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PHYTODIVERSITY OF DHAULIGIRI HILL AND ITS ADJOINING AREA, ODISHA, INDIA: A FLORISTIC APPROACH

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Abstract

Dhauligiri hill (Latitude 20°112 32.633 N; Longitude 85°502 21.353 E) lying on the bank of the river Daya, is situated 8 km south of the state capital, Bhubaneswar in Odisha. The hill has historical significance for the site of famous Kalinga war and Buddhist monument, 'Shanti Stupa' or Peace Pagoda. Floristic study conducted in the area revealed that a total of 276 plant species belonging to 199 genera under 77 different families were recorded. Habit wise grouping showed that 86 (31%) were herbs followed by 54(20%) grasses, 51(19%) trees, 39(14%) shrubs, 19 (7%) climbers, 15 (5%) hydrophytes, 6(2%) pteridophytes, 3(1%) parasites, 2(1%) bryophytes and 1 gymnosperm. Among the families of plant species, Poaceae with 36 species was the dominant family followed by Cyperaceae (19), Euphorbiaceae (16), Fabaceae (14) and Asteraceae (11). *Cyperus* was the dominant genus with 13 species followed by *Ficus* (6), *Phyllanthus* (5) and *Cassia, Crotalaria, Sida, Panicum* (4) species each. Important medicinal plant species include *Gymnema sylvestre, Saraca asoca, Tinospora cordifolia, Desmodium gangeticum, Evolvulus alsinoides, Wedelia chinensis, Bombax ceiba, Vetiveria zizanioides, Pandanus fascicularis, Andrographis paniculata, Adiantum phillippense,* etc. Total 49 invasive alien species belonging to 43 genera under 25 families were documented. Invasive plant species include *Eichhornia crassipes, Monochoria vaginalis, Lantana camara, Mikania micrantha, Parthenium hysterophorus, Emilia sonchifolia* etc. Among the plants *Wedelia chinensis, Anacardium occidentale, Panicum brevifolium, Saccharum spontaneum, Echinochloa colona, Parthenium hysterophorus* and *Blepharis maderaspatensis* were predominant. *Saraca asoca* critically threatened species in Odisha and endangered species like *Crateva magna, Cycas circinalis* (Endemic) and threatened species *Microccocca mercurialis* of Odisha were recorded. Uncommon plant species found were *Kigelia africana, Limnophila heterophylla, Acacia obtusifolia, Hygrophila auriculata, Dentella repens, Hydrocera trifolia* etc. The presence of rich phytodiversity and dense vegetation cover provides an excellent carbon sink to the city, Bhubaneswar.

Key words: Invasive Alien species, Medicinal plants, Dhauligiri hill, Odisha

Introduction

The flora are helpful in providing clues of changing floristic patterns, new invasions, current status, rare, endemic and threatened taxa (RET) in a phyto-geographical area (Rajendran 2014). The floristic studies are considered as the backbone of the assessment of phytodiversity, conservation management and sustainable utilization (Jayanthi and Rajendran 2013). Today there is an urgent need for detailed surveys of plant resources in order to prevent the extinction of potentially valuable plant species. It is essential to prepare local floras of urban areas where there is severe threat to natural vegetation due to identification of species that are in different stages of vulnerability (Padalia *et al*., 2004), as well as the various factors that influence the existing vegetation in any region (Parthasarathy 1999). Invasive alien species poses immense threat to the floral diversity and a better planning is needed for early detection and reporting of infestations of spread of new and naturalized weeds by creation of plant detection network in each State by establishing communication links between taxonomists, ecologists and land managers to monitor and control (Reddy 2008). Several studies have been conducted to analyze the floristic composition in India and abroad but little work has been done on documentation, assessment of present status and conservation of plants in different regions of Odisha. Over 131 invasive alien plant species were identified in Dhenkanal district of Odisha (Nayak and Satapathy 2015). The past floristic exploration of the Khurda region was fragmentary except for some sporadic references made by Haines (1921-1925). As per the

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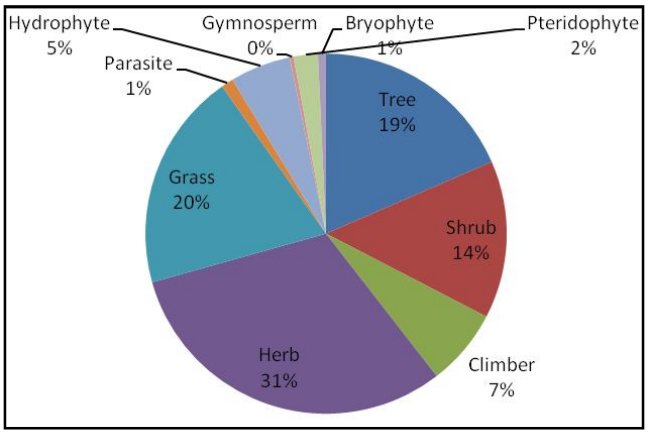

Fig. 1: Habit wise distribution of plant species in Dhauligiri hills.

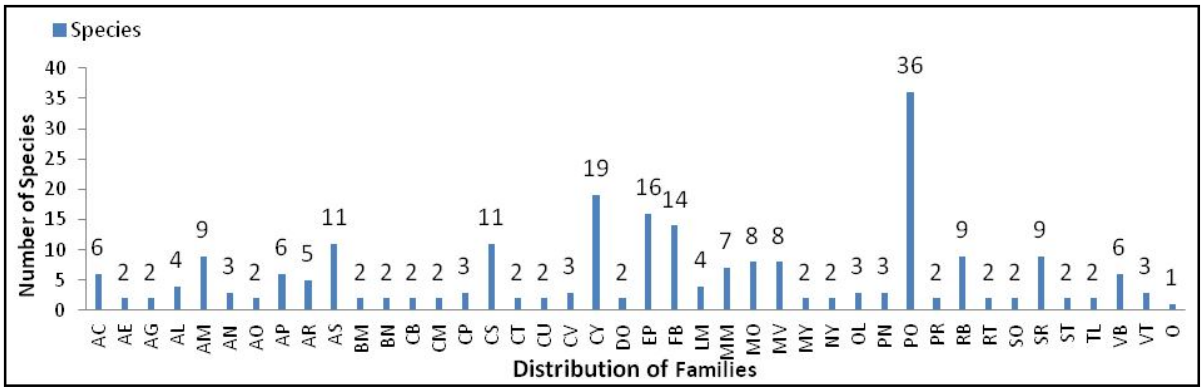

Fig. 2: Family wise distribution of plant species in Dhauligiri hills.

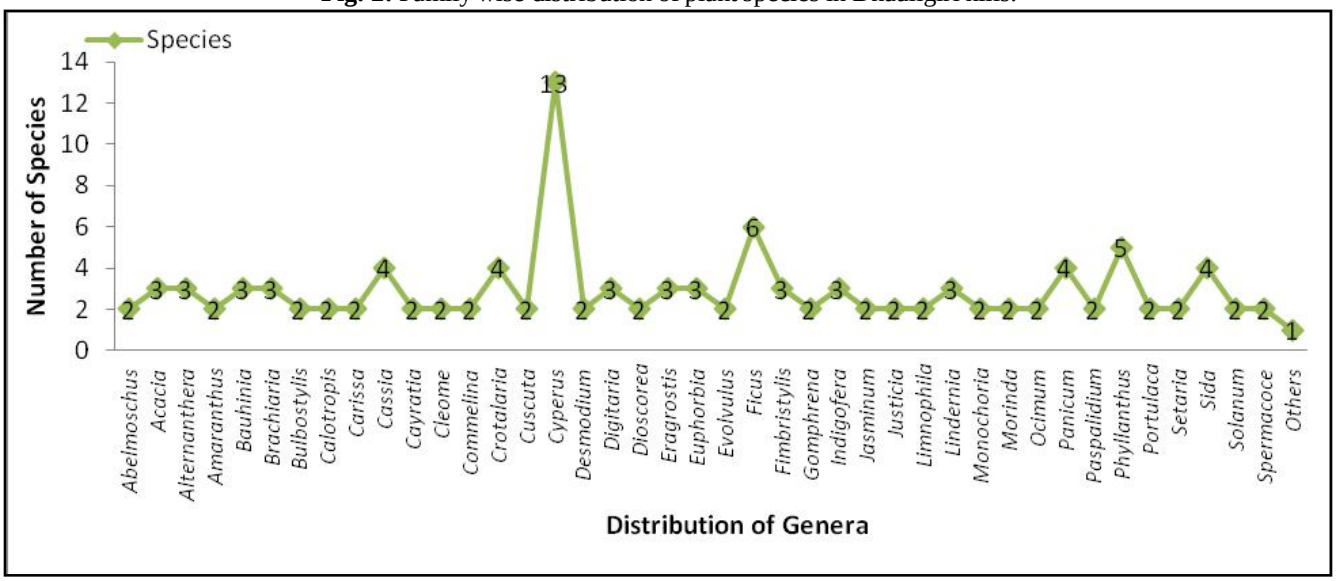

Fig. 3: Genus wise distribution of plant species in Dhauligiri hills.

earlier report 934 angiosperm species were recorded in Bhubaneswar and its adjoining regions (Choudhary 1980), 220 species were documented from Sikharchadi hill near Bhubaneswar (Noor *et al.*, 2015) and 357 angiosperm species found in the religious centres of Khurda district with special reference to Bhubaneswar (Das 2001).

To understand the significance of the existing biodiversity, it is necessary to document and analyze the floral diversity. Hence, the present study was undertaken to examine the plant diversity in the Dhauligiri hill and its adjoining area, Odisha (India) which is less explored. The outcome of the study can be used constructively in planning sustainability of both man and natural environment.

Materials and Methods

Study site

Dhauligiri also known as Dhauli (Lattitude 20°112 32.633 N; Longitude 85°502 21.353 E) is a hillside lying on the banks of the river Daya, situated 8 km south of the state capital Bhubaneswar in Khurda district, Odisha. Dhauli hill is believed to be the battle ground of the Kalinga war of 261 B.C. and is famous for dazzling white Peace Pagoda or 'Shanti Stupa' situated on the top of the hill which was built in 1972 by the Japan Buddha sangha and the Kalinga Nippon Buddha sangha. The hill also houses the marvelous edicts of Ashoka imprinted on a mass of rock and an ancient 'Shiv' temple which is a place for mass gathering during the 'Shiv Ratri' celebration. The

Table 1: List of Trees found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Acacia auriculiformis* A. Cunn ex Benth	Jaranasaka	Mimosaceae
2	*Acacia nilotica* (L.) Delile subsp. *indica* (Benth.) Brenan	Desibabool	Mimosaceae
3	*Acacia obtusifolia* A.Cunn.	Akasia	Mimosaceae
4	*Aegle marmelos* (L.) Corr.	Bela	Rutaceae
5	*Ailanthus excelsa* Roxb.	Goranimba	Simaroubaceae
6	*Albizia lebbeck* (L.) Benth.	Sirisa	Mimosaceae
7	*Anacardium occidentale* L.	Kaju	Anacardiaceae
8	*Areca catechu* L.	Gua	Arecaceae
9	*Artocarpus heterophyllus* Lam.	Panasa	Moraceae
10	*Azadirachta indica* A.Juss.	Nimba	Meliaceae
11	*Bombax ceiba* L.	Similitula	Bombacaceae
12	*Bridelia retusa* (L.)Spreng.	Panikashi	Euphorbiaceae
13	*Callistemon citrinus* (Curtis.) Stapf.	Bottlebrush	Myrtaceae
14	*Caryota urens* L.	Salapa	Arecaceae
15	*Cassia fistula* L.	Sunari	Caesalpiniaceae
16	*Cassia siamea* Lam.	Bada chakunda	Caesalpiniaceae
17	*Ceiba pentandra* (L.) Gaertn. var. *pentandra*	Sweta simuli	Bombacaceae
18	*Cleistanthus collinus* (Roxb.) Benth. ex Hook.f.	Karada	Euphorbiaceae
19	*Cocos nucifera* L.	Nadia	Arecaceae
20	*Crateva magna* (Lour.) DC.	Baruna	Capparaceae
21	*Delonix regia* (Boj. ex Hook.) Raf.	Krushna chuda	Caesalpiniaceae
22	*Drypetes roxburghii* (Wall.) Hurusawa	Poichandia	Euphorbiaceae
23	*Ficus benghalensis* L.var. *benghalensis*	Baragachha	Moraceae
24	*Ficus benghalensis* L. var. *krishnae* C.DC.	Baragachha	Moraceae
25	*Ficus microcarpa* L.f.	Gida	Moraceae
26	*Ficus racemosa* L.	Dimiri	Moraceae
27	*Ficus religiosa* L.	Pipala	Moraceae
28	*Ficus tinctoria* Forst f. subsp *gibbosa* (Bl.)Corner.	Udabara	Moraceae
29	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	Sundari	Fabaceae
30	*Gmelina arborea* Roxb.	Gambhari	Verbenaceae
31	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G.Don	Pita keruan	Apocynaceae
32	*Kigelia africana* (Lam.) Benth.	Beenchi	Bignoniaceae
33	*Lannea coromandelica* (Houtt.) Merr.	Indra Mahi	Anacardiaceae
34	*Lagerstroemia reginae* Roxb.	Patali	Lythraceae
35	*Leucaena leucocephala* (Lam.) de Wit	Kedikadamba	Mimosaceae
36	*Mangifera indica* L.	Amba	Anacardiaceae
37	*Mimusops elengi* L.	Baula	Sapotaceae
38	*Morinda citrifolia* L.	Aachu	Rubiaceae
39	*Morinda pubescens* Sm.	Aachu	Rubiaceae
40	*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne	Radhachuda	Caesalpiniaceae
41	*Phoenix sylvestris* (L.) Roxb.	Khajuri	Arecaceae
42	*Plumeria rubra* L.	Kathachampa	Apocynaceae
43	*Pongamia pinnata* (L.) Pierre	Karanja	Fabaceae
44	*Polyalthia longifolia* (Sonn.) Thw.	Debadaru	Annonaceae
45	*Samanea saman* (Jacq.) Merr.	Bada sirisa	Mimosaceae
46	*Saraca asoca* (Roxb.) de Wilde	Asoka	Caesalpiniaceae
47	*Sterculia foetida* L.	Badabadaam	Sterculiaceae
48	*Streblus asper* Lour.	Sahada	Moraceae
49	*Syzygium cumini* (L.) Skeels	Jammu Koli	Myrtaceae
50	*Tectona grandis* L.f.	Sagwan	Verbenaceae
51	*Terminalia cattapa* L.	Desi badaam	Combretaceae

Table 2: List of Shrubs found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Agave americana* L.	Baramasi	Agavaceae
2	*Abelmoschus manihot* (L.) Medic subsp. *tetraphyllus*	----	Malvaceae
3	*Adenosma indianum* (Lour.) Merr.	----	Scrophulariaceae
4	*Bambusa arundinacea* (Retz.) Willd.	Baunsa	Poaceae
5	*Bauhinia acuminata* L.	Kanchana	Caesalpiniaceae
6	*Bauhinia tomentosa* L.	Kanchana	Caesalpiniaceae
7	*Bauhinia variegata* L.	Kanchana	Caesalpiniaceae
8	*Bougainvillea spectabilis* Willd.	Kagaz phula	Nyctaginaceae
9	*Calamus guruba* Buch-Ham	Kanta betta	Arecaceae
10	*Carica papaya* L.	Amrutabhanda	Caricaceae
11	*Cassia occidentalis* L.	Ghoda chakunda	Caesalpiniaceae
12	*Caesalpinia pulcherrima* (L.) Sw.	Godibana	Caesalpiniaceae
13	*Calotropis gigantea* R.Br.	Arakha	Asclepiadaceae
14	*Calotropis procera* (Ait.) R.Br.	Dhala Arakha	Asclepiadaceae
15	*Carissa carandas* L.	Karanda koli	Apocynaceae
16	*Carissa spinarum* L.	Khira koli	Apocynaceae
17	*Cascabela thevetia* (L.) Lippold.	Kaniara	Apocynaceae
18	*Chromolaena odorata* (L.) R.King & H.Robins	Pokasungha	Asteraceae
19	*Clerodendrum viscosum* Vent.	Kunti	Verbenaceae
20	*Duranta repens* L.	Bilati kanta	Verbenaceae
21	*Ervatamia divaricata* (L.) Burkill	Tagara	Apocynaceae
22	*Glycosmis pentaphylla* (Retz.) DC.	Chauda dhua	Rutaceae
23	*Hibiscus rosa-sinensis* L.	Mandara	Malvaceae
24	*Ixora coccinea* L.	Katharangani	Rubiaceae
25	*Jasminum sambac* (L.)Ait.	Malli	Oleaceae
26	*Jatropha gossypifolia* L.	Baigaba	Euphorbiaceae
27	*Lantana camara* L. var. *aculeata* (L.) Mold.	Nagaeri	Verbenaceae
28	*Lippia javanica* (Brum.f.) Spreng.	Naguaari	Verbenaceae
29	*Nyctanthes arbor-tristis* L.	Gangasiuli	Oleaceae
30	*Ocimum sanctum* L.	Tulasi	Lamiaceae
31	*Pandanus fascicularis* Lam.	Kia	Pandanaceae
32	*Pavetta crassicaulis* Bremek	Kukurchelia	Rubiaceae
33	*Pedilanthus tithymaloides* (L.) Poit.	Khira siju	Euphorbiaceae
34	*Phyllanthus reticulatus* Poir.	Jajanga	Euphorbiaceae
35	*Punica granatum* L.	Dadimba	Punicaceae
36	*Sansevieria roxburghiana* Sch. & Schult.f.	Murga	Agavaceae
37	*Solanum torvum* Sw.	Denga vezi	Solanaceae
38	*Tecoma stans* (L.) Kunth	----	Bignoniaceae
39	*Ziziphus mauritiana* Lam. var. *fruticosa* (Haines) Sebast. & Henry	Barakoli	Rhamnaceae

climate is mainly tropical, wet and dry. The South-west monsoon is the main source of rainfall and the average rainfall is around 154 cm. The average temperature ranges 12^0C in winter and 42^0C - 45^0C during summer. Generally humidity is high especially during south west monsoon and post monsoon months. In the summer afternoons the relative humidity varies between 25 - 40%. The soils of this region vary red-brown in colour, laterite type with sandy loam texture.

Methods

Intensive seasonal field visits were undertaken (2012-2014) for collection of plants and their relevant information. The plants were freshly collected and their digital photographs were also taken. The collected plant specimens had been identified in consultation with the regional floras (Haines 1921-1925; Saxena and Brahmam, 1994-1996) and preserved in the herbarium of the Post

Table 3: List of Climbers found in Dhauligiri hill.

S. No.	Name of species	Local name	Family
1	*Abrus precatorious* L.	Kaincha	Fabaceae
2	*Ampelocissus latifolia* (Roxb.)Planch	Kanjia-nai	Vitaceae
3	*Aristolochia indica* L.	Hansalata	Aristolochiaceae
4	*Atylosia scarabaeoides*(L.)Benth.	Baanakolatha	Fabaceae
5	*Cardiospermum halicacabum* L.	Kanafuta	Sapindaceae
6	*Cayratia pedata* (Lour.) Juss ex Gagnep.	Pitapotala	Vitaceae
7	*Cayratia trifolia* (L.) Domin.	Amadilata	Vitaceae
8	*Coccinia grandis* (L.) Voigt	Kunduri	Cucurbitaceae
9	*Dioscorea oppositifolia* L.	Pitalikanda	Dioscoreaceae
10	*Dioscorea wallichii* Hook.f.	Pitaalu	Dioscoreaceae
11	*Gymnema sylvestre* (Retz.) R.Br.	Gudmari	Asclepiadaceae
12	*Ipomea pes-trigidis* L.	Bileipada	Convolvulaceae
13	*Jasminum arborescens* Roxb.	Niali lata	Oleaceae
14	*Mikania micrantha* Kunth	----	Asteraceae
15	*Passiflora foetida* L.	Gandhatamala	Passifloraceae
16	*Pergularia daemia* (Forssk.) Choiv	Uturudi	Asclepiadaceae
17	*Quisqualis indica* L.	Madhumalati	Combretaceae
18	*Solena amplexicaulis* (Lam.) Gandhi	Ban kunduri	Cucurbitaceae
19	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Guluchi	Menispermaceae

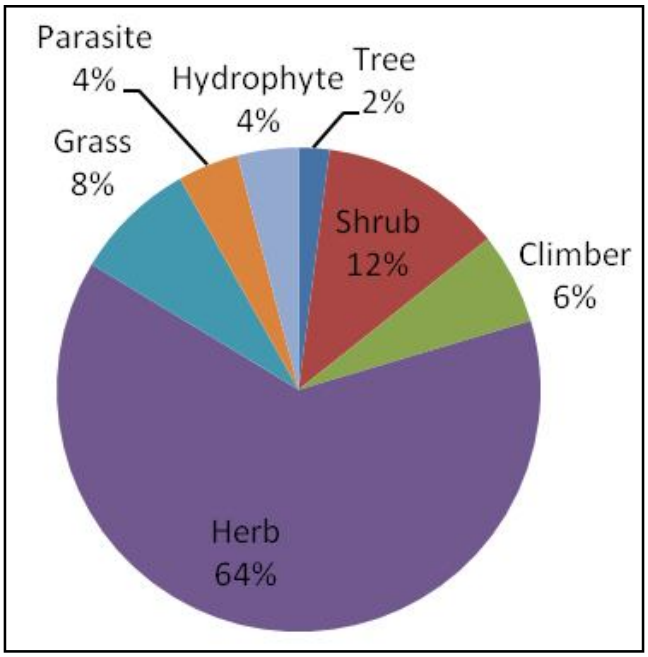

Fig. 4: Habit wise distribution of invasive alien species in Dhauligiri hills.

Graduate Department of Botany, Utkal University, Bhubaneswar. The information was gathered through oral interview of the local peoples and Shiv temple priest. The religious beliefs, spirituality and the participation of locals on conservation of this site were also documented. Invasive alien species of this region were also recorded based on the "Catalogue of Invasive Alien Flora of India" by Reddy (2008) in order to assess the impact of invasive alien species on plant diversity and distribution.

Results and Discussion

From the study site, 267 angiosperms (191 dicot species with 144 genera under 54 families and 76 monocot species with 46 genera under 14 families) 6 pteridophytes, 2 bryophytes and 1 gymnosperm belonging to 199 genera under 77 different families were recorded (Table 1-10). On the basis of habit, 86 (31%) were herbs followed by 54 (20%) grasses, 51(19%) trees, 39 (14%) shrubs, 19 (7%) climbers, 15 (5%) hydrophytes, 6 (2%) pteridophytes, 3 (1%) parasites, 2 (1%) bryophytes and 1 gymnosperm (Table 1-10; Fig. 1). Family-wise trend in diversity of species with following dominant families: Poaceae (36), Cyperaceae (19), Euphorbiaceae (16), Fabaceae (14) and Asteraceae (11) were compared and illustrated (Fig. 2). Cyperus with 13 species was the dominant genus followed by Ficus (6), Phyllanthus (5) and Cassia, Crotalaria, Sida, Panicum with 4 species each (Fig. 3).

A total of 49 invasive alien species belonging to 43 genera under 25 families were recorded. Habit wise grouping of invasive alien species shows 31 (64%) were herbs followed by 6 (12%) shrubs, 4 (8%) grasses, 3(6%) climbers, 2 (4%) parasites, 2 (4%) hydrophytes, and 1 (2%) tree (Fig.4) Among the families of invasive alien plant species, Asteraceae was the dominant family with 8 species followed by Poaceae and Euphorbiaceae with

Table 4: List of Herbs found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Abelmoschus moschatus* Medic.	Bana-bhendi	Malvaceae
2	*Achyranthes aspera* L.	Apamaranga	Amaranthaceae
3	*Aerva lanata* (L.) Juss. ex. Sch.	Paunsia	Amaranthaceae
4	*Ageratum conizoides* L.	Pokasungha	Asteraceae
5	*Alternanthera paronychioides* St.	Madaranga	Amaranthaceae
6	*Alternanthera philoxeroides* Griseb.	Madaranga	Amaranthaceae
7	*Alternanthera sessilis* (L.) R. Br. ex DC.	Madaranga	Amaranthaceae
8	*Amaranthus spinosus* L.	Kantaleutiya	Amaranthaceae
9	*Amaranthus viridis* L.	Nalikhada	Amaranthaceae
10	*Andrographis paniculata* (Brum.f.) Wall. ex Nees	Bhuinimba	Acanthaceae
11	*Anisochilus carnosus* (L.f.) Wall.	Bania	Lamiaceae
12	*Argemone mexicana* L.	Kanta kusuma	Papaveraceae
13	*Blepharis maderaspatensis* (L.) Roth	----	Acanthaceae
14	*Boerhavia diffusa* L.	Ghodapuruni	Nyctaginaceae
15	*Breynia retusa* (Dennst.) Alston	Rakta trichudi	Euphorbiaceae
16	*Cassia tora* L.	Sana chakunda	Caesalpiniaceae
17	*Cleome rutidosperma* DC.	----	Capparaceae
18	*Cleome viscosa* L.	Anasorisa	Capparidaceae
19	*Colocasia esculenta* (L.) Schott		Saru Araceae
20	*Commelina benghalensis* L.	Kansiri	Commelinaceae
21	*Commelina erecta* L.	Kansiri	Commelinaceae
22	*Corchorus aestuans* L.	Bana nalita	Tiliaceae
23	*Crotalaria albidia* Heyne ex Roth.	----	Fabaceae
24	*Crotalaria pallida* Ait.	Jhumjhumka	Fabaceae
25	*Crotalaria prostrata* Rottl. ex Wild.	Jhumjhumka	Fabaceae
26	*Crotalaria verrucosa* L.	Balijhumuka	Fabaceae
27	*Croton bonplandianus* Baill.	Bana lanka	Euphorbiaceae
28	*Desmodium gangeticum* (L.) DC.	Krusnaparni	Fabaceae
29	*Desmodium triflorum* (L.) DC.	Kuradia	Fabaceae
30	*Emilia sonchifolia* (L.) DC	Sarkara	Asteraceae
31	*Eranthemum capense* L.	----	Acanthaceae
32	*Euphorbia thymifolia* L.	Patrasiju	Euphorbiaceae
33	*Euphorbia heterophylla* L.	----	Euphorbiaceae
34	*Euphorbia hirta* L.	Chitakuti	Euphorbiaceae
35	*Evolvulus alsinoides* (L.) L.	Sankhapushpi	Convolvulaceae
36	*Evolvulus nummularius* (L.)L.	Bichhamalia	Convolvulaceae
37	*Glinus oppositifolius* (L.) A.DC.	Pita saga	Molluginaceae
38	*Gomphrena serrata* L.	Hiragola	Amaranthaceae
39	*Gomphrena celosoides* Mart.	Hiragola	Amaranthaceae
40	*Hedyotis corymbosa* (L.)Lam.	Gharapodia	Rubiaceae
41	*Hybanthus enneaspermus* (L.) F.v.Muell.	Madanamastaka	Violaceae
42	*Indigofera linnaei* Ali	Raktapuspi	Fabaceae
43	*Indigofera tinctoria* L.	Nila	Fabaceae
44	*Indigofera longifolia* Forssk.	----	Fabaceae
45	*Justicia betonica* L.	----	Acanthaceae
46	*Justicia quinqueangularis* Koenig ex Roxb.	----	Acanthaceae
47	*Lindernia ciliata* (Colsm.) Pennell	Khetakura	Scrophulariaceae
48	*Lindernia crustacea* (L.)F.V.Muell	Khetakura	Scrophulariaceae
49	*Hygrophila auriculata* (Schum.)Heine	Koilikhia	Acanthaceae
50	*Majus pumilus* (Burm.f.)Steenis.	----	Scrophulariaceae

Sl. No.	Name of species	Local name	Family
51	*Mecardonia procumbens* (Mill.) Small	----	Scrophulariaceae
52	*Melochia corchorifolia* L.	Telapuri	Sterculiaceae
53	*Microccocca mercurialis* (L.) Benth.	----	Euphorbiaceae
54	*Mimosa pudica* L.	Lajakulilata	Mimosaceae
55	*Mitracarpus villosus* (Sw.)DC.	Sanagharapodia	Rubiaceae
56	*Mollugo nudicaulis* Lam.	----	Aizoaceae
57	*Musa paradisiaca* L.	Kadali	Musaceae
58	*Ocimum canum* Sims.	Gangatulasi	Lamiaceae
59	*Orthosiphon pallidus* Benth.	Gayatulasi	Lamiaceae
60	*Parthenium hysterophorus* L.	Gajara ghasa	Asteraceae
61	*Pilea microphylla* (L.) Liebm	Barudagachha	Utricaceae
62	*Phyllanthus fraternus* Webster	Bhuinaonla	Euphorbiaceae
63	*Phyllanthus tenellus* Roxb.	Badi aonla	Euphorbiaceae
64	*Phyllanthus urinaria* L.	Badi aonla	Euphorbiaceae
65	*Phyllanthus virgatus* Forst.f.	----	Euphorbiaceae
66	*Portulaca oleracea* L.	Badabalabalua	Portulacaceae
67	*Portulaca quadrifida* L.	Duludulia	Portulacaceae
68	*Scoparia dulcis* L.	Khila papada	Scrophulariaceae
69	*Sida acuta* Burm.f.	Bajramuli	Malvaceae
70	*Sida cordata* (Brum.f.) Borssum	Bajramuli	Malvaceae
71	*Sida cordifolia* L.	Bisiripi	Malvaceae
72	*Sida rhombifolia* L. subsp. *Rhombifolia* var. *rhombifolia*	Bajramuli	Malvaceae
73	*Solanum virginianum* L.	Bhejibaigana	Solanaceae
74	*Spermacoce hispida* L.	Sanagharapodia	Rubiaceae
75	*Spermacoce articularis* L.f.	––	Rubiaceae
76	*Spilanthes paniculata* Wall. ex DC.	––	Asteraceae
77	*Synedrella nodiflora* (L.)Gaertn.	––	Asteraceae
78	*Tephrosia purpurea* (L.) Pers. var. *purpurea*	Kolathia	Fabaceae
79	*Trianthema protulacastrum* L.	Puruni	Aizoaceae
80	*Trichodesma indicum* (L.)R.Br.	Hetamundia	Boraginaceae
81	*Tridax procumbens* L.	Bisalyakarani	Asteraceae
82	*Triumfetta pentandra* A.Rich.	-	Tiliaceae
83	*Urena lobata* L. subsp. *sinuata* (L.) Borssum var. *sinuata*	Raktapheni	Malvaceae
84	*Vernonia cinerea* (L.)Less.	Pokasungha	Asteraceae
85	*Wedelia chinensis* (Osbeck) Merr.	Kasaraja	Asteraceae
86	*Xanthium indicum* Koenig	Chotagokharu	Asteraceae

3 species each (Fig. 5). A large number of alien species were reported which includes *Eichhornia crassipes*, *Indigofera linnaei*, *Monochoria vaginalis*, *Ipomoea pes-trigidis*, *Lantana camara*, *Mikania micrantha*, *Emilia sonchifolia, Sida acuta* etc. The predominance of Asteraceae species in invasive category shows the high impact of neotropical flora on Indian region (Reddy 2008). Important medicinal plant species include *Gymnema sylvestre*, *Saraca asoca* (critically endangered), *Tinospora cordifolia, Desmodium gangeticum, Evolvulus alsinoides, Wedelia chinensis, Bombax ceiba,* V*etiveria zizanioides, Pandanus fascicularis, Andrographis paniculata, Adiantum capillus-veneris,* etc.

Saraca asoca, critically endangered species in Odisha (IUCN red list 2010) and *Crateva magna*, (endangered species) *Cycas circinalis* (endemic) and species *Microccocca mercurialis* (threatened) were recorded. Some uncommon plant species present in Dhauligiri include *Kigelia africana, Limnophila heterophylla, Dioscorea wallichi, Acacia obtusifolia, Crotalaria albida, Hygrophila auriculata*, *Dentella repens*, *Hydrocera trifolia* etc. Predominant plant species of Dhauligiri were *Wedelia chinensis, Anacardium occidentale, Panicum brevifolium, Saccharum spontaneum, Echinochloa colona, Parthenium hysterophorus* and *Blepharis maderaspatensis*.

Table 5: List of Grasses found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Aristida setacea* Retz.	Khadikaghasa	Poaceae
2	*Brachiaria distachya* (L.) Stapf	----	Poaceae
3	*Brachiaria mutica* (Forssk.) Stapf	----	Poaceae
4	*Brachiaria ramosa* (L.) Stapf	----	Poaceae
5	*Bothriochloa pertusa* (L.) A. Camus	Gandhabena	Poaceae
6	*Bulbostylis barbata* (Rottb.) C.B.Cl.	----	Cyperaceae
7	*Bulbostylis subspinescens* C.B.Cl.	----	Cyperaceae
8	*Chloris barbata* Sw.	----	Poaceae
9	*Chrysopogon aciculatus* (Retz.)Treen	Guguchia	Poaceae
10	*Cynodon dactylon* (L.) Pers.	Kakudia	Poaceae
11	*Cyperus articulatus* L.	----	Cyperaceae.
12	*Cyperus compressus* L.	----	Cyperaceae
13	*Cyperus distans* L.f.	----	Cyperaceae
14	*Cyperus dubius* Rottb.	----	Cyperaceae
15	*Cyperus iria* L.	----	Cyperaceae
16	*Cyperus halpan* L.	----	Cyperaceae
17	*Cyperus kyllingia* Endl.	----	Cyperaceae
18	*Cyperus paniceus* (Rottb.) Boeck.	----	Cyperaceae
19	*Cyperus platystylis* R.Br.	----	Cyperaceae
20	*Cyperus polystachyos* Rottb.	----	Cyperaceae
21	*Cyperus pygmaeus* Rottb.	----	Cyperaceae
22	*Cyperus rotundus* L. var. *rotundus* Kern.	Mutha	Cyperaceae
23	*Cyperus triceps* Endl.	----	Cyperaceae
24	*Dactyloctenium aegypticum* (L.) P.Beauv.	Kakudiaghasa	Poaceae
25	*Digitaria abludens* (Roem. & Schult.) Veldk.	----	Poaceae
26	*Digitaria ciliaris* (Retz.) Koeler		---- Poaceae
27	*Digitaria longiflora* (Retz.) Pers.	----	Poaceae
28	*Echinochloa colona* (L.)Link.	Suan	Poaceae
29	*Eleusine indica* (L.) Gaertn.	Anamandia	Poaceae
30	*Eragrostis cilliaris* (L.) R.Br.		---- Poaceae
31	*Eragrostis ciliata* (Roxb.) Nees		---- Poaceae
32	*Eragrostis unioloides* (Retz.) Nees ex Steud.	----	Poaceae
33	*Fimbristylis dichotoma* (L.) Vahl	----	Cyperaceae
34	*Fimbristylis miliacea* (L.) Vahl	Swanli	Cyperaceae
35	*Fimbristylis polytrichoides* (Retz.) R.Br.	----	Cyperaceae
36	*Heteropogon contortus* (L.) P. Beauv. Ex Roem. & Schult.	----	Poaceae
37	*Lipocarpha sphacelata* (Vahl)Kunth.	----	Cyperaceae
38	*Myriostachya wightiana* (Nees.ex Steud.) Hook.f.	——	Poaceae
39	*Oplismenus compositus* (L.) P.Beauv.	----	Poaceae
40	*Panicum brevifolium* L.		---- Poaceae
41	*Panicum paludosum* Roxb.	----	Poaceae
42	*Panicum psilopodium* Trin.	----	Poaceae
43	*Panicum notatum* Retz.	----	Poaceae
44	*Paspalidium flavidum* (Retz.) A.Camus	Beleilanji	Poaceae
45	*Paspalidium geminatum* (Forssk.) Stapf	----	Poaceae
46	*Paspalum scrobiculatum* L.		---- Poaceae
47	*Pennisetum pedicellatum* Trin.	——	Poaceae
48	*Saccharum spontaneum* L.	Kasatandi	Poaceae
49	*Sacciolepis indica* (L.) Chase	----	Poaceae
50	*Setaria verticillata* (L.) P.Beauv.	----	Poaceae

Sl. No.	Name of species	Local name	Family
51	*Setaria pumila* (Poir.) Roem. & Schult.	----	Poaceae
52	*Sporobolus indicus* (L.) R. Br.	----	Poaceae
53	*Urochloa panicoides* P.Beauv.	Baunsa ghasa	Poaceae
54	*Vetiveria zizanioides* (L.)Nash	Bena	Poaceae

Table 6: List of Parasitic climbers found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Cassytha filiformis* L.	Akashbel	Lauraceae
2	*Cuscuta chinensis* Lam.	Nirmuli	Cuscutaceae
3	*Cuscuta reflexa* Roxb. (Total parasite)	Nirmuli	Cuscutaceae

Conclusion

Present study revealed that Dhauligiri hill act as repository of wild gene pools supporting many threatened plants, medicinal plants and grass species. This region is also endowed with many potential resources which have not been explored and utilized. Furthermore, Dhauligiri hills being a natural sacred site and has being maintained by local people on religious beliefs. However, Dhauligiri

Table 7: List of Hydrophytes found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Aponogeton natans* (L.)Engl. & K.Krause	----	Aponogetonaceae
2	*Dentella repens* (L.) J.R. & G. Forst. var. *repens*	----	Rubiaceae
3	*Eichhornia crassipes* (Mart.) Solms-Laub.	Bilatidala	Pontederiaceae
4	*Hydrilla verticillata* (L.f.)Royle	Chingudia dala	Hydrocharitaceae
5	*Hydrocera trifolia* (L.) W.& A	----	Balsaminaceae
6	*Limnophila heterophylla* (Roxb.)Benth.	Hidimichi	Scrophulariaceae
7	*Limnophila indica* (L.)Druce	Kapura	Scrophulariaceae
8	*Lindernia rotundifolia*(L.) Standl & L.O.Williams	----	Scrophulariaceae
9	*Monochoria hastata* Solms-Laub.	Kajalapatia	Pontederiaceae
10	*Monochoria vaginalis* (Burm.f.) Presl	Kajalapatia	Pontederiaceae
11	*Nymphaea pubescens* Willd.	Nalikain	Nymphaeaceae
12	*Nymphoides hydrophylla* (Lour.) Kuntze	----	Gentianaceae
13	*Pistia stratiotes* L.	Burujhanji	Araceae
14	*Sagittaria guayanensis* Kunth	----	Alismataceae
15	*Spirodela polyrhiza* (L.) Schleiden	----	Lemnaceae

Table 8: List of Gymnosperms found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Cycas circinalis* L. var. *orixensis* Haines	Araguna	Cycadaceae

Table 9: List of Pteridophytes found in Dhauligiri hill

Sl. No.	Name of species	Local name	Family
1	*Adiantum phillippines* L.	----	Adiantaceae
2	*Azolla pinnata* R.Br.	----	Azollaceae
3	*Dryopteris cochleata* (D.Don) C.Chr.	----	Dryopteridaceae
4	*Lygodium palmatum* (Bernh)Swartz	----	Lygodiaceae
5	*Marsilea quadrifolia* L.	Sunsunia saga	Marsileaceae
6	*Pteris vittata* L.	----	Pteridaceae

Table 10: List of Bryophytes found in Dhauligiri hill.

Sl. No.	Name of species	Local name	Family
1	*Tortula muralis* Hedw.	----	Pottiaceae
2	*Riccia huebeneriana* Lindenb-kohatakegoke	----	Marchantiaceae

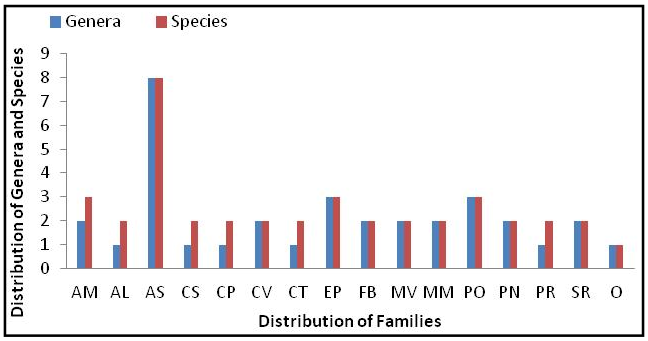

Fig. 5: Family wise distribution of invasive alien Genera and Species in Dhauligiri hills.

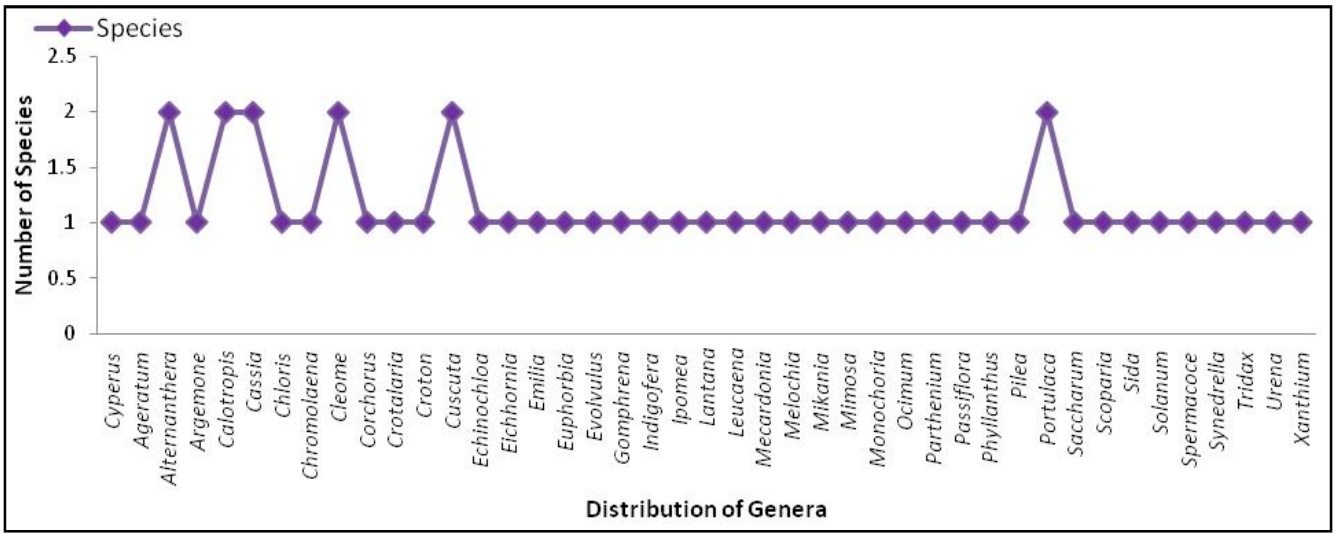

Fig. 6: Genera wise distribution of invasive alien species in Dhauligiri hills.

is a tourist destination and phytodiversity of this area is affected by anthropogenic activity like pollution and over-exploitation of plant resources, invasion of alien species, grazing, etc. Invasive alien species of this area have a huge possibility of causing great ecological damage to natural habitat and a threat to the existence of threatened and endemic species. Therefore, awareness among people and their participation in conservation and management of plant resources is highly essential. The outcome of present study indicates the rich floral diversity of the region and can draw attention of different agencies for its conservation to make it a site of eco-tourism with historical and religious importance.

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Abbreviations

AC-Acanthaceae, AE : Araceae, AG : Agavaceae, AL- Asclepiadaceae, AM-Amaranthaceae, AN-Anacardiaceae, AO : Aizoaceae, AP-Apocynaceae, AR-Arecaceae, AS-Asteraceae,BM :Bombacaceae, BN : Bignoniaceae, CB-Combretaceae, CM-Commelinaceae, CP-Capparidaceae, CS- Caesalpiniaceae, CT : Cuscutaceae, CU-Cucurbitaceae, CV-Convolvulaceae, CY-Cyperaceae, DO-Dioscoreaceae, EP-Euphorbiaceae, FB-Fabaceae, LM-Lamiaceae, MM-Mimosaceae, MO-Moraceae, MV-Malvaceae, MY : Myrtaceae, NY : Nyctaginaceae, OL : Oleaceae, PO-Poaceae, PN : Pontederiaceae, PR : Portulacaceae, RB-Rubiaceae, RT-Rutaceae, SO:Solanaceae, SR-Scrophulariaceae, ST-Sterculiaceae, TL-Tiliaceae, VB-Verbenaceae, VT : Vitaceae, O-Others.

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