SL	Nov–Apr	DCJ791
202	*Plectranthus* sp.	H; C, PL	Aug–Jan	VDV *s.n.*
203	*Pogostemon benghalensis* (Burm.f.) Kuntze	H; SL	Nov–Feb	DCJ801
204	*Salvia plebeia* R.Br.	H; PL	Oct–Mar	VDV272
	Lauraceae			
205	*Actinodaphne angustifolia* (Blume) Nees	T; C	Oct–June	PTG706
	Lentibulariaceae			
206	*Utricularia reticulata* Sm.	H; PT, PL, WL	July–Sept	DCJ836
	Linaceae			
207	*Linum mysurense* B. Heyne ex Benth	H; GL, PT, PL	Sept–Nov	VDV752/ MDN-T708
	Loranthaceae			
208	*Scurrula parasitica* L.	PS; RP	Aug–June	PTG733
	Lythraceae			
209	*Ammannia baccifera* L.	H; PL	Dec–Mar	VDV3122
210	*Ammannia multiflora* Roxb.	H; PL	Sept–Mar	VDV3130
211	*Woodfordia fruticosa* (L.) Kurz	S; HS	Dec–June	VDV3209
	Magnoliaceae			
212	*Magnolia champaca* (L.) Baill. ex Pierre	T; C	Feb–Sept	DCJ795
	Malvaceae *sensu lato*			
213	*Abelmoschus moschatus* Medik.	H; C	July–Dec	PTG701
214	*Abutilon ranadei* Woodrow & Stapf*	S; SL; END MH; EN	Nov–Jan	PTG702
215	*Hibiscus hirtus* L.	S; PL	Oct–Mar	KC-T005
216	*Sida cordata* (Burm.f.) Borss.Waalk.	H; RA	Apr–Nov	DCJ818
217	*Sida rhombifolia* L.	H; RA	July–Dec	DCJ819
218	*Urena lobata* L.	H; RA	Apr–Dec	PTG835
219	*Erinocarpus nimmonii* J. Graham*	T; SL; END WG	Aug–Dec	VDV645
220	*Grewia abutilifolia* Vent. ex Juss.	S; SL	Feb–Nov	VDV6471/ MDN-T712
221	*Grewia tiliifolia* Vahl.	T; SL	Apr–Sept	VDV696/ MDN-T721
222	*Triumfetta rhomboidea* Jacq.	S; HS	Aug–Apr	VDV725

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223	*Bombax ceiba* L.	T; VH	Feb–June	VDV536
	Meliaceae			
224	*Cipadessa baccifera* (Roth) Miq.	S; PL	Sept–Feb	PTG735
225	*Azadirachta indica* A.Juss.	T; C	Jan–July	DCJ858
	Menispermaceae			
226	*Cocculus hirsutus* (L.) W. Theob.	CL; HG	Jan–Mar	VDV*s.n*
227	*Cyclea peltata* (Lam.) Hook. f. & Thomson	CL; HG	Sept–Mar	DCJ739
228	*Stephania japonica* (Thunb.) Miers	CL; C	June–Sept	DCJ826
229	*Tinospora cordifolia* (Willd.) Miers ex Hook. f. &Thomson	CL; HG	Jan–Aug	PTG829
	Moraceae			
230	*Artocarpus heterophyllus* Lam.	T; C	Dec–June	PTG720
231	*Artocarpus lacucha* Roxb.exBuch.–Ham.	T;C	Dec–June	DCJ711
232	*Ficus arnottiana* (Miq.) Miq.	T; PT	Feb–June	DCJ767
233	*Ficus benghalensis* L.	T; RA	Apr–June	DCJ757
234	*Ficus racemosa* L.	T; PL	Feb–June	PTG703
235	*Ficus religiosa* L.	T; C	Mar– Aug	DCJ770
	Musaceae			
236	*Ensete superbum* (Roxb.) Cheesman.*	RH; HS; END WG	Sept–Jan	DCJ768
	Myrtaceae			
237	*Psidium guajava* L.	S; C	Throughout	DCJ805
238	*Syzygium cumini* (L.) Skeels	T; C	Mar–June	PTG821
	Oleaceae			
239	*Jasminum malabaricum* Wight*	CL; SL; END WG	Mar–June	PTG792
	Orchidaceae			
240	*Aerides maculosa* Lindl.*	EH; TT; END WG	May–Dec	MDN-T723
241	*Habenaria brachyphylla* (Lindl.) Aitch.*	H; PL; END WG.	Aug–Oct	PTG778
242	*Habenaria digitata* Lindl.	H; PL	July–Nov	DCJ776
243	*Habenaria furcifera* Lindl.	H; HS	July–Dec	PTG780
244	*Habenaria grandifloriformis* Blatt. & McCann*	H; PL; END WG	June–Nov	PTG803
245	*Habenaria heyneana* Lindl.*	H; PL; END WG	July–Nov	DCJ777
246	*Habenaria longicorniculata* J.Graham*	H; RC; END AP, KA, TN, TL, KL	July–Jan	PTG709
247	*Habenaria rariflora* A. Rich.*	H; SL; WG	July–Dec	DCJ848
248	*Oberonia falconeri* Hook.f.	EH; TT	Sept–Dec	MDN-T722
	Orobanchaceae			
249	*Aeginetia indica* L.	PH; RP	July–Feb	DCJ778
	Oxalidaceae			
250	*Oxalis corniculata* L.	H; PL	Throughout	PTG779
	Papaveraceae			
251	*Argemone mexicana* L.	H; RA	Throughout	VDV12030
	Poaceae			
252	*Apluda mutica* L.	H; SL,GL	Oct–May	MDN707/1354
253	*Aristida adscensionis* L.	H; GL	Feb–Apr	PTG722
254	*Aristida funiculata* Trin. & Rupr.	H; GL	Sept–Dec	DCJ721
255	*Aristida redacta* Stapf.	H; GL, RC	Sept–Dec	PTG714

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256	*Arthraxon hispidus* var. *hispidus* (Thunb.)Makino	H; GL	Sept–Nov	PTG715
257	*Arthraxon jubatus* Hack.*	H; RC; END WG	Oct–Feb	DCJ729
258	*Arthraxon lanceolatus* var. *lanceolatus* (Roxb.) Hochst.	H; HS	Aug–Jan	PTG717
259	*Arthraxon meeboldii* Stapf*	H; SL; END WG	Aug–Oct	DCJ744
260	*Arthraxon lancifolius* (Trin.) Hochst.	H; RC	Aug–Jan	PTG719
261	*Arundinella ciliata* (Roxb.) Nees ex Miq.*	H; GL, RC; END WG	Sept–Dec	DCJ712/1358
262	*Arundinella metzii* Hochst. ex Miq.	H; GL, HS	Oct–Jan	DCJ730
263	*Arundinella pumila* (Hochst. ex A. Rich.) Steud.	H; HS	Aug–Nov	PTG739
264	*Arundinella spicata* Dalzell*	H; PT; END WG	Sept–Nov	DCJ715
265	*Bothriochloa bladhii* (Retz.) S.T. Blake	H; GL	Aug–Dec	DCJ853
266	*Bothriochloa pertusa* (L.) A. Camus	H; GL	Sept–Oct	PTG712
267	*Brachiaria remota* (Retz.) Haines	H; PL	July–Dec	PTG723
268	*Capillipedium assimile* (Steud.) A. Camus	H; SL	May–Jan	PTG730
269	*Capillipedium filiculme* (Hook. f.) Stapf*	H; HS; END WG	Aug–Jan	PTG713
270	*Chionachne gigantea* (J. Koenig) Veldkamp	H; PT, PL	July–Dec	PTG716
271	*Chloris barbata* Swartz	H; PL,WA	Aug–Feb	DCJ713
272	*Chloris virgata* Swartz	H; PL,WA	July–Dec	PTG731
273	*Chrysopogon fulvus* (Spreng.) Chiov.	H; GL	Sept –Jan	PTG734
274	*Coelachne simpliciuscula* (Wight & Arn. ex Steud.) Munro ex Benth.	H; PL, PT	Oct–Apr	DCJ714
275	*Cymbopogon martini* (Roxb.) W. Watson	H; GL	Aug–Dec	DCJ747/1351
276	*Cynodon dactylon* (L.) Pers.	H; PL, SL	Jan–Dec	DCJ741
277	*Cynodon radiatus* Rothex Roem. & Schult.	H; SL	Aug–Nov	DCJ742
278	*Dactyloctenium aegyptium* (L.) Willd.	H; GL	Sept–Oct	PTG718
279	*Dendrocalamus strictus* (Roxb.) Nees	H; GL	Oct–Mar	PTG746
280	*Dichanthium annulatum* (Forssk.) Stapf	H; GL, SL	Oct–Mar	PTG759
281	*Dichanthium caricosum* (L.) A. Camus	H; GL	Sept–Dec	DCJ740
282	*Dichanthium jainii* (Deshpande & Hemadri) Deshpande*	H; HS; END MH	Oct–Jan	DCJ748
283	*Digitaria ciliaris* (Retz.) Koeler	H; SL	Aug–Feb	DCJ750
284	*Digitaria ischaemum* (Schreb.) Schreb. ex Muhl.	H; SL	July–Dec	PTG751
285	*Dimeria ornithopoda* Trin.	H; SL	Aug–Dec	DCJ755
286	*Dinebra retroflexa* (Vahl) Panz.	H; SL	Aug–Feb	PTG753
287	*Echinochloa colona* (L.) Link	H; PL	July–Feb	DCJ746
288	*Eleusine indica* (L.) Gaertn.	H; SL	Sept–Feb	DCJ754
289	*Elytrophorus spicatus* (Willd.) A. Camus	H; WL	Jan–Mar	PTG752
290	*Eragrostiella bifaria* (Vahl) Bor	H; RC	Aug–Jan	DCJ758
291	*Eragrostis amabilis* (L.) Wight & Arnott ex Nees	H; SL	Sept–Mar	DCJ759
292	*Eragrostis gangetica* (Roxb.) Steud.	H; PL, PT	July–Mar	DCJ760
293	*Eragrostis japonica* (Thunb.) Trin.	H; PL, PT	Sept–Mar	DCJ749
294	*Eragrostis* sp.	H; PL, PT	Jan–Dec	PTG762
295	*Eragrostis unioloides* (Retz.) Nees ex Steud.	H; SL	Aug–Mar	1359
296	*Eulalia fimbriata* (Hack.) Kuntze	H; GL, SL	Oct–Feb	PTG767
297	*Eulalia trispicata* (Schult.) Henrard	H; GL, HS	June–Dec	PTG768
298	*Garnotia tenella* (Arn. ex Miq.) Janowsky	H; WA	Aug–Dec	PTG775
299	*Glyphochloa forficulata* (C. E. C. Fisch.)W. D. Clayton*	H; HS, RC; END WG	Sept–Dec	DCJ774/1353

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300	*Hackelochloa granularis* (L.) Kuntze	H; GL, HS	July–Dec	DCJ779
301	*Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult.	H; GL, RC	Aug–Feb	1355
302	*Heteropogon triticeus* (R. Br.) Stapf ex Craib	H; HS, RC	Sept–Dec	PTG786
303	*Indopoa paupercula* (Stapf) Bor*	H; WA, R; END WG MH	Aug–Nov	PTG787
304	*Isachne elegans* Dalzell ex Hook. f.*	H; PL, PT; END WG; LC	Sept–Jan	PTG788
305	*Ischaemum commutatum* Hack.	H; SL	Sept–Oct	PTG789
306	*Ischaemum diplopogon* Hook. f.*	H; R; END MH	Sept–Dec	PTG790
307	*Ischaemum impressum* Hack.*	H; PL; END MH	Sept–Jan	DCJ781
308	*Ischaemum indicum* (Houtt.) Merr.	H; GL, PL, PT	Sept–Feb	DCJ782
309	*Ischaemum kingii* Hook. f.*	H; RC; END MH,G	Sept–Nov	DCJ783
310	*Ischaemum rugosum* Salisb.	H; GL	Sept–Jan	DCJ784
311	*Ischaemum* sp.	H; GL	Sept–Jan	DCJ785
312	*Ischaemum tumidum* Stapf ex Bor*	H; GL, RC; END MH, KA	Sept–Dec	DCJ786
313	*Iseilema hackelii* U. B. Shrestha & Gandhi	H;	Aug–Jan	DCJ787
314	*Jansenella griffithiana* (C. Muell.) Bor	H; PL, PT	Sept–Nov	DCJ790
315	*Jansenella neglecta* S.R. Yadav, Chivalkar & Gosavi*	H; GL; END MH	Aug–Nov	PTG791
316	*Leersia hexandra* Swartz.	H; WL	Throughout	PTG800
317	*Coelorachis clarkei* (Hack.) Blatt. & McCann*	H; SL; END WG	Aug–Nov	PTG740
318	*Oplismenus burmannii* (Retz.) P. Beauv.	H; C	July–Feb	DCJ800
319	*Oplismenus compositus* (L.) P. Beauv.	H; SL	Aug–Dec	PTG801
320	*Panicum* sp.	H; SL	Aug–Nov	1363
321	*Paspalum canarae* (Steud.) Veldkamp*	H; PL, PT; END WG; LC	Aug–Dec	PTG805
322	*Pennisetum pedicellatum* Trin.	H; GL, HS	Aug –Jan	PTG806
323	*Pseudanthistiria heteroclita* (Roxb.) Hook. f.*	H; GL, HS; END WG	Sept–Jan	DCJ802
324	*Pseudodichanthium serrafalcoides* (T. Cooke & Stapf) Bor*	H; SL; END MH	Sept–Nov	DCJ803
325	*Pseudosorghum fasciculare* (Roxb.)A. Camus	H; SL	Sept–Dec	DCJ804
326	*Sehima nervosum* (Rottler) Stapf.	H; GL	Sept–Dec	DCJ811
327	*Setaria italica* (L.) P. Beauv.	H; C	July–Nov	DCJ816
328	*Setaria pumila* (Poir.) Roem. & Schult.	H; GL, PL	July–Nov	DCJ817
329	*Sorghum controversum* (Steud.) Snowden*	H; FB; END MH	Sept–Jan	DCJ821
330	*Spodiopogon rhizophorus* (Steud.) Pilger*	H; HS; END WG	Aug–Jan	DCJ825
331	*Thelepogon elegans* Roth ex Roem. & Schult.	H; GL	Sept–Jan	PTG824
332	*Themeda laxa* (Andersson) A. Camus	H; SL	Aug–Nov	PTG825
333	*Themeda quadrivalvis* (L.) Kuntze	H; GL	Aug–Jan	PTG826
334	*Themeda triandra* Forssk.	H; GL, HS	Sept–Feb	PTG827/1357
335	*Trilobachne cookei* (Stapf) Schenck ex Henrard*	H; HS; END WG MH	Sept–Nov	1352
336	*Triplopogon ramosissimus* (Hack.) Bor*	H; HS; END MH	Aug–Dec	DCJ834
337	*Tripogon jacquemontii* Stapf*	H; GL,WA; END WG	Aug–Dec	PTG835
338	*Tripogon pungens* C.E.C. Fischer*	H; VRC; END WG	June–Sept	PTG831
339	*Tripogon bromoides* Roth	H; R, GL	Aug–Nov	1366
340	*Tripogon lisboae* Stapf*	H; PL, PT; END, GU, MH, TN	Sept–Nov	PTG833
	Polygalaceae			
341	*Polygala chinensis* L.	H; GL	June–Sept	VDV284
342	*Polygala persicariifolia* DC.	H; HS	Aug–Oct	VDV321

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	Polygonaceae			
343	*Persicaria nepalense* (Meisn.) H. Gross	H; HS	Aug–Nov	VDV6799
344	*Persicaria glabra* (Willd.) M. Gomez	H; PL	Throughout	PTG809
	Portulacaceae			
345	*Portulaca oleracea* L.	H; PL	Throughout	VDV346
	Primulaceae			
346	*Anagallis arvensis* L.	H; PL	Aug–May	DCJ704
	Ranunculaceae			
347	*Clematis hedysarifolia* DC.*	L; B, HG; END WG	Oct–Dec	DCJ822
348	*Clematis wightiana* Wall.*	L; B, HG; END WG	Dec–Feb	KC-T001
349	*Delphinium malabaricum* (Huth) Munz var. *malabaricum**	H; SL; END MH	Aug–Oct	VDV280/1350
350	*Thalictrum dalzellii* Hook.*	H; HS, RC; END KA, MH	Aug–Oct	VDV16659
	Rhamnaceae			
351	*Ziziphus jujuba* Mill.	S; SL	Jan–Nov	PTG837
352	*Ziziphus rugosa* Lam.	S; HS, PT	Dec–Feb	VDV1115
353	*Ziziphus xylopyrus* (Retz.) Willd.	SS; HS	Apr–July	VDV1120
	Rubiaceae			
354	*Catunaregam spinosa* (Thunb.)Tirveng.	S; HS	Mar–Nov	DCJ723
355	*Haldina cordifolia* (Roxb.) C.E. Ridsdale	T; RA	Mar–Aug	DCJ780
356	*Hedyotis aspera* B. Heyne ex Roth	H; FB	Aug–Nov	VDV130
357	*Ixora brachiata* Roxb.*	S; HS; END WG	Nov–Mar	DCJ789
358	*Neanotis lancifolia* (Hook. f.) W. H. Lewis.*	H; HS; END WG	Sept–Nov	VDV1339/ MDN-T709
359	*Pavetta indica* L.	T; SL	Sept–May	VDV125
360	*Rubia cordifolia* L.	H; SL	Throughout	VDV3771/ MDN-T710
361	*Spermacoce articularis* L. f.	H; GS	Sept–Nov	VDV3532
362	*Spermacoce hispida* L.	H; GS	Sept–Dec	VDV *s.n*
363	*Spermacoce pusilla* Wall.	H; GS	July–Oct	VDV3540
364	*Spermadictyon suaveolens* Roxb.	S; HS	Oct–Feb	VDV1490
	Rutaceae			
365	*Aegle marmelos* (L.) Correa	T; C	Apr–Nov	PTG710
366	*Limonia acidissima* L.	T; C	Mar–Aug	VDV951
	Santalaceae			
367	*Osyris quadripartita* Salzm. ex Decne.	S; HS	Jan–Apr	PTG802
368	*Santalum album* L.*	T; C; END WG; VU	Mar–Aug	DCJ810
	Sapindaceae			
369	*Allophylus cobbe* (L.) Raeusch.	S; RA	May–Oct	VDV1280
370	*Dodonaea angustifolia* L. f.	S; HG	July–Mar	VDV1293
	Scrophulariaceae			
371	*Buchnera hispida* Buch.-Ham. ex D. Don	H; GL	Sept–Jan	PTG726
372	*Lindernia parviflora* (Roxb.) Haines	H; WL	July–Sept	DCJ792
373	*Rhamphicarpa longiflora* (Arn.) Benth.*	H; PT, PL, GL; ENG WG	Aug–Dec	DCJ806
374	*Sopubia delphiniifolia* (L.) G. Don	H; PT, GL	July–Jan	PTG819
375	*Sopubia trifida* Buch.-Ham. ex D. Don	H; GL	Sept–Oct	PTG820
376	*Striga asiatica* (L.) Kuntze	PH; SL, RC	July–Jan	VDV *s.n.*

	Family / Species	Habit, Habitat, Endemism, IUCN status	Phenology	Accession number
377	*Striga gesnerioides* (Willd.) Vatke	PH; SL	Aug–Dec	DCJ828
378	*Verbascum chinense* (L.) Santapau	H; PL	Throughout	DCJ837
	Smilacaceae			
379	*Smilax zeylanica* L.	CL; SL	Aug–May	VDV4289
	Solanaceae			
380	*Datura stramonium* L.	S; PL	Sept–Oct	DCJ745
381	*Solanum anguivi* Lam.	S; SL	July–Feb	PTG817
382	*Solanum nigrum* L.	S; SL	May–June	VDV *s.n*
	Thymelaeaceae			
383	*Gnidia glauca* (Fresen.) Gilg.	S; HS	Oct–June	DCJ775
	Ulmaceae			
384	*Trema orientalis* (L.) Blume	T; PL	Jan–Oct	PTG830
	Urticaceae			
385	*Girardinia diversifolia* (Link) Friis	H; PL	Sept–Dec	DCJ771
386	*Lecanthus peduncularis* Wedd.	H; R, WA	Aug–Nov	PTG799
	Verbenaceae			
387	*Clerodendrum indicum* (L.) Kuntze	S; HS	July–Dec	VDV150
388	*Clerodendrum serratum* (L.) Moon	S; HS	June–Dec	PTG737
389	*Lantana camara* L.	S; RA	Throughout	PTG796
390	*Phyla nodiflora* (L.) Greene	H; PL	Aug–Dec	PTG810
391	*Tectona grandis* L. f.	T; RA	Aug–Dec	PTG822
392	*Vitex negundo* L.	S; SL	Jan–July	DCJ840
	Vitaceae *sensu lato*			
393	*Cissus elongata* Roxb.	CL; HS	May–Nov	VDV1175
394	*Cissus woodrowii* (Stapf ex T. Cooke) Santapau*	S; HG; END AP, MH, TL	June–Oct	VDV1205
395	*Leea indica* (Burm. f.) Merr.	S; HS	Aug–Mar	VDV12297
396	*Leea macrophylla* Roxb. ex Hornem.	S; HS	July–Oct	VDV1283
	Zingiberaceae			
397	*Curcuma pseudomontana* J. Graham*	RH; HS; END WG	June–Oct	DCJ736
398	*Curcuma caulina* J.Graham*	RH; HS; END WG; EN	July–Oct	DCJ850
399	*Zingiber diwakarianum* R. Kr. Singh*	H; HS; END MH	June–Nov	DCJ861

Abbreviations: Habit: H - Herb; S - Shrub; T - Tree; CL - Climber; SH - Scandent herb; SS - Scandent shrub; RH - Rhizomatous herb; RS - Rhizomatous shrub; L - Liana; PS - Parasitic Shrub; TH - Twining herb; EH - Epiphytic herb.
Habitat: PT - Plateau; SL - Slope; RC - Rocky crevices; HS - Hill slopes; VRC - Vertical Rocky Cliffs; PL - Plain;
WL-Wetland; C - Cultivated; GL - Grassland; WA - Walls; RA - Roadsides; HG - Hedges; B - Bushes; GS - Gravelly Soil; FB - Field bunds; R - Rocks; VH - Variety of Habitats; HSV - Hill slopes & valleys; RP - Root parasite; TT - Tree Trunk.
IUCN status: EN - Endangered; LC - Least Concern; NT - Near threatened; VU - Vulnerable; END - Endemic (also marked by *);
WG - Western Ghats; AP - Andhra Pradesh; G - Goa; KA - Karnataka; KL - Kerala; MH - Maharashtra; TL - Telangana; TN - Tamil Nadu; C. IND - central India; E. IND -eastern India; P.IND - Peninsular India.

have *Flemingia rollae* (Billore & Hemadri) Anand Kumar and *Cyanotis tuberosa* (Roxb.) Schult. & Schult.f. Hillslopes and valleys are occupied by *Strobilanthes callosus* Nees, and the undergrowth shelters species like *Ceropegia maccannii* Ansari, *C. oculata* Hook., *C. media* (H. Huber) Ansari, *Vigna sahyadriana* Aitwade et al., *Cucumis setosus* Cogn., *C. ritchiei* Ghebret. & Thulin, *Argyreia cuneata* (Willd.) Ker Gawl., *Aeginetia indica* L., and *Abutilon ranadei* Woodrow & Staf (Image 2D). Different micro-habitats are enlisted for each plant species separately in Table 1.

A total of 399 angiosperm species which comprised 274 genera and 73 families are listed in the present study (Table 1); 269 are dicotyledonous which belong to 199

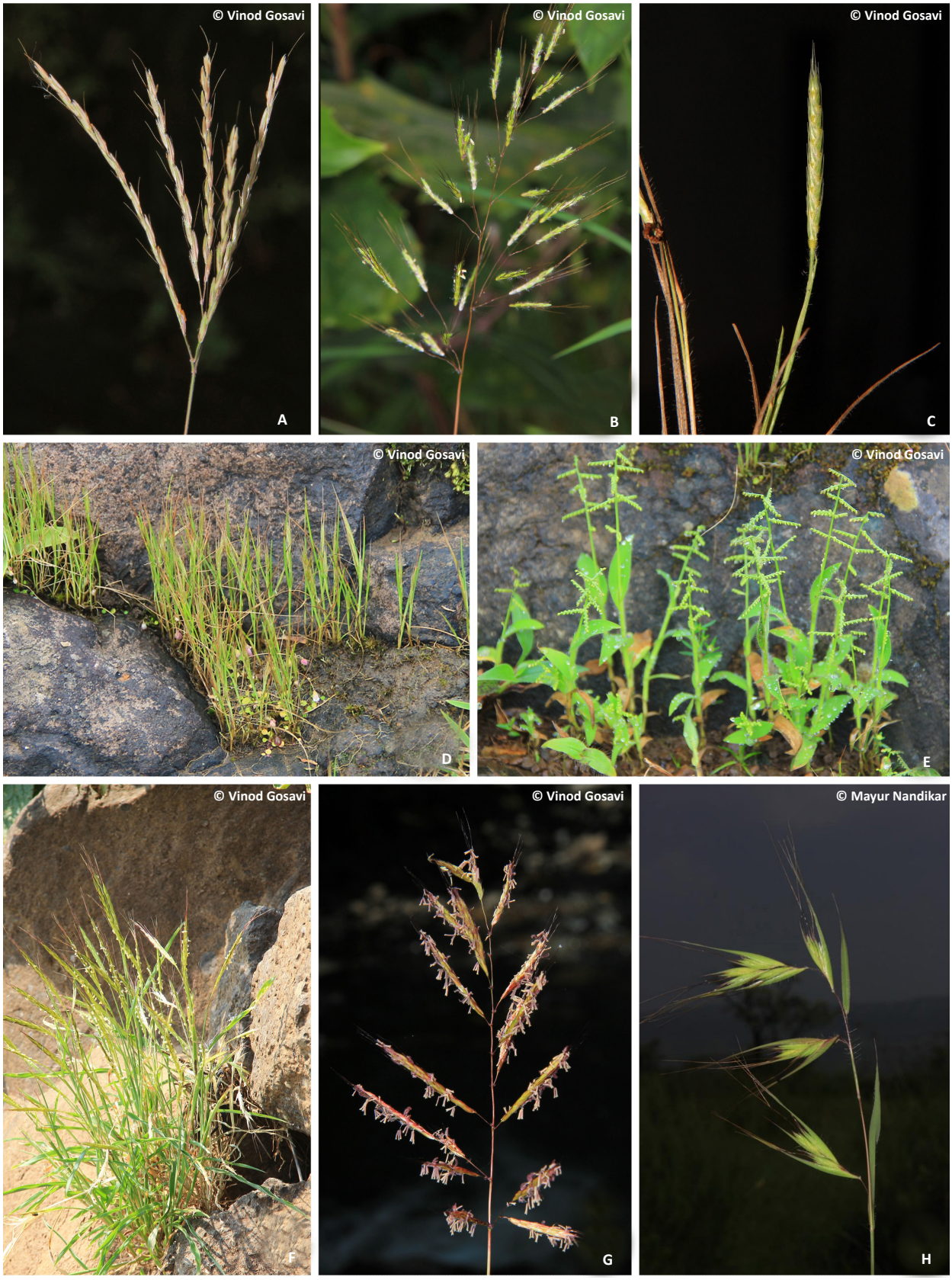

Image 3. A - *Arthraxon lanceolatus* var. *lanceolatus*; B - *Capillipedium filiculme*; C - *Glyphochloa forficulata*; D - *Indopoa paupercula*; E - *Paspalum canarae*; F - *Ischaemum diplopogon*; G - *Spodiopogon rhizophorus*; H - *Pseudanthistiria heteroclita*.

genera and 59 families and 130 are monocotyledonous, which belong to 75 genera and 14 families. Poaceae dominated the list by having a total of 89 species, followed by Fabaceae (41 spp.), Asteraceae (30 spp.), Acanthaceae (17 spp.), and Euphorbiaceae (13 spp.). Poaceae comprises 52 genera, followed by Fabaceae (24 genera), Asteraceae (24 genera), Acanthaceae (15 genera), Apocynaceae and Rubiaceae (nine genera each). The most diverse genera are *Ischaemum* (8 spp.), *Euphorbia, Smithia,* and *Habenaria* (7 spp. each), *Dioscorea*, *Arthraxon* and *Eragrostis* (5 spp. each), *Arundinella, Ceropegia, Ficus, Tripogon* and *Vigna* (4 spp. each). Six families are represented by a single genus and 22 families are represented by a single species. The vegetation is also diversified in habits (Table 1) like annual, perennial, parasitic herbs, shrubs, scandent shrubs, trees, climbers, and lianas.

DISCUSSION

From the 399 plant species documented, 109 species (27.31%) are referred to as endemic to the Western Ghats and India. The Torna Fort is enriched with eight species of *Ischaemum* L. (4 endemic), seven species of *Habenaria* Willd. (5 endemic), seven species of *Euphorbia* L. (2 endemic), seven species of *Smithia* Aiton (5 endemic), four endemic species of *Ceropegia* L. (3 rare in occurrence) (Nayar & Sastry 1987, 1988, 1990). Sixteen species viz. *Triplopogon ramosissimus* (Hack.) Bor, *Indopoa paupercula* (Stapf) Bor, *Moullava spicata* (Dalzell) Nicolson, *Tamarindus indica* L., *Aegle marmelos* (L.) Correa, *Urena lobata* L., *Erinocarpus nimmonii* J. Graham, *Frerea indica* Dalzell, *Hemidesmus indicus* (L.) R.Br., *Haldina cordifolia* (Roxb.) C.E. Ridsdale, *Spermadictyon suaveolens* Roxb., *Calacanthus grandiflorus* (Dalzell) Radlk., *Colebrookea oppositifolia* Sm., *Adenoon indicum* Dalzell, *Pinda concanensis* (Dalzell) P.K. Mukh. & Constance and *Trilobachne cookei* (Stapf) Schenck ex Henrard are recorded as monotypic.

Torna Fort is the only repository for the Critically Endangered *Barleria sepalosa* C.B. Clarke (Acanthaceae) which is rediscovered after a lapse of 128 years (Gosavi et al. 2013), and the recent study also extends the distribution of *Flemingia rollae* (Fabaceae), the species which was earlier known from its type locality at Kalsubai Hilltop, Ahmednagar, Maharashtra (Gavade et al. 2016).

In the context of anthropogenic activities and threat to the habitats, many hilltops like the table land of Panchgani (Satara District), Sinhagad Fort (Pune District), Panhala (Kolhapur District) are prone to disturbances viz., tourism, overgrazing, invasive species and grassland fires. Poor planning of tourism and lack of awareness regarding the unique habitat and vegetation are serious threats to these areas. Present efforts have been made to create awareness amongst the visitors, authorities and custodians as authors have witnessed the developmental activities like clearing of roadside vegetation for widening of roads and new road construction during the last four years at Torna Fort. The earlier enumeration by Vartak (1953) listed 241 species while the present study of Torna lists 399 angiosperms of which 109 (27.31%) are endemic to India. The detailed plant enumeration with its endemism, distribution, phenology, habitat and habit has been tabulated in Table 1.

CONCLUSION

Torna Fort in the northern Western Ghats exhibits habitat diversity with annual and perennial floristic components. The fort stands as a storehouse of endemic and unique floral diversity. The topography, elevation and distinct climatic conditions make the fort different from other lowland floristic habitats. Although, Torna Fort is in consideration for tourism development by the government as archaeological monument, we strongly believe that presence of endemic, threatened plant species and unique habitats can be adequate for 'Biodiversity Heritage Sites' to ensure further conservation measures.

REFERENCES

Billore, K.V. & K. Hemadri (1969). Observation on the flora of Harishchandragarh, Sahyadri range, Maharashtra. *Bulletin of Botanical Survey of India* 11: 335–346.

Bridson, D. & L. Forman (1999). *The Herbarium Handbook. 3rd Edition*. Royal Botanic Gardens, Kew, UK.

Cooke, T. (1901–1908). *The Flora of the Presidency of Bombay. Vol. 1 & 2* . Taylor & Francis, London.

Gaikwad, S., R. Gore, K. Garad & S. Gaikwad (2014). Endemic flowering plants of nothern Western Ghats (Sahyadri Ranges) of India: A checklist. *Checklist* 10(3): 461–472; http://doi.org/10.15560/10.3.461

Gavade, S.K., M.D. Nandikar, V.B. Shimpale & M.M. Lekhak (2016). A new location for a rare legume *Flemingia rollae* (Family Fabaceae) and notes on its typification. *Journal of the Bombay Natural History Society* 113: 48–49.

Gosavi, K.V.C., A.D. Nalawade & S.R. Yadav (2013). Taxonomic identity, rediscovery and epitypification of *Barleria sepalosa* (Acanthaceae) from northern Western Ghats, India. *Rheedea* 24(1): 23–26.

IUCN (2017). The IUCN Red List of threatened species. Version 2017.1. International Union for Conservation of Nature Accessed at http://www.iucnredlist.org. Accessed on 26 May 2017.

Lakshminarasimhan, P. (1996). Monocotyledones In: Sharma, B.D., S. Karthikeyan & N.P. Singh (eds.). *Flora of Maharashtra State*.

Image 4. A - *Curcuma caulina*; B - *Curcuma pseudomontana*; C - *Delphinium malabaricum*; D - *Thalictrum dalzellii*; E - *Kalanchoe olivacea*; F - *Cissus woodrowii*; G - *Euphorbia pycnostegia*; H - *Euphorbia elegans*.

Image 5. A - *Moullava spicata*; B - *Desmodiastrum belgaumense*; C - *Flemingia rollae*; D - *Vigna khandalensis*; E - *Vigna sahyadriana*; F - *Smithia setulosa*; G - *Smithia purpurea*; H - *Smithia hirsuta.*

Image 6. A - *Neanotis lancifolia*; B - *Argyreia cuneata*; C - *Barleria sepalosa*; D - *Calacanthus grandiflorus*; E - *Eranthemum roseum*; F - *Haplanthodes verticillatus*; G - *Neuracanthus sphaerostachys*; H - *Strobilanthes callosus.*

Image 7. A - *Strobilanthes sessilis* var. *ritchiei*; B - *Anisomeles heyneana*; C - *Jasminum malabaricum*; D - *Rhamphicarpa longiflora*; E - *Adelocaryum coelestinum*; F - *Adelocaryum malabaricum*; G - *Adenoon indicum*; H - *Baccharoides microcephalum.*

Calcutta, Botanical Survey of India, 794pp.

Maharashtra State Gazetteer, Pune District (1992). http://gazetteers.maharashtra.gov.in. Accessed at 13 December 2016.

Nayar, T.S., M. Sibi & A.R. Beegam (2014). *Flowering Plants of the Western Ghats, India,* Vol.1 and Vol.2. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Kerala, India.

Nayar, M.P. & A.R.K. Sastry (eds.) (1987). *Red Data Book of Indian Plants, Vol. 1.* Calcutta, Botanical Survey of India, 367pp.

Nayar, M.P. & A.R.K. Sastry (eds.) (1988). *Red Data Book of Indian Plants, Vol. 2*. Calcutta, Botanical Survey of India, 150pp.

Nayar, M.P. & A.R.K. Sastry (eds.) (1990). *Red Data Book of Indian Plants, Vol. 3*. Calcutta, Botanical Survey of India, 271pp.

Rana, T.S. & S.A. Ranade (2009). The enigma of monotypic taxa and their taxonomic implications. *Current Science* 96(2): 219–229.

Razi, B.A. (1952). Some aspects of vegetation of Poona and neighbouring districts. *Journal of Poona University (Science & Technology)* 1(2): 1–57.

Santapau, H. (1951). A contribution to the flora of Simhagad Hill, Poona District. *Poona Agricultural College Magazine* 41(4): 270–284.

Santapau, H. (1957). *The Flora of Purandar*. Oxford University Press, New Delhi.

Santapau, H. (1967). *The Flora of Khandala on the Western Ghats of India Records of the Botanical Survey of India. Vol. XVI, No.1*. Botanical Survey of India, Calcutta.

Singh, N.P. & S. Karthikeyan (ed.). (2000). *Flora of Maharashtra State (Dicotyledones). Volume 1.* Botanical Survey of India, Calcutta.

Singh, N.P & S. Karthikeyan (Eds.) (2001). *Flora of Maharashtra State (Dicotyledones). Volume 2.* Botanical Survey of India, Calcutta.

Singh, P., K. Karthigeyan, P. Lakshminarasimhan & S.S. Dash (2015). *Endemic Vascular Plants of India*. Botanical Survey of India Kolkata.

Tetali, P., S. Tetali, B.G. Kulkarni, P.V. Prasanna, P. Lakshminarasimhan, M. Lale, M.S. Kumbhojkar, D.K. Kulkarni & A.P. Jagtap (2000). *Endemic Plants of India (A status report of Maharashtra State).* Naoroji Godrej Centre for Plant Research, Shindewadi, Satara, India

The International Plant Name Index (2012). Published on the Internet http://www.ipni.org (accessed at 12 December 2016).

Vartak, V.D. (1953). Contribution to the Flora of Torna Hill, Poona District. *Journal of Poona University (Science and Technology)* 1 (4): 1–10.

Vartak, V.D. (1960). The study of the Flora of the Katraj Ghat. *Journal of Poona University (Science & Technology)* 22: 85–117.

Vartak, V.D. (1965). Contributions to the Flora of Raigad Hill, Kolaba District, Maharashtra State. *Journal of Poona University (Science &Technology)* 30: 19–29.

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