



Ecological status and ethno-medicinal studies on plant resources of Rajaji National Park, Uttarakhand, India

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Abstract

The present communication relates to the status and ethno-medicinal knowledge of the flora of world famous Rajaji National Park in the state of Uttarakhand (India). The paper describes local/traditional uses of the 135 medicinal flora representing 63 families, in which 45 species were trees, 58 were herbs, 24 were shrubs and 08 were climbers. Amongst these families, Poaceae was dominant (11 plant species) in having medicinal importance, followed by Caesalpiniaceae, Apocynaceae and Moraceae with 6 species each. Various parts, such as: whole plant (35), roots (24), fruits (23), stem (4), leaves (41), barks (23), rhizome (4), bulbs (2), buds (3), seeds (12), flowers (7), tuber (1) and bulbils (1) were used in different ailments. Of the 135 medicinal plants, 18 species were reported to be threatened, endangered or rare. These identified plants need conservation and protection.

Keywords: traditional, medicinal, family, habit, species

Introduction

Knowledge of flora and vegetation of any area is essential for the study of biodiversity, environment and conservation of natural resources. Large number of plants grows spontaneously in the forests having huge medicinal and economic value which plays an important effective role in the budget of the district. Ethno-botany has come up as a key branch of study which concentrates on the efficacy of different plant species and their properties as food, medicine and other uses (Allen *et al.*, 1990; Cotton, 1997) [2, 4]. A total of 17,000 species of higher plants have been reported in India out of which 7500 are having medicinal importance (Shiva, 1996) [17]. About 300 BC, a document on herbal therapy was written named "The Charak Samhita" which reported 340 herbal drugs along with their traditional uses (Prajapati *et al.*, 2003) [14]. Many people now-a-days have started increasing their faith in herbal medicines which are cheap with fewer side effects as compared to allopathic medicine which however cure a wide range of diseases but are costly and produce side-effects (Kala, 2005) [12]. In Himalayan regions indigenous people are dependent on traditional knowledge of medicinal plant species because these areas can't be easily approached and are known to have comparatively slower rate of development (Farooque *et al.*, 2004, Kala, 2002) [5, 10]. In these areas, due to unfavorable situations viz. inadequacy of latest medical amenities, costly drugs and poor transportation, patients generally experience hardships for a long time and traditional herbal healers play an important role to provide them as an alternate source of therapeutic facilities for their primary healthcare. According to the World Health Organization (WHO), as many as 80% of the world's population depend on traditional medicine to meet their

primary health care needs (Akerle, 1992) [1]. Improvement in modern techniques of phyto-chemistry and pharmacology led to the isolation of a number of active principles of medicinal plants that are established as extremely useful drugs in modern system of medicine (Joshi, 2004) [8]. There is an ever increasing demand of medicinal plants in drug and pharmaceutical industries leading to their over exploitation. Due to over harvesting or un-skilled harvesting, many of these medicinal plants are close to extinction and need immediate attention for conservation in India.

The state of Uttarakhand is a part of north-western Himalaya, and still maintains a dense vegetation cover (65%) with maximum species of medicinal plants reported from Uttarakhand (Kala, 2004, Singh *et al.*, 2005) [11, 19], followed by Sikkim and North Bengal (Samant, 1998) [15]. RajaJi National Park is an Indian National Park, established on 12 August 1983 for conservation of wild life in-situ by the forest department, Government UP (now Uttarakhand), India. This park has been named after C.RAJGOPALACHARI (RAJAJI) a prominent leader of the freedom struggle, the second and last Governor General of independent India and one of the first recipients of India's highest civilian awards BHART RATNA. In 1983, three wild life sanctuaries in the area namely, Chilla, Motichur and Rajaji sanctuaries were merged into one. The Rajaji National Park is rich in biological diversity and is one of the most important regions of Garhwal Himalaya. Though, Singh and Prakash (2002) [18] have documented flora of Rajaji national park, but knowledge regarding the ethnomedicinal uses of these plants species is hardly available. Present study therefore aims to assess the ecological status and an effort to identify important ethno-medicinal plants of Rajaji National park of Garhwal Himalaya.

Study Area

Topography and General Features

The present study was carried out in Rajaji National Park situated in the Shiwalik hill of the sub mountain Himalayan regions with an area of approximately 820sq.km stretching in the Haridwara, Dehradun and Pauri Garhwal district of Uttarakhand, India. The Shiwalik ranges of the park constitute an alluvial formation and are low ranges between Himalaya and indo-gangetic plain. Topography is extremely rugged with several sharply dissected hills due to natural and human influences. There are numerous steep and precipitous slopes all over the park. The altitude varies between 302 m to 1000 m and at some places the variation is rather abrupt. The land slope is marked by steep gorges and gullies, which cut through the unconsolidated strata, which form the floor of these valleys.

Soil

The soil is very poor and consists of beaus of sand stone, gravel and conglomerates. The torrent beds which are distinctive features of the area are most part of the year remain dry but are active during rainy season when they carry a large amount of debris often causing considerable damage to the vegetation of the area. These torrential beds are locally known as rags.

Climate and Rainfall

The climate of the park has extremes of high rainfall, high humidity and high temperature favoring a rich tropical moist type of vegetation. May and June are the hottest month with temperature reaching up to 400 or 410 c and December to January being the coldest (temp. below 200 c). Average rainfall varied from 400 mm in outer hills to 2800 mm in the upper hills.

Forest vegetation

The Forests ecosystem of the park is tropical and quite diverse with rich flora and fauna that interact with each other. The park has many unique characteristics which have both scientific importance and practical significance for

development. Based on the physiognomy and floristic composition, the permanent vegetation of the park may be classified under the “Northern Tropical Moist Deciduous Forests” and can be grouped into the following six types: 1) Sal Forest 2) Mixed Forest 3) Riverine Forest 4) Scrubland 5) Grassland or Savannah 6) Sub-tropical pine Forest.

Material and Method

The present study was based on a field survey in the years 2012-13 in Rajaji National Park, Uttarakhand, India to find the plants of medicinal values. The plants with medicinal values, as known from local people and rural persons were collected, and studies were conducted to know their local names, plant parts used and medicinal values. The knowledge regarding the medicinal importance of plant species was gathered from local people and traditional healers known as “vaids” who are apparently very friendly but maintained a deep secrecy about their traditional knowledge. However, after visiting them for several times, they finally shared their knowledge about the medicinal uses of plants growing around them. Data were collected through interview of randomly selected peoples of all the areas. All the voucher specimens were identified using relevant floras and standard literature, herbarium were prepared and deposited in the Department of Botany, Dr. P.D.B.H. Govt. P.G. College, Kotdwara, HNB Garhwal University, (UK). The plants identified were further compared with relevant available literature in Himalayan region for ethno-medicinal uses (Gaur, 1999, Joshi *et al.*, 2010, Singh, 2011) [6, 20, 9]. Besides, these species were cross checked with the Red Data Book and other publications who have categorized them under various threat (ecological status) categories (Bhat *et al.*, 2013, IUCN, 1993, Kumari *et al.*, 2011, Semwal *et al.*, 2007) [3, 7, 13, 16].

Results and Discussion

The following is the list of some ethno-medicinal plants found in the Rajaji National Park along with their Local/common name(s), family, habit, status, parts used and ethno-medicinal uses given in Table 1. These plants have been arranged alphabetically for their easy understanding.

Table 1: List of ethno-medicinal plant species with botanical name, common/local name, their habit, status, parts used in different ailment.

S. No	Botanical name	C.N/L.N	Family	Habit	Status	Part used	Ethno medicinal uses
1	<i>Acacia catechu</i> Willd.	Khair	Mimosaceae	T	R	B	bleeding piles, nose bleeding
2	<i>Albizia procera</i> (Roxb.) Benth.	Siris	Fabaceae	T		W	Anti-cancerous, rheumatism, hemorrhage, stomach pain
3	<i>Ampelocissus latifolia</i> (Roxb.) Planch.	Wild grape	Vitaceae	C		L	Bone fracture, leucorrhoea, indigestion, gout, dysentery
4	<i>Allium sativum</i> Linn.	Lahsun	Alliaceae	H		Bu	eye problems, indigestion
5	<i>Allium cepa</i> Linn.	Pyaz	Alliaceae	H		Bu	epilepsy, abdominal pain
6	<i>Acacia pennata</i> (L.) Willd.	Biswal	Mimosaceae	S		LB	bleeding gum, indigestion, stomach & urinary problem
7	<i>Aegle marmelos</i> (L.) Corr.	Bael	Rutaceae	T		FRL	diarrhea, fever, dysentery, dyspepsia, diabetes, asthma inflammation
8	<i>Argemone Mexicana</i> Linn	Satyanasi	Papavaraceae	H		W	stomach pain, eye & skin problem, leprosy, diuretic, fever inflammation,
9	<i>Alstonia scholaris</i> Linn.R.Br.	Dita bark	Apocynaceae	T		F	malaria, indigestion, ulcer, tumor, epilepsy, asthma
10	<i>Aloe vera</i> (L.) Burn.	Aloe	Asphodelaceae	H		W	Diabetes, acne, sun-burns, inflammation, purifies blood, respiratory disorders
11	<i>Artemisia parviflora</i> Buch.-	Kunth	Asteraceae	H		W	insecticidal

	Ham. Ex Roxb.						
12	<i>Artemisia nilagirica</i> (Clarke) Pamp.	Mugwort	Asteraceae	H		L	anti-bacterial, menstrual and digestive disorders
13	<i>Abrus precatorious</i> Linn.	Ratti	Leguminosae	C		SRL	Diarrhea, fits, acne, sores, boils, abscesses, diabetes, scratches, wounds.
14	<i>Ageratum conyzoides</i> L.	Goat weed	Asteraceae	H		W	dysentery, wounds, fever, rheumatism, anti-bacterial,
15	<i>Azadirachta indica</i> A. Juss	Neem	Meliaceae	T		W	Tooth-brush, blood purifier, tonic, insecticidal, diabetes, stomachache, rheumatism, wounds, antihelmintic
16	<i>Apluda mutica</i> L.	Lapdu	Poaceae	H		W	Astringent, diuretic
17	<i>Achyranthes aspera</i> L.	Chirchita	Amaranthaceae	H		W	asthma, cough, bronchitis, anti-inflammatory, vomiting, piles, dysentery, blood/skin diseases
18	<i>Amaranthus blitum</i> L.	Chaulai	Amaranthaceae	H		W	ulcers, sore throat, tumor
19	<i>Atropa belladonna</i> L.	Nightshde	Solanaceae	H		W	asthma, cough, cold, fever
20	<i>Adina cordifolia</i> (Roxb.) Hook. f.ex B.D. Jacks	Haldu	Rubiaceae	T		BR	fever, dyspepsia, urinary problems, dysentery, burns
21	<i>Asparagus racemosus</i> Willd.	Shatavar	Liliaceae	H		LR	abscesses, heat, jaundice, diarrhea, indigestion,
22	<i>Agave americana</i> L.	Gethi	Asparagaceae	H	Th	LR	indigestion, anti-bacterial, venereal, snake-bites
23	<i>Bauhinia variegata</i> Linn.	Kachnar	Caesalpinaceae	T		B Bd	leprosy, ulcer, skin diseases
24	<i>Beta vulgaris</i> L.	Beetroot	Amaranthaceae	H		R	anti-diabetic, liver disorders
25	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Ghamari	Crassulaceae	H		L	Antimicrobial, kidney stone, headache, anti-inflammatory, anti-cancerous, anti-diabetic
26	<i>Bombax ceiba</i> Linn.	Semal	Bombacaceae	T		B R Fl	Boils, gonorrhea, sexual disorders, aphrodisiac, tonic, dysentery, antimicrobial
27	<i>Bauhinia variegata</i> Linn.	Kachnar	Caesalpinaceae	H		R B Bd	Dysentery, diarrhea, stomach disorder, dyspepsia, wounds, insect-bites, ulcer, piles
28	<i>Bacopa monnieri</i> L.	Ban Brahmi	Scrophulariaceae	H	R	R L	therapeutic, stomach and intestinal disorders
29	<i>Bennincasa hispida</i> Thunb.	Ash Gourd	Cucurbitaceae	C		F	constipation, tonic, stomach problems,
30	<i>Berberis asiatica</i> Roxb.	Kilmora	Berberidaceae	S	Th	BL	ear and eye problems
31	<i>Butea monosperma</i> (Lamk.)	Palash	Fabaceae	T	R	B L	diabetes, pimples, diarrhea, ulcer, tumor, hemorrhoids, gonorrhea, antihelmintic, anti-inflammatory
32	<i>Boerhavia diffusa</i> Linn.	Punryaru	Nyctaginaceae	H		L	cardio and hepatoprotective, diabetes, eyesight, diuretic, antioxidant
33	<i>Cynadon dactylon</i> Linn.	Doob	Poaceae	H		W	laxative, tonic, emetic, anti-inflammatory, bruises
34	<i>Cassia tora</i> (L.) Roxb.	Kasivinda	Caesalpinaceae	H		L S	Leprosy, ringworm, cough, bronchitis, cardiac disorders
35	<i>Cassia fistula</i> Linn.	Amaltas	Caesalpinaceae	T	R	S R	rabies, abdominal pain, constipation
36	<i>Cassia occidentalis</i> L.	Kasodi	Caesalpinaceae	H		W	night blindness, worms
37	<i>Calotropis procera</i> (Ait.)R.Br	Aak	Asclepiadaceae	S		R Fl	Dysentery, cold, cough, fever, asthma
38	<i>Centella asiatica</i> (L.) Urban	Brahmi	Apiaceae	H		W	mental disorder, eye problems
39	<i>Cannabis sativus</i> Linn.	Bhang	Cannabaceae	H		Fl S L	Diarrhea, diuretic, dysentery, malaria, gonorrhea, asthma, nausea, anti-inflammatory
40	<i>Cymbopogon martini</i> (Roxb.) Wats.	Palmarosa	Poaceae	H		L	aromatic, dry skin, eczema, anti-microbial
41	<i>Catharanthus roseus</i> (L.) G. Don	Sadabahar	Apocynaceae	S		W	Anti-cancerous, antibacterial, diabetes, tonic, wasp-stings
42	<i>Carissa carandas</i> L.	Kalimi	Apocynaceae	S		F	Jaundice, fever, earache
43	<i>Cupressus torulosa</i> D.Don	Cypress	Cupressaceae	T		L	body pain
44	<i>Chenopodium album</i> Linn.	Bethua	Chenopodiaceae	H		W	bladder-stone, blood purifier jaundice,
45	<i>Cinnamomum tamala</i> Nees&Eberm.	Tejpat	Lauraceae	T	R	B	gonorrhoea, nausea, malaria, diabetes, pimples, asthma, diarrhea, menstrual disorder
46	<i>Citrus medica</i> Linn.	Nimmu	Rutaceae	S		F	eye sight
47	<i>Carica papaya</i> Linn.	Papita	Caricaceae	T		F St	arborificient, anti-pregnant, dyspepsia, chronic eczema
48	<i>Citrus aurantifolia</i> (Christm.)Swingle	Neebu	Rutaceae	S		F	Nose bleeding, epitasis
49	<i>Curcuma aromatica</i> Salisb.	Haldi	Zingiberaceae	H		Rh	Eye diseases, flowing ear, discoloration of skin
50	<i>Coccinia grandis</i> (L.) Voigt.	Kundru	Cucurbitaceae	C		F L	anti-diabetic, anti-microbial, hepato-protective, arthritis
51	<i>Carissa carandus</i> Linn.	Karonda	Apocynaceae	S		R	jaundice, indigestion, wounds, carminative
52	<i>Coriandrum sativum</i> Linn.	Dhaniya	Apiaceae	H		W	Eyesight, baldness
53	<i>Cuscuta reflexa</i> Roxb.	Amerbel	Boraginaceae	C		W	Jaundice, joint pain, abortion

54	<i>Costus speciosus</i> (Koenig. Ex Retz.) J.E. Smith.	Kewati	Zingiberaceae	H	En	Rh	Abortion
55	<i>Dalbergia sissoo</i> Roxb.	Shisam	Fabaceae	T		B L	inflammation, anti-microbial astringent, stimulant
56	<i>Dendrocalamus strictus</i> (Roxb.) Nees.	Bans	Poaceae	T		L	cough, cold
57	<i>Dalbergia paniculata</i> Roxb.	Safed Pihl	Fabaceae	T		L S	anti-bacterial, anti-oxidative, anti-inflammatory
58	<i>Delphinium denudatum</i> Wall.ex Hook. f & Thoms	Nirbisi	Ranunculaceae	H	En	R	stimulant, tonic, snake bite, liver problems, insecticidal, boils, blister
59	<i>Datura stramonium</i> Linn.	Dhatura	Solanaceae	H		Fl S	ear ache, poisonous bites diarrhea, wound
60	<i>Digitaria ciliaris</i> (Retz.) Koeler	Crab grass	Poaceae	H		W	Gonorrhoea, cataract, emetic
61	<i>Dioscorea bulbifera</i> L.	Genthi	Dioscoreaceae	H		Bul T	Diarrhea, jaundice, diabetes, dysentery, goiter, stomach ache, anti-cancerous
62	<i>Desmodium gangeticum</i> (L.) DC.	Salparni	Fabaceae	H	R	L	wound, fever, dysentery
63	<i>Eucalyptus citridora</i> Hook.	Safeda	Myrtaceae	T		B	asthma, sore throat, fever, typhoid, ulcer, wounds, gout
64	<i>Emblica officinalis</i> L.	Amla	Euphorbiaceae	T		F S L	Diabetes, diuretic, eyesight, blood-purifier, hemorrhages, earache, dysentery, asthma constipation
65	<i>Eupatorium citriodora</i> Hook.	Kalabasa	Asteraceae	H		L	bleeding, fever, head-ache, dandruff
66	<i>Euphorbia hirta</i> L.	Asthma plant	Euphorbiaceae	S		W	rheumatism, wounds, eye sore, constipation
67	<i>Eleusine</i> spp.	Wire grass	Poaceae	H		L	diuretic, anti-oxidant, anti-inflammatory, asthma
68	<i>Ficus benghalensis</i> Linn.	Bargad	Moraceae	T		W	Ulcer, leprosy, biliousness rheumatism, gonorrhoea
69	<i>Ficus semicordata</i> Bunch.-Ham.ex Smith	Drooping Fig	Moraceae	T		R F	fever, menstrual disorders, headache, constipation
70	<i>Ficus racemosa</i> Linn.	Gullar	Moraceae	T	R	FL	conception, anti-oxidative
71	<i>Ficus palmate</i> Forsk.	Bedu	Moraceae	T		F	stings, spines
72	<i>Ficus religiosa</i> Linn.	Peepal	Moraceae	T		L	vomiting, cardiac diseases, inflammation
73	<i>Foeniculum vulgare</i> Mill.	Saunf	Apiaceae	H		S	Worm infection
74	<i>Grewia asiatica</i> L.	Phalsa	Tiliaceae	T		FL R	Antioxidant, urinary tract and sexually transmitted infections, backache
75	<i>Grewia optiva</i> Drum.ex Burret	Bhimal	Tiliaceae	T		LF	diarrhea
76	<i>Hedychium spicatum</i> Buch.-Ham. ex Sm.	Ban-haldi	Zingiberaceae	H	Th	R	inflammation, body-ache, asthma
77	<i>Hibiscus rosa-sinensis</i> Linn.	Gurhal	Malvaceae	Shrub		L St	contraceptive, male-sterility, impotency, fever
78	<i>Eulaliopsis binata</i> (Retz.) C.E. Hubb.	Babar	Poaceae	Herb		L	Diuretic, bladder stone, rheumatism, diabetes
79	<i>Indigofera tinctora</i> L.	Neelichetu	Papilionaceae	H		W	piles, diuretic, dropsy
80	<i>Justicia adhatoda</i> L.	Basinga	Acanthaceae	S		W	Bronchitis, antispasmodic, asthma, diabetes, pyorrhea, dysentery, jaundice
81	<i>Juglans regia</i> L.	Akhor	Juglandaceae	T		B	intestinal worms, toothache
82	<i>Lawsonia inermis</i> L.	Mehndi	Lythraceae	S		L Fl	baldness, burning, smallpox ring-worm, rheumatism
83	<i>Lannea coromandelica</i> Houtt.	Jhinghan	Anacardiaceae	T	R	B F	Bleeding
84	<i>Lantana camara</i> Linn.	Kuri	Verbenaceae	S		L	Diaphoretic, carminative, antispasmodic
85	<i>Murraya koenigii</i> (L.) Spreng	Curry pata	Rutaceae	T		B R	anti-diabetic, stimulant
86	<i>Mangifera indica</i> Linn.	Aam	Anacardiaceae	T		F	constipation, indigestion, dyspepsia, bleeding
87	<i>Melia azadirach</i> Linn.	Bakain	Meliaceae	H	R	B L	urinary disorders, headache, hemorrhoids, anti-helminthic
88	<i>Momordica charantia</i> Linn.	Karela	Cucurbitaceae	C		FS	Headache, diabetes, leprosy, piles, jaundice
89	<i>Mimosa pudica</i> Linn.	Chui-mui	Mimosaceae	H		L R	piles, joint-pains, jaundice, ulcers, leprosy, impotency
90	<i>Myrica nagi</i> Hook.f.non-Thumb	Kaphal	Myricaceae	T		B	anti-inflammatory, chest pains, vomiting, stomach and digestive problems
91	<i>Mentha piperata</i> Linn.	Podina	Lamiaceae	H		W	Nausea, vomiting
92	<i>Mentha arvensis</i> L.	Podina	Lamiaceae	H		W	dyspepsia, stomach pain
93	<i>Mallotus philippensis</i> (Lam.) Muell.Arg.	Rolli,Rui	Euphorbiaceae	T		F	Wounds
94	<i>Morus alba</i> Linn.	Shahtoot	Moraceae	T		R	Sore throat, dyspepsia, fever
95	<i>Musa paradisiaca</i> Linn.	Kela	Musaceae	S		W	Haemoptysis, snake bite, venereal diseases, diabetes, sterility in man, dysentery

96	<i>Nerium indicum</i> Miller.	Kaner	Apocynaceae	S		L R	eye diseases, conjunctivitis, leprosy, syphilis, migraine
97	<i>Ocimum sativum</i> Linn.	Tulsi	Lamiaceae	H		L	malaria, fever, cough, antiseptic, expectorant
98	<i>Origanum vulgare</i> Linn.	Bantulsi	Lamiaceae	H	R	W	urinary disorders, cough, cold
99	<i>Oxalis corniculata</i> Linn.	Chilmora	Oxalidaceae	H		W	cataract, dysentery, diarrhea, conjunctivitis
100	<i>Piper betle</i> L.	Pan	Piperaceae	H		L	Respiratory problems, back pain, breast inflammation, ulcer, indigestion
101	<i>Pinus roxburghii</i> Sarg.	Chir	Pinaceae	T		St	bladder stone, piles
102	<i>Punica granatum</i> Linn.	Anar	Punicaceae	S		F	Diarrhea, dyspepsia, fever, menstrual-disorders
103	<i>Psidium guajava</i> L.	Amrood	Myrtaceae	T		Bd F	diarrhea, vomiting, fever, dysentery, diabetes, ulcer
104	<i>Quercus spp.</i>	Banj	Fagaceae	T		B	Tonsillitis
105	<i>Rumex hastatus</i> D.Don	Chilmora,	Polygonaceae	H		W	Rheumatism
106	<i>Rhododendron arboretum</i> Sm.	Burans	Ericaceae	T		Fl B	dysentery, headache
107	<i>Rubus ellipticus</i> Smith	Hisalu	Rosaceae	S		F	Cholera
108	<i>Rhus parviflora</i> Roxb.	Toong	Anacardaceae	T		F B	Diarrhea, eye, liver, bile and urinary disorders
109	<i>Ricinus communis</i> Linn.	Erandi	Euphorbiaceae	S		L	Backache
110	<i>Rauwolfia serpentina</i> (Linn.)Benth. ex Kurz	Sarpaganda	Apocynaceae	H		R	insomnia, poisonous bites diabetes, uterine contraction
111	<i>Sida cordifolia</i> L.	Denusha	Malvaceae	S	R	W	Antipyretic, ulcer, paralysis, anemia
112	<i>Shorea robusta</i> Gaertn.	Sal	Dipterocarpaceae	T		B L	salivation, ear/ skin diseases, epilepsy, dysentery
113	<i>Sapindus mukorossi</i> Gaertn.	Reetha	Sapindaceae	T		F	Migrain, abortifacient, skin tanning, freckles
114	<i>Saccharum bengalense</i> Retz.	Baruwa	Poaceae	H		R	birth control, sexual diseases
115	<i>Saccharum spontaneum</i> Linn.	Kusha	Poaceae	H		R	burning sensation
116	<i>Saccharum munja</i> Roxb.	Munja	Poaceae	H		R	blood purifier, burning sensation, urinary disorders
117	<i>Solanum nigrum</i> L.	Makoi	Solanaceae	S		S L	dysentery, piles, gonorrhoea, liver-enlargement, jaundice
118	<i>Solanum viarum</i> Dunal	Soda-apple	Solanaceae	S		W	diabetes, anti-cancerous
119	<i>Syzygium cumini</i> (L.) Skeels	Jamun	Myrtaceae	T		B L F	Indigestion, bleeding-gums, urinary/ intestinal problems, blood purifier, sore throat, diabetes, diarrhea, worms
120	<i>Saraca indica</i> (Roxb.) de Wild	Ashoka	Caesalpinaceae	T		Fl	Diabetes, bone fractures, hemorrhage, dysentery, anti-microbial, fever, cold.
121	<i>Stearia glauca</i> (L.) P.Beauv.	Golden foxtail	Poaceae	H		S	Digestive, diuretic
122	<i>Tectona grandis</i> Linn.	Teak	Verbenaceae	T		B	eczema, hair growth
123	<i>Tagetes erecta</i> Linn.	Hazari	Asteraceae	H		W	ulcers, eczema, diuretic
124	<i>Tinospora cordifolia</i> (Willd.) Miers.	Guduci	Menispermaceae	C	R	W	hepatitis, diabetes, anemia, syphilis, leprosy
125	<i>Terminalia arjuna</i> (Roxb.)Wt.andArn.	Arjun	Combretaceae	T		B R	cardiac & urinary diseases
126	<i>Terminalia bellirica</i> (Gaertn.) Roxb	Barar	Combretaceae	T		B R	heat burn, acidity
127	<i>Utrica dioca</i> L.	Kandai	Urticaceae	H		L	Paralysis
128	<i>Vitex negundo</i> L.	Nirgundi	Verbinaceae	S		W	Arthritis, eye trouble
129	<i>Ventilago denticulata</i> Willd.	Pitti	Rhamnaceae	C		B L	Tonic, antioxidant
130	<i>Verbascum thapsus</i> L.	Mullein	Scrophulariaceae	H		W	eye ailments, respiratory disorders, cough, asthma
131	<i>Woodfordia fruticosa</i> (L.) Kurz.	Dhaaya	Lythraceae	S		W	astringent, piles, stimulant, diarrhea, dysentery, fever, skin infections, ulcers
132	<i>Withania somnifera</i> (Linn.) Dunal	Ashwgnda	Solanaceae	H		W	anti-diabetic, cough, cancer, aphrodisiac, conjunctivitis, ulcer
133	<i>Zanthoxylum armatum</i> DC	Timru	Rutaceae	S	R	S St	miswak, insecticidal, piles, indigestion, hepatoprotective
134	<i>Zingiber officinale</i> Rosc.	Adarak	Zingiberaceae	Herb		Rh	Arthritis, ulcer, rheumatism, diabetes, constipation, cold, cough, bronchitis, body pain
135	<i>Ziziphus mauritiana</i> Lam.	Gangaregu	Rhamnaceae	Tree		L B	Aphrodisiac, diuretic

Abbreviation C.N/L.N: Common/Local name; Habit: T Tree, S = Shrub, H = Herb; Status: R = Rare, Th = Threatened, En = Endangered; Plant parts used: W Whole plant, L Leaf, R Root, F Fruit, Fl Flower, St Stem, S Seed, B Bark, Bu Bulb, Bul Bulbil, Rh Rhizome, T Tuber, Bd Bud.

Present investigation records 135 species of medicinally important plants belonging to 63 families (Table 1). Poaceae was the dominant family (Fig. 1) having 11 plant species with medicinal value, followed by Caesalpinaceae, Apocynaceae, and Moraceae with 6 species each; Rutaceae, Asteraceae and

Fabaceae with five species; Zingiberaceae, Lamiaceae and Euphorbiaceae with 4 species; Anacardiaceae, Amaranthaceae, Cucurbitaceae, Myritaceae, Apiaceae, Mimosaceae with three species. The rest of the families contribute one or two species.

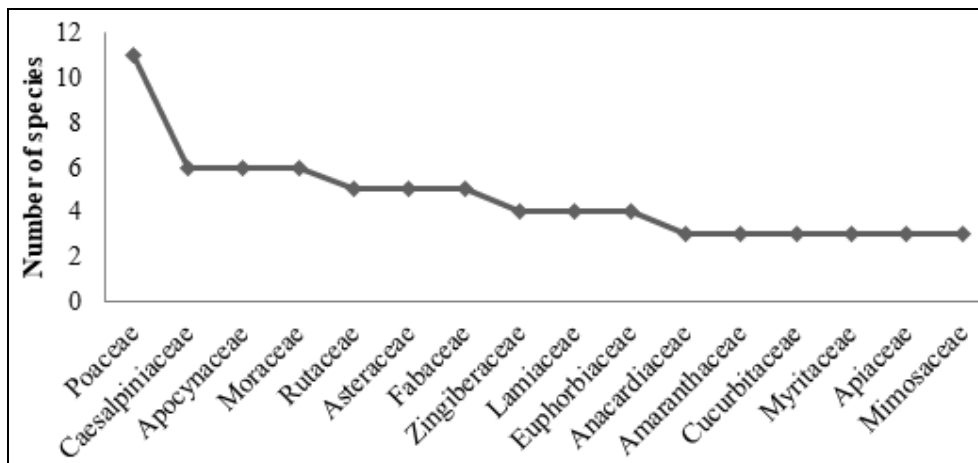


Fig 1: Dominant families contributing ethno-medicinal plant species.

Majority of these ethno-medicinal plant species were herbs (58), followed by trees (45 species), shrubs (24 species) and the remaining 08 plant species were climbers (Table 1, Fig 2).

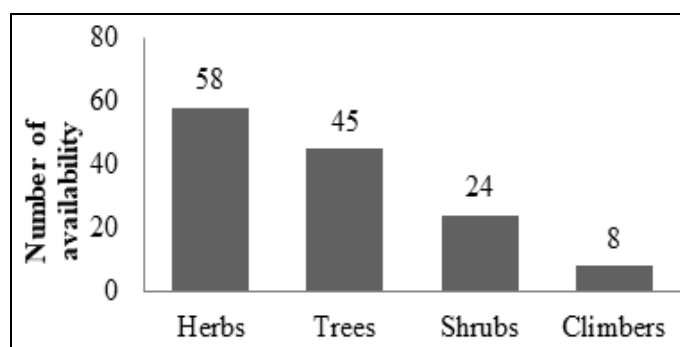


Fig 2: Habit-wise analysis of the medicinal plants.

Further analysis of the ecological status of these plant species by comparing them with different reports (Bhat *et al.*, 2013,

IUCN, 1993, Kumari *et al.*, 2011, Semwal *et al.*, 2007) [3, 7, 13, 16] indicated that eighteen plant species encountered are rare (13), endangered (2) and threatened (3). These were *Acacia catechu*, *Agave americana*, *Bacopa monnieri*, *Berberis asiatica*, *Butea monosperma*, *Cassia fistula*, *Cinnamomum tamala*, *Costus speciosus*, *Delphinium denudatum*, *Desmodium gangeticum*, *Ficus racemosa*, *Hedychium spicatum*, *Lannea coromandelica*, *Melia azadirach*, *Origanum vulgare*, *Sida cordifolia*, *Tinospora cordifolia* and *Zanthoxylum armatum*. The remaining plant species enlisted in Table 1 were found to be either common or cultivated.

Various parts, such as: whole plant (35), roots (24), fruits (23), stem (4), leaves (41), barks (23), rhizome (4), bulbs (2), buds (3), seeds (12), flowers (7), tuber (1) and bulbils (1) were used in different ailments. The most commonly used parts of ethno-medicinal plants, compiled with relevant literature were leaves (30%), whole plants or plant (26%), roots (18%), followed by fruits and bark (17%), seeds (9%), flowers (5%), stem and rhizome (3% each) (Fig. 3).

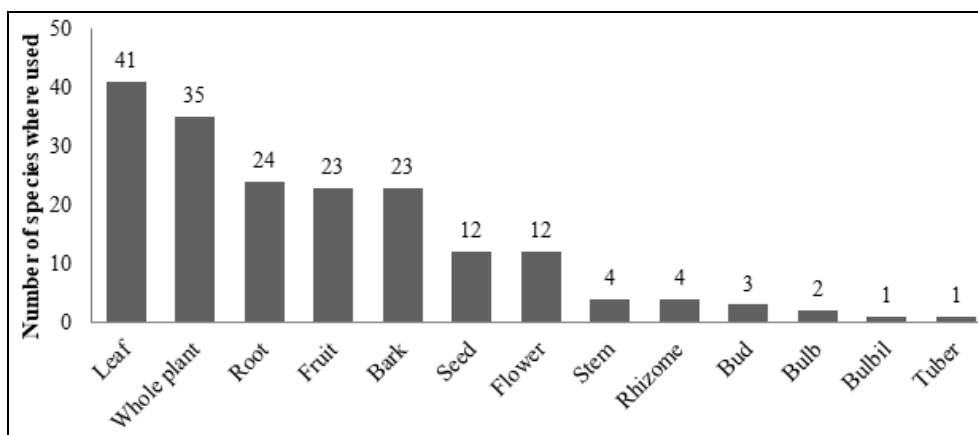


Fig 3: Plant parts used in different ethno-medicine

Conclusion

Present communication embodies the diversity and ethno-medicinal importance of plant species of Rajaji National Park, Uttarakhand. The medicinal plants enlisted in Table 1 revealed that large number (135 species) of local plants of the area are known to be used in the traditional system of medicine. Of

these species, a total of 18 plants have been over-exploited to such an extent that these are on verge of extinction i.e. rare, endangered or threatened. Hence, there is an urgent need to conserve these plants in-situ. Apart from this, the remaining plant species that are common and/ cultivated can be exported on commercial scale resulting as a source of income to local

inhabitants of that region. However, the collection of such medicinally important plants should mostly be done in a planned and systematic way by taking guidance from experts in government organizations so that these are not over exploited. Due to modernization and deforestation, most of the flora, fauna and vegetation cover in our country is degrading. Therefore; there is an urgent need to document the bio-resource and conservation of bio-wealth of Rajaji National Park for wise management and sustainable utilization of biodiversity.

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