AN ACCOUNT OF "LEAF DRUG" AMONG MEDICINAL PLANT RESOURCES OF JALPAIGURI DISTRICT, WEST BENGAL, INDIA

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Abstract

The aim of the present study was to prepare a basic and more specific documentation of medicinally important plants of Jalpaiguri district of West Bengal province of India for future use, preservation of the bio-resource of the country in a scientific way and use it for the betterment of mankind. The present work concentrated on a total of 65 families which include 144 genera and 173 species of 'leaf drug'. Highest numbers of species (21) were under the family Fabaceae, followed by Asteraceae (13) and Lamiaceae (10). Leaf drugs are prepared in four different ways and are mainly used to cure fever, skin diseases, rheumatism, diarrhoea, asthma, gonorrhea and jaundice.

Key words: Medicinal plants, leaf drug, Jalpaiguri, West Bengal, India, Survey.

INTRODUCTION

From the ancient time, every human civilization depends on wild plants for important component of healthcare system (Pushpangadan 2002). They gathered plant resources from nature to meet up their needs of food and health care components (Schippmann *et al.* 2002). The World Health Organization reports that over 80% of the global population relies mainly on traditional medicine (Akerele 1992).

In Indian sub-continent medicinal plants are being used for 5000 years (Siva Ramakrishana and Sujatha 2012). In India there are 2500 such plant species which are known for medicinal properties. But more than 6000 plant species with potential medicinal values are still to be recognized (Huxley 1984). The Ministry of Environment & Forests, Govt. of India acknowledged that Ethnobotanical investigations of any kind documented a large number of wild plants used by tribal communities for meeting their daily needs (Anonymous 1990). This documentation was initiated by the Economic Botany Section of Botanical Survey of India (BSI), Sibpur, West Bengal (Siva Ramakrishana and Sujatha 2012). Jain published a series of papers and books on this topic (Jain 1963, 1964a-b, 1965, Jain and Mitra 1997). Recently a good number of ethnomedicinal works have been reported from south India (Reddy *et. al.* 2002, Raju and Reddy 2005).

The Eastern Himalaya and the adjoining area is biodiversity rich area (Saha *et al.* 2013). The study region is situated within this area. Ahmed *et al.* (2007) did a similar work near to the study area. This district comprises of Terai, Duars and the parts of Hills of Eastern Himalaya. Almost the entire forest covers an area of Jalpaiguri district, except adjoining hills was classified as North Indian moist tropical forest type (Champion and Seth's 1968). Recent botanical survey in Gorumara National Park of this area recorded 70 species belonging to 38 families of medicinal values. The present survey was conducted to record such plants during the years from 2007 to 2009 jointly by West Bengal State Council of Science and Technology and Ananda Chandra College of West Bengal, India.

Bose *et al*. (2015) found that leaf is an important source of medicine. Thus the work was concentrated on 'the leaf'. This is a unique approach for documenting medicinal plants and first of its kind in this region. The aim of the present study is to prepare a basic and more specific documentation

of medicinally important plants of this area for the future use and preserve the bio-resource of the country.

MATERIAL AND METHODS

It is revealed that only ethnomedicobotanical work or only botanical work have some limitations of its own and cannot reflect the situation perfectly (Bose *et al*. 2015, Bose 2011, 2013). So in this work we use a comprehensive approach for the documentation of medicinal plants of this area. The research team adopted a basic work plan for execution of the project. The team divided the district in a few imaginary divisions. Checklist of forest villages with relevant demographic information to study ethnomedicobotanical work were collected from the forest department. Besides forest villages the tribal population is distributed throughout the districts. Local Scheduled Caste and Scheduled Tribe Departments were also visited for detailed information about location and nature of tribal population. An intensive search was made through internet. The working team made a detailed plan for field trip for one year duration. Detailed information on types, traditional method of preparation, mode of consumption, shelf life and ethnic value of the medicinal and aromatic plants were collected from elderly persons, medicine men of tribal communities and forest villagers. Information was collected through pretested proforma by personal interview. Literature was surveyed and a check list was prepared for known medicinal plants.

The present study covers almost all the areas of the district including remote areas inhabited by various tribal populations. During the investigations we have collected plant specimens and information on the uses of the plants to cure common diseases. Beside ethnomedical data, a large number of plant specimens were also collected which have medicinal properties.

The plant specimens were collected in flowering and fruiting conditions. Digital photographs of the concerned plants were also taken. Some plants which were not in flowering and fruiting conditions at the time of collection. They were recorded during their flowering season.

The collected specimens were dried, chemically treated and herbarium sheets were prepared. The herbarium sheets were identified jointly by the research team and WBCST with help of pertinent literature, internet, and resource persons.

RESULTS AND DISCUSSION

The present work concentrated on a total of 65 families which included 144 genera and 173 species. Highest number of species (13 species) were recorded under the family Asteraceae followed by Lamiaceae (10 species), Fabaceae as well as Caesalpiniaceae (9 species each). Among the other families Solanaceae, Verbenaceae each was represented by seven species; Malvaceae, Cucurbitaceae, Rubiaceae and Acanthaceae were represented by six species each; similarly Piperaceae and Euphorbiaceae contained five species each; Poaceae was represented by four species; Tiliaceae, Rutaceae, Lauraceae, Asclapiadaceae, Myrtaceae, Mimosaceae, Moraceae and Rosaceae contained three species each, whereas Basellaceae, Sterculiaceae, Olacaceae, Menispermaceae, Meliaceae, Liliaceae, Combretaceae, Chenopodiaceae, Apocynaceae, Apiaceae, Anacardiaceae and Amaranthaceae were represented with two species each. There are thirty one such plant families which contain a single species under a single genus. The ‘leaf drugs’ are mostly found from dicotyledonous angiosperm, however, there is one pteridophyte, *Alangium chinensis*, which belongs to the family Alangiaceae used as a ‘leaf drug’.

There are a few genera, where more than one species was recorded under each genus. The genus *Ocimum* and *Piper* are represented by five species; the genus *Cassia* is represented by four species;

Cymbopgon, *Solanum* and *Clerodendrum* were also represented by three species each; and *Calotropis*, *Basella*, *Momordica*, *Jatropha*, *Bauhinia*, *Caesalpania*, *Litsea*, *Hibiscus*, *Sida*, *Murrya*, *Nicotiana* and *Corchorus* were represented by two species and rest of one hundred twenty six genera is represented by a single species each. Distribution of 'Leaf Drug' among families with more than one species is given in Fig. 2.

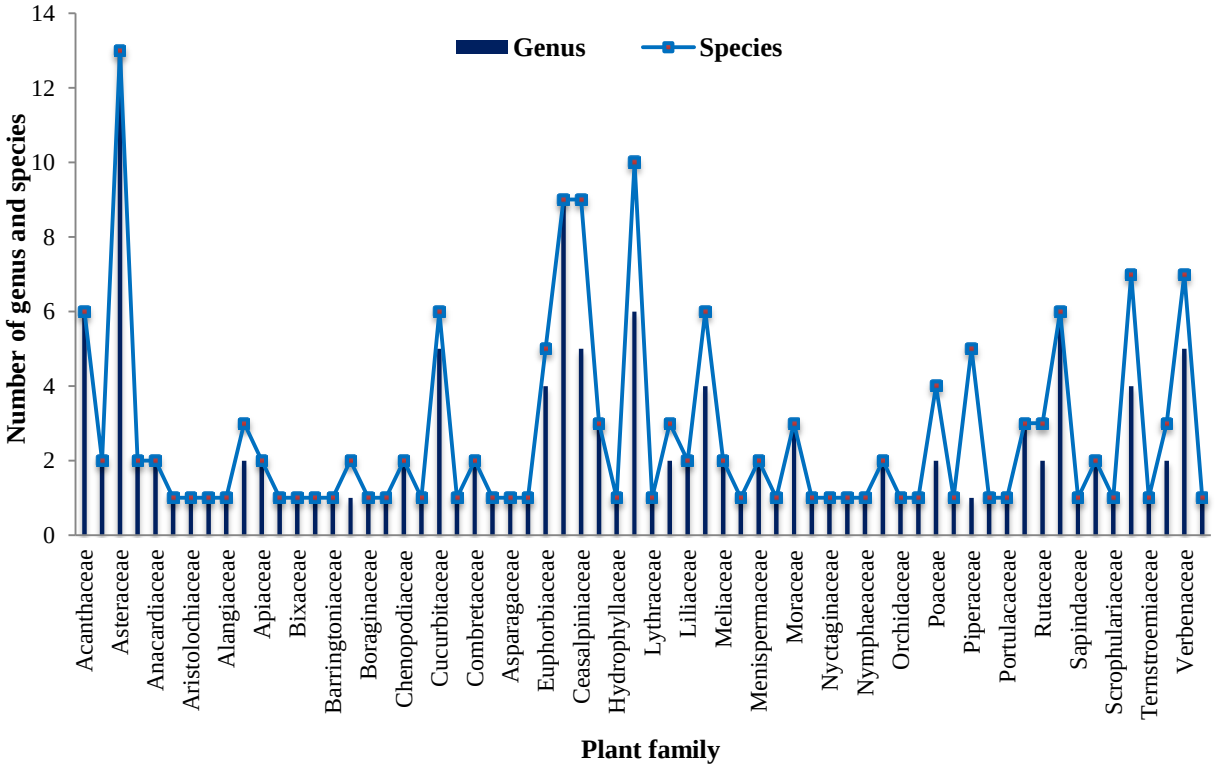

Fig. 1. Distribution of 'Leaf Drug' among families with more than one species.

The methods of preparation of ‘leaf drug’ fall into four categories, viz. plant parts applied as a paste, juice extracted from the fresh parts of the plant, and plants used to prepare a decoction in combination with water and powder made from fresh or dried material. The ‘leaf drug’ is mainly used to cure fever, which was found in twenty two cases, followed by skin disease in nineteen cases, rheumatism in fifteen cases, diarrhoea in fourteen cases, cough and cold, bronchitis as well as eye related disease in twelve cases, diarrhoea in eleven cases, asthma in ten cases, gonorrhea in eight cases, jaundice in five cases. Selected photographs of rare medicinal plants found in this area are given in Fig. 1. The detail uses of the ‘leaf drug’ found in the study area is given in Table 1.

Table 1. An account of "Leaf drug" among medicinal plant resources of Jalpaiguri district, West Bengal, India.

Family	Name	Status	Flowering and Fruiting time	Medicinal use
Acanthaceae 6 genera, 6 spp.	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Common	August-March	Leaf extract used as liver tonic, cure diarrhoea flatulence, asthma, chronic fever, bronchitis.
	Barleria cristata Linn.	Common.	September-February	Edema, rheumatism, colic pain and cough.
	Hygrophila schulli (Buch. Ham.) M. Ret. et. S.M.Almeida	Common.	June-January	Leaf extract used to treat anemia.
	Justicia adhatoda L.	Frequent	December-April	Leaf juice taken for several days as expectorant to treat chronic bronchitis, cough and cold.
	Phlogacanthus thyrsiformis (Hardwicke) Mabberley.	Frequent	December-April	The leaf is used against opthalmia, against acidity, indigestion, cough and cold, whooping cough, asthma, chronic bronchitis, worm infection, heart disease, rheumatism, diarrhoea, dysentery, piles, pox, antiseptic and leucoderma.
	Rungia pectinata Nees.	Common	April-October	Leaf juice refrigerant and aperient, bruised leaves applied in convulsions.
Apocynaceae 2 genera, 2 spp.	*Allamanda carthartica L*	Rare	Throughout the Year	Leaf extract with $NaHCO_3$ has anti tumor property. It is antifungal also.
	Carissa carandas Linn	Infrequent	March-October	Leaf is used to treat thrust, rheumatism and stomach problem.
Asteraceae 13 genera, 13 spp.	*Artemisia nilagirica* (C.B Clarke) Pamp.	Rare	September-November	The leaf sap is used in fever.
	Emilia sonchifolia (L.) DC	Abundant	August-April	Juice of leaves used to treat eye inflammation, night blindness and sore eyes.
	Eclipta prostrate (L.) L.	Common	Throughout the Year	Leaf juice is used against skin disease.
	Eupatorium odoratum L	Frequent	November-March	Leaf is used to prevent bleeding.
	Grangea maderspatana(L.) Poir.	Rare	December-May	Leaves antispasmodic, stomachic, deobstruent; prescribed in hysteria due to obstructed mense; fermented leaf as anodyne, leaf juice as ear drop in ear ache.
	Spilanthes calva DC	Infrequent	September-February	Young leaves are eaten after cooking to increase lactation. Used in cough and cold as well as glossites.
	Tithonia diversifolia Desf.	Common	November-March	Crushed leaves mixed with water used for treatment of the throat and liver ailments, stomach upsets, diarrhoea in livestock.
	Vernonia cinerea (L.) Less	Frequent	August-March	Leaves taken to treat worms.
	Wedelia chinensis (Osbeck) Merr	Cultivated	April-October	Leaf extract used to treat wounds.
	Xanthium strumarium L.	Abundant	September-April	Leaf acrid, anodyne, hypotensive, thermogenic; useful in hypertension, odontalgia.
	Enhydra fluctuans Lour.	Common	December-March	The leaf is taken in digestion problem.
	Tagetes erecta L.	Cultivated	September-April	Leaf juice is applied on cuts, wounds to stop bleeding.

	Tridex procumbens L.	Wild and Common	Throughout the Year	The leaf is used in bronchial catarrh, dysentery, diarrhoea and hemorrhage of wounds.
Amaranthaceae 2 genera, 2 spp.	*Amaranthus viridis*. L.	Common	Throughout the Year	Leaf is used to treat snake-bite, scorpion-sting, inflammation, boils , abscesses.
	Gomphrena globosa Linn.	Cultivated	April-January	Leaf prevents bleeding from wounds.
Anacardiaceae 2 genera, 2 spp.	*Anacardium occidentale* L.	Rare, Cultivated	March-June	Leaves possess anti-cancer properties.
	Buchanania lanzan Spr.	Infrequent		Leaf is general tonic and cardiotonic.
Araceae 1 genera, 1 sp.	*Colocasia esculenta* (L.) Schott.	Common	July-November	Leaf juice astringent, styptic, stimulant, rubifacient, used to treat internal hemorrhage, otalgia, adenitis, otopyorrhea and buboes.
Aristolochiaceae 1 genus, 1 sp.	*Aristolochia indica* L.	Cultivated	July-February	The leaf is used as tonic, stimulant, emetic, and used to treat acidity and stomach pain. Powdered mixed with honey widely used in leucoderma (high dose is fatal to human).
Anonaceae 1 genus, 1 sp.	*Anona reticulate* Linn.	Infrequent	August-December	Leaf is used against amaebiasis, malnutrition, boils, nervous disorder and anti tic.
Alangiaceae 1 genus, 1 sp.	*Alangium chinensis* (Loureoro) Herms.	Rare	May-July	The leaf juice is applied as ointment in pain and inflammation.
Asclapiadaceae 2 genera, 3 spp.	*Asclepias curassavica* Linn.	Common	Throughout the year	Leaf juice anthelmintic, sudorific, useful in abdominal pain, hemorrhage, gonorrhea and externally in piles.
	Calotropis gigantea (L.) R. Br. Ex Aitn.	Rare, very infrequent	January-August	Tincture of leaf is used to treat intermittent fever.
	Caltropis procera (Ait.) R.Br.	Common.	January-August	Tincture of leaf is used to treat intermittent fever. The mastered oil mixed with leaf is applied on wounds.
Apiaceae 2 genera, 2 spp.	*Centella asiatica* (L.) Urban	Wild, abundant	July-January	Leaf used to treat diarrhoea, dysentery, leprosy, and skin diseases. Leaf extract improve blood, nerve, memory.
	Eryngium foetidum L	Frequent	July-November	The leaves are used to stimulate appetite, improve digestion, combat colic, soothe stomach pains, eliminate gasses, and as an aphrodisiac.
Bromeliaceae 1 genus, 1 sp.	*Anaras comosus* (L.) Merr.	Cultivated	January-August	Leaves are anthelmintic, abortifacient, emmenagogue; useful in induction of abortion, helminthiasis, amenorrhoea, dysmenorrhoea and whooping cough.
Bixaceae 1 genus, 1 sp.	*Bixa orellana* L.	Rare	February-June	The leaf is used against blood dysentery, blood disease, kidney disease, intermittent and continued fever, jaundice, gonorrhea, mosquito bite and vomiting.
Brassicaceae 1 genus, 1 sp.	*Brassica campestris* L	Common	December-February	The leaves are much more likely to contain reasonable quantities of vitamin C.
Barringtoniaceae 1 genus, 1 sp.	*Barringtonia acutangula* (L.) Gaertn.	Rare	April-December	The leaf is also tonic and leaf juice is used to treat diarrhoea.
Basellaceae 1 genus, 2 spp.	*Basella alba* L. var. *rubra* Stewart	Cultivated	March-December	Sweet, appetizing, aphrodisiac, cooling, diuretic, demulcent, emollient, haemostatic, laxative, sedative and tonic. Used to treat constipation, flatulence, anorexia, hemorrhages, haemoptysis, sleeplessness, proritus, leprosy, ulcers, dysentery, gonorrhea, strangury, fatigue and general debility.
	Basella alba L.	Cultivated	March-December	Sweet, appetizing, aphrodisiac, cooling, diuretic, demulcent, emollient, haemostatic, laxative, sedative and tonic. Used to treat constipation, flatulence,

				anorexia, haemorrhage, haemoptysis, sleeplessness, proritus, leprosy, ulcers, dysentery, gonorrhea, strangury, fatigue and general debility.
Boraginaceae 1 genus, 1 sp.	*Heliotropium indicum* L.	Common	February-October	Leaf is used to treat fever, urticaria, ulcer, wounds, localized inflammation, gonorrhea, ringworm, rheumatism, erysipelas and pharyngodynia.
Capparidaceae 1 genus, 1 sp.	*Cleome viscosa* L	Frequent.	June-December	Leaf is rubifacient, viscient and sudorific.
Chenopodiaceae	*Chenopodium album* L.	Common	January-June	Leaf carminative, digestive, laxative and tonic.
2 genera, 2 spp.	*Spinacea oleracea* L.	Cultivated	February-April	Leaves used in inflammation of lungs. Leaves source of Vitamin A, B complex and K. Leaves as source of vitamin A good against night blindness.
Commelinaceae 1 genus, 1 sp.	*Murdania nudiflora* (L.) Brenan.	Infrequent	July-November	Leaves used as poultice in sores. Bruised plants applied in boils, itches, and burns.
Cucurbitaceae 5 genera, 6 spp.	*Cucurbita pepo* L.	Cultivated	Throughout the Year.	Leaf is used for de-worming, to treat nephritis, painful urination, renal stone, cardiac debility, burning sensation, weakness.
	Coccinia grandis (L.) Voigt	Abundant	March-December	Leaf used as astringent juice beneficial for diabetes and eruptions in skin.
	Luffa acutangula (L.) Roxb.	Cultivated	March-September	Leaf is used as poultice for haemorrhoid, leprosy and splenitis. Leaf juice is used in conjunctivitis. Leaf decoction is used in uraemia. Seeds and fruits are emetic and purgative.
	Momordica cochinchinensis Spreng.	Cultivated	October-January	Leaf is used to treat child birth, cough, anemia and hair fall.
	Momordica charantia L.	Common	March-November	Leaves bitter, anthelmintic, antipyretic, emetic, used to treat helminthiasis, constipation, burning sensation of the sole, nyetalopia, bilious affection.
	Trichosanthes dioica Roxb.	Cultivated	February-November	Leaf decoction with equal parts of coriander give in bilious fever as febrifuge, laxative and alterative.
Cannabinaceae 1 genus, 1sp.	*Cannabis sativa* L.	Wild and frequent	June-December	Leaves bitter, astringent, aphrodisiac, anti diarrhoea, analgesic, intoxicating, stomach and tonic, used in convulsion, abdominal disorders, otalgia, stomachalgia, excessive use causes dyspepsia, cough, dropsy, melancholy and insanity.
Combretaceae	*Quisqualis indica* Linn.	Infrequent	March-June	Leaf extract is used in boils and wounds as well as in stomach problem.
2 genera, 2 spp.	*Terminalia bellirica* (Gaertn.) Roxb.	Infrequent	March-February	Leaf is mildly diuretic, used in anemia and leucoderma and gum demulcent and purgative.
Dilleniaceae 1 genus, 1 sp.	*Dillenia indica* L.	Rare, common in forest	May-December	Leaf is astringent.
Asparagaceae 1 genus, 1 sp.	*Dracaena angustifolia* (Medik.) Roxb.	Rare	March-August	Leaf is used in insect bite.
Dipterocarpaceae 1 genus, 1 sp.	*Shorea robusta* Gaertn.f.	Common	March-June	Leaf is astringent, acrid, anodyne, alexeteric, anthelmintic, cooling, constipating, depurative and tonic. They are used to treat ulcers, wounds, diarrhoea, dysentery, gonorrhea, leprosy, cough, leucorrhoea, hyperhidrosis, haemorrhoid and anemia.
Euphorbiaceae	*Acalypha hispida* Brum. F.	Cultivated	Throughout the	The leaf is used to treat skin disease, constipation, ulcer and bronchitis.

4 genera, 5 spp			Year.	
	Croton bonplandianum Baill.	Wild, frequent	March-December	Leaf is used to treat cut and wounds.
	Jatropha gossypifolia L.	Common	April-August	The leaf decoction is used as purgative and to treat stomachic.
	Jatropha curcas L.	Common	March-October	The leaf and latex is galactagogue, rubifacient, suppurative and insecticide.
	Ricinus communis L.(BM.)	Infrequent	March-August	Leaves diuretic, anthelmintic, galactagogue. Useful in burns, night blindness, strangury, arthritis, pain on urination, arthralgia. Applied to head to relief headache and as poultice for boils and sores.
Fabaceae 9 genera, 9 spp.	*Abrus precatorius* L.	Rare, cultivated	August-September	Substitute of liquorices; water extract relives obstinate cough.
	Alysicarpus vaginalis DC	Infrequent	July-December	Leaf extract has anticancer property.
	Butea monosperma (Lamk.) Taub.	Rare	February-July	Leaves used to treat stomach disorders.
	Crotalaria mucronata Desv	Common	July-January	Leaf is antiseptic.
	Cicer arietinum L.	Infrequently cultivated	September-February	Leaf is purgative and used in anorexia and dyspepsia.
	Cajanus cajan (L.) Millsp.	Infrequently cultivated		Leaf decoction beneficial for jaundice. Seed is used in snake bite.
	Clitoria ternatea L.	Cultivated	May-December	Leaf used in hepatopathy and eruption.
	Sesbania sesban (L.) Merr.	Cultivated	June-March	Leaf juice anthelmintic, seed stimulant, emmenagogue and astringent; used in diarrhoea and spleen enlargement; an ingredient of ointments used in itches and skin eruption.
	Trigonella foenum-graecum L.	Cultivated	December-February	Leaves are aperient and refrigerant. It is used as poultice on swellings, burns, boils and ulcers. Leaf is an emollient of intestinal inflammation.
Ceasalpiniaceae 5 genera, 9 spp.	*Bauhinia vahlii* Wt. & Arn.	Infrequent	May-April	Leaves are demulcent.
	Bauhinia acuminate L	Common	April-February	Leaf decoction to treat biliousness, leprosy, asthma, stone in bladder.
	Caesalpania bonduc (L) Roxb. Emend. Dandy & Excell	Infrequent	August-April	Leaves emmenagogue, febrifuge, anthelmintic. Tender leaves used in liver disorder, external application of leaf and seed reduce the swellings in inflammation.
	Caesalpinia pulcherrima (L.) Sw	Cultivated	April-October	Leaves purgative, tonic and emmenagogue.
	Senna sophera L.	Wild, restricted	August-January	Leaf is carthertic and leaf juice is used to treat ring worm.
	Senna tora. L.	Common	July-January	Leaf is acrid, antiperiodic, anthelmintic, cardio tonic, depurative, expectorant, laxative, liver tonic, ophthalmic, purgative and thermogenic. Leaf is used to treat ring worm, skin disease, pruritus, leprosy, hepatopathy, helminthiasis, flatulence, colic, dyspepsia, intermittent fever, constipation, cough, bronchitis, cardiac disorders, opthalopathy and hemorrhoids.
	Senna alata L.	Infrequent	September-December	Leaf pest is used to treat skin disease.
	Cassia fistula L.	Infrequently	March-	Leaf is antiperiodic, depurative, laxative, useful n leprosy, skin disease, ulcers,

		cultivated	December	intermittent, fever, juice in skin eruption, jaundice piles, rheumatism.
	Tamarindus indica L.	Infrequent	April-March	The leaf is astringent, sour, anthelmintic, anodyne, anti-inflamatory, antifungal, aperients, cooling, diuretic, febrifuge and ophthalmic. It is used in swelling, fever, scalding of urine, gastropathy, helminthiasis, wounds, ulcers, jaundice, scabies, tumors, ringworms, boils, small pox, conjunctivitis and pain in the ear.
Mimosaceae 3 genera, 3 spp.	*Acacia fernesiana* Willd.	Infrequent	Throughout the year	Leaf is used against diarrhoea and dysentery, diabetes, blood vomiting, food poisoning, tonsillitis, leucorrhoea, gum problem and boils.
	Mimosa pudica L.	Common	July-November	Leaf bitter sudorific tonic. Used to treat hydrocele, haemorrhoid, fistula, scrofula, conjunctivitis, cuts, wounds, hemorrhages. Given to treat snake bite
	Pithecellobium dulce (Roxb.) Benth.	Rare	November-February	Leaf astringent and contain insulin like principle.
Hydrophyllaceae 1 genus, 1 sp.	*Hydrolea zeylanica* Vahl.	Infrequent	November-February	Leaf is antiseptic, used in the form of poultice on callous ulcers.
Lamiaceae 6 genera, 10 spp.	*Pogostemon plectranthoides* Desf.	Rare	January-March	Young apical leaf prevent nose running.
	Ocimum gratissimum L.	Cultivated, rare in wild condition.	June-October	Leaf is tonic, demulcent, diuretic, anthelmintic, antiseptic, styptic. Used for relief from earache, toothache, abdominal colic of children. Given aromatic bath of fumigation to treat rheumatism and paralysis.
	Ocimum sanctum L.	Cultivated frequently	September-March	Paste made from leaves used in parasitical skin diseases and applied to finger and nails during fever. It is also diuretic and tonic. Used against cough and cold.
	Ocimum basilicum L	Rare	August-January	Leaf juice used as nasal douche and for ringworm. To treat inflammation, spasmodic affections, dyspepsia, helminthiasis, cardiac debility, cough, asthma, bronchitis, malarial fever. Expectorant, stimulant, stomachic and thermogenic.
	Ocimum kilimendscharicum Gurke	Cultivated	Throughout the year	It produces camphor and thymol and use as aromatic plant.
	Ocimum americanum L.	Infrequent	May-October	Paste made from the leaf are used in parasitical skin disease and applied to finger and nails during fever. It is diuretic and tonic. Used against cough and cold.
	Leucas plukenetii (Roth.) Spreng.	Common	August-January	Leaves acrid, anthelmintic, anti-inflammatory, antipyretic, antibacterial, carminative, digestive, depurative, emmenagogue, expectorant, sudorific, thermogenic, used to treat arthralgia, amenorrhoea, colic, chronic skin eruptions, cough and catarrh in children, dyspepsia, dysmenorrhoea, verminosis, intermittent fever and ulcers. Leaf juice applied externally in psoriasis, chronic amoebiasis, painful swelling, juice is highly recommendable as an eye drop in encephalopathy due to worm infestation in children, used as a nasal drop in catarrh and cephalalgia.
	Leonurus sibiricus L.	Common	September-February	Tonic, emmenagogue, vulnerary, employed in puerperal and menstrual disorders. Leaf extract is used for uterus constriction.
	Mentha spicata L.	Cultivated	October-March	Antispasmodic, carminative, stimulant, sweetened infusion given for infantile troubles, vomiting during pregnancy and hysteria.
	Anisomeles indica (L.) O.	Wild and	September-	The plant is astringent and carminative. The essential oil useful in uterine

	Kuntze	frequent	January	affections.
Lythraceae 1 genus; 1 sp.	*Lagerstroemia speciosa* (L.) Pers.	Common	February-October	Leaf is purgative.
Lauraceae 2 genera; 3 spp.	*Cinnamomum tamala* Nees & Eberm.	Cultivated	March-September	Leaf is stimulant, carminative, used to treat rheumatism, colic, diarrhoea and scorpion sting. Decoction as component of cough syrup.
	Litsea monopetala (Roxb.) Pers.	Infrequent	March-May	Leaf is used against stomach problem, amoebiasis, sexual problem, leucorrhoea, wounds, insect bite and rheumatism.
	Litsea glutinosa (Lour.) Robinson	Infrequent	June-November	Leaf is used against stomach problem, ambaeasis, sexual problem, leucorrhoea, wounds, insect bite and rheumatism.
Liliaceae 2 genera; 2 spp.	*Aloe vera* Tourn. Ex. L.	Cultivated	Occasional, depends upon the age of the plant, generally March- May	Leaf is bitter, sweet, anthelmintic, cooling, refrigerant, aperient, cathartic, carminative, deobstruent, depurative, diuretic, stomachic, emmenagogue, ophthalmic, protective against infectious disease, *Micobacterium tuberculosis* inhibitor, leaf juice beneficial in amenorrhoea, burns, colic, dyspepsia, hyper adhenosis, against liver, spleen and skin disease, scanty or failure of menstruation, constipation, abdominal tumors, dropsy, carbuncles, sciatica, lumbago, flatulence, eye troubles, X-ray burns, dermatitis, cutanious, leishmaniasis.
	Asparagus racemosus Willdenow.	Cultivated	October-January	Leaves are used against night blindness, blood dysentery, stomach disorder, blood in urine, epilepsy, filarial, haematemesis, dryness of mother's milk, aphomia, abdominal discharge of semen, sunstroke, wounds and improve eyesight.
Malvaceae 4 genera; 6 spp.	*Abutilon indicum* (L.) SW.	Cultivated	July-December	Leaf is used against sore.
	Hibiscus cannabinnus L.	Infrequent	August-November	Leaf sap is a mild purgative.
	Hibiscus rosa-sinensis L.	Common	Throughout the year	Leaf is refrigerant, emollient, anodyne, aperient, and depurative.
	Sida acuta Burm.f.	Abundant	September-May	Leaves demulcent, diuretic, abort facient; boiled leaf in oil applied to testicular swellings and elephantiasis. Leaf decoction emollient; used to treat hemorrhoids and impotence.
	Sida rhombifolia L.	Infrequent	August-February	Leaves contain ephedrine.
	Gossypium herbaceum Linn.	Infrequent	December-April	Leaf, used against female disease, mental disease, leucorrhoea, indigestion, problem in menstrual cycle, blood dysentery, blood dysentery, rheumatism and ear infection.
Meliaceae 2 genera; 2 spp.	*Azadirachta indica* A. Juss.	Common, cultivated	March-July	Leaf is used to treat skin diseases, malaria. They are antiseptic and applied on boils in the form of poultice. The decoction is used to treat ulcer and eczema.
	Melia azederach Linn.	Frequent	March-June	A diluted infusion of leaves and trees has been used in the past to induce uterus relaxation.
Melastomataceae 1 genus; 1 sp.	*Melastoma malabathricum* L.	Common	Throughout the year	The leaf pest is used against boils.
Menispermaceae	*Parabaena sagittata* Miers.	Rare.	April-December	Leaf is used to treat headache.

2 genera; 2 spp.	*Stephania hernandifolia* Walp.	Cultivated, rare in wild	July-December	Leaves are useful in opening up boils and as depilatory.
Menyanthaceae 1 genus; 1 sp.	*Nymphoides hydrophyllum* (Lour.) Kuntz.	Common	Throughout the year	Leaf is used as a substitute of Chirata in fever and jaundice. Decoction leaves are used as a wash in parasitic skin infection.
Moraceae 3 genera, 3 spp.	*Ficus religiosa* L.	Common	May-September	The young tender shoot and leaf used as purgative and to treat wounds and skin disease.
	Morus australis L	Rare	May-September	Leaves are antiemetic expectorant dental anesthetic laxative. They are used to treat elephantiasis and tinnitus.
	Artocarpus heterophylus. Lam.	Common	February-July	Leaf used in fever, boil, wound, skin diseases.
Moringaceae 1 genus, 1 sp.	*Moringa oleifera.* Lamk.	Common	December-April	The leaf is anti inflammatory, anodyne, anthelmintic, ophthalmic and emetic. It is also used to treat scurvy, wounds, tumors, inflammation, helminthiasis, catarrhal and affections.
Myrtaceae 3 genera, 3 spp.	*Eucalyptus globules*. Labille	Infrequent	February-July	The leaf is expectorant. The leaf decoction is used as insect and vermin repellant, fusion used against diabetes mellitus. Dried leaves in the form of tincture in asthma, phthisis and chronic bronchitis.
	Psidium guajava L	Cultivated, rare in wild	April-October	Leaf is used astringent, anodyne, febrifuge, antispasmodic, tonic. Used to treat wounds, ulcers, cholera, vomiting, nephritis, depression, epilepsy, toothache, gum boils, bowel trouble.
	Syzygium cumini (L.) Skeels.	Infrequent	February-August	Leaf is anti bacterial and used for strengthening teeth and gum; juice with goat's milk is given to the children to treat diarrhoea.
Nyctaginaceae 1 genus, 1 sp.	*Mirabilis jalapa* L.	Common	Throughout the year	Leaf used to treat wounds, bruises.
Nelumbonaceae 1 genus, 1 sp.	*Nelumba nucifera* Gaertn.	Infrequent	January-November	Leaf is bitter, cooling, diuretic, and useful in burning sensation, intense thirst of short duration, fever, strangury, hemorrhoids and leprosy.
Nymphaeaceae 1 genus, 1 sp.	*Nymphaea stellata* Willd	Infrequent	Throughout the year	Macerated leaves are used as a lotion in eruptive fevers and also used for erysipelas.
Olacaceae 2 genera, 2 spp.	*Nyctanthes arbor-tristis* L.	Infrequent	September-January	Leaves are antibilious, expectorant, acrid, antibacterial, anodyne, digestive, depurative, diuretic, febrifuge, laxative, sudorific, thermogenic, tonic, used to treat inflammations, dyspepsia, helminthiasis, pruritus, dermatopathy. Chronic fever, bronchitis, asthma, constipation, hepatopathy, strangury and rheumatism. Leaf decoction prepared over a gentle fire used as specific remedy for obstinate sciatica.
	Jesminum multifloram (Burm.f) Andr.	Common	February-July	Dried leaf is used to treat indolent ulcer.
Orchidaceae 1 genus, 1 sp.	*Venda tessellate* Lodd. ex Loud.	Common	April-August	Leaf juice applied as drops in the ear to treat otitis, and other inflammatory condition.
Oxalidaceae 1 genus, 1 sp.	*Biophytum sensitivum* L	Common	July-December	Leaf is antiseptic, astringent, diuretic and styptic. The leaf juice or pest is used in healing cuts and wounds and to promote suppurations of abscesses. Leaf decoction is used to treat asthma and tuberculosis.
Poaceae 2 genera, 4 spp.	*Cymbopgon martini.*(Roxb.) Wats.	Wild and frequent	October-December	Leaf is thermogenic, appetizing, carminative, digestive, cardiotonic, depurative, galactagogue, diuretic, sudorific, febrifuge. To treat neuralgia, bronchitis,

				cough, cataract, anorexia, cardiac debility, leprosy, strangury, pharyngopathy and fever, lumbago, and skin disease mosquito repellent.
	Cymbopogon flexuosus (Nees ex Steud.)Watson.	Common	November-March	The plat yields an essential oil called lemon grass oil, which is used as flavoring agents and insect repellant.
	Cymbopogon citrates (DC.) Stapf	Common	Throughout the year.	The plat yields an essential oil called lemon grass oil, which is used as flavoring agents and insect repellant.
	Cynodon dactylon Pers	Common	May-December	The plant extract improve fertility and used against leucorrhoea, wounds, skin disease.
Padaliaceae 1genus, 1 sp.	*Sesamun indicum* L.	Cultivated	April-January	Leaves emollient; decoction used as hair wash to promote hair growth and blackening. Leaves useful in cholera, dysentery, disease of eye, kidney, skin and urinary tract.
Piperaceae	*Piper longum* L.	Common	July-January	Leaf is used to treat cough and cold.
1 genus, 5 spp.	*Piper thomsonii* (C. DC) Hook. f.	Common	July-January	Leaf is used to treat cough and cold.
	Piper nepalense Miq.	Common	July-January	Leaf is used to treat cough and cold.
	Piper chaba Hunter	Common	July-January	Leaf is used to treat cough and cold.
	Piper betle L.	Cultivated.	September-January	The leaf is carminative, stimulant and used in snake bite.
Pontederiaceae 1 genus, 1 sp.	*Monochoria hastate* (L.)Solms.	Infrequent	July-October	Leaf juice applied on boils.
Portulacaceae 1 genus, 1 sp.	*Portulaca oleracea* L.	Common	August-October	Leaves are sour, bitter, salty, alexeteric, antibacterial, anti scorbutic, aperient, alternative, diuretic, refrigerant, stomachic, sudorific, thermogenic, vulnerary and tonic. They are used to treat dysuria, dysentery, cardiovascular disease, sore in nipples, gastropathy, tumors, inflammations, nephropathy, cystalgia, cystitis, splenopathy, haemorrhoid, jaundice, diabetes, cephalalgia, otalgia, scurvy, vomiting, skin disease and ulceration of the mouth.
Rosaceae 3 genera, 3 spp.	*Fragaria nilgerrensis* Schlecht. ex J. Gay	Infrequent	April-August	It can be used in decoction or the fresh leaves can be crushed and applied externally as a poultice. It is used in the treatment of boils and abscesses, weeping eczema, ringworm, stomatitis, laryngitis, acute tonsillitis, snake and insect bites and traumatic injuries.
	Punica granatum L.	Rare	March-October	The leaf pest with sugar and camphor is used to treat wounds in cattle.
	Rosa centifolia L.	Cultivated	Throughout the year.	Leaves are useful in treating wounds, hepatopathy, haemorrhoid and opthalmia.
Rutaceae 2 genera, 3 spp.	*Aegle marmelos* (L.) Corr. Ex Roxb .	Infrequent	May-March	Leaf is febrifuge and is used to treat eye diseases, ulcer, dropsy, beri-beri, diabetes. Extracts show cardio tonic effect and antimicrobial properties.
	Murrya paniculata (L.) Jack.	Infrequent	February-December	Leaf is used to treat diarrhoea, cough, rheumatism, hysteria and dysentery. Leaf powder is used to treat cuts. The oil decoction from leaf is used to treat dropsy.
	Murraya koenigii Spreng (L.)	Infrequent	March-September	Leaf is bitter , acrid, astringent, cooling, aromatic, demulcent, depurative, stomachic, appetizing, anodyne, constipating, anti- inflammatory, antiseptic, tonic. Used in intense thirst for a short period, burning sensation, pruritis, skin disease, anorexia, helminthiasis, colic, flatulence, leaves used in diarrhoea, dysentery and to cheek vomiting; root juice as renal pain reliever.

Rubiaceae 6 genera, 6 spp.	*Anthocephalus chinensis* (Lamk) A. Rich. Ex Walp.	Infrequent, cultivated	July-October	Leaf decoction is used as gargle in case of apthae and stomatitis.
	Gardia jasminoides Ellis	Cultivated	March-October	The whole plant or leaf is antiperiodic, anthelmintic, cathartic and antiseptic.
	Ixora arborea Roxb. Ex J.E Sm.	Cultivated	March-June	Leaf decoction is used to treat general debility and anemia.
	Mussaenda roxburghii Hook.f.	Common	June-January	Leaf juice is taken with hot water to reduce the body ache.
	Morinda citrifolia L.	Infrequent	February-May	Leaf juice is used to treat gout.
	Paederia scandens (Lour.) Merr.	Infrequent	July-December	The leaf is tonic astringent, used in soup and other food preparation for invalid and convalescents, particularly for bowel troubles.
Sapindaceae 1 genus, 1 sp.	*Cardiospermum helicacabum* L.	Rare	April-January	The leaf is rubifacient, used in arthritis, pain in eye, rheumatism, ear ache and snake bite.
Sterculiaceae 2 genera, 2 spp.	*Ambroma augusta* L.f	Infrequent	January – June	Leaf is used for utrine disorder, diabetes, rheumatic pains, and sinusitis.
	Melochia corchorifolia L.	Rare	July-December	Leaf decoction used to treat as dysentery.
Scrophulariaceae 1 genus, 1 sp.	*Scoparia dulcis* L.	Abundant	May-December	Infusion of leaves is used to treat fevers, cough and bronchitis.
Solanaceae 4 genera, 7 spp.	*Datura metel* L.	Common	August-May	The leaf is narcotic, anodyne and antispasmodic. The leaf is used to treat asthma, opthalmodynia, otalgia, lumbago, sciatica, neuralgia, mums, epilepsy, cephalalgia, dandruff and painful swellings.
	Nicotiana tabacum L.	Cultivated	July-October	The leaves are antispasmodic, discutient, diuretic, emetic, expectorant, irritant, narcotic, sedative. They are used externally in the treatment of rheumatic swelling, skin diseases
	Nicotiana plumbaginifolia Viv.	Common	September-December	Leaf is use to treat worm infection, allergy, stomach problem and rheumatism.
	Solanum indicum L.	Infrequent	August-December	Leaf juice with fresh juice of ginger used to stop vomiting.
	Solanum melongena L.	Cultivated	September-April	Leave increase saliva secretion, it is narcotic; useful in cholera, bronchitis, asthma, fever disuria and toothache.
	Solanum xanthocarpaum Schrad and Wendl.	Rare	January-December	Leaf is used treat piles, reduce toxic effect of liquor, cough, breathing problem, micturition, whooping cough and asthma.
	Withania somnifera Dunal	Rare	January-December	The plant is antipyretic, anthelmintic, diuretic, carbuncles, scabies, ulcers, painful swellings, impotency, cough, chronic bronchitis, catarrhal breathing troubles, tuberculosis, general weakness, emaciation, boils and eruptions, dropsy, heart disease, leucoderma, spermatorrhoea, menstrual and sexual troules, lumbago, fatigue, rheumatism and mental debility.
Ternstroemiaceae 1 genus, 1sp.	*Camellia sinensis* (L.) O. Kuntze.	Common, rare in wild	September-February	Leaf is bitter, astringent, appetizer, carminative, diuretic, diaphoretic, detergent, digestive, thermogenic and nerve tonic.
Tiliaceae 2 genera, 3 spp.	*Corchorus olitorius.*L.	Frequently cultivated	July-October	Leaf is bitter tonic, demulcent, diuretic, stomachic and useful in chronic cystiss, gonorrhea and disuria.
	*Corchorus capsularis.*L.	Cultivated	July-October	Leaf is bitter tonic, demulcent, diuretic, stomachic and useful in chronic cystiss, gonorrhea and disuria.
	Triumfetta rhomboidea	Common	August-January	Leaf is anti-haemmaregic, sexual problem, increase urination, boils, child birth

	Jacq.			and wound.
Verbenaceae 5 genera, 7 spp.	*Clerodendrum viscosum* Vent	Wild and frequent	February-July	The leaf is tonic, expectorant, antiseptic, demulcent, anti-inflammatory, depurative, laxative and cholagogue. Fresh leaf juice is introduced into rectum for removal of acaroids. The leaf is also used to treat helminthiasis, abscesses, tumors, leprosy, skin disease, indolent, ulcers, cough, bronchitis, intermittent fever, general debility and proctoptosis.
	Clerodendrum serratum (L.) Spreng.	Wild, occasional	August-January	Leaf is used to treat fever, ointment made by boiling with butter and oil used to treat cephalalgia, opthalmia, as also snake bite.
	Clerodendrum indicum (L.) O. Kutze.	Rare	May-November	Leaf juice with ghee (clarified butter) used in herpetic eruptions.
	Gmelina arborea Roxb.	Common	February-June	The leaf is demulcent. The leaf pest is used in gonorrhea, cough, cephlalgia, and the juice is a good wash for foul ulcer.
	Lippia alba (Mill.) N.E.Br. ex Britton and Wilson	Infrequent	March-December	Plant is expectorant. Leaf nervine and stomachic. Fresh root externally applied to treat rheumatism, sprains, scabies, eczema, wounds, and carbuncles.
	Tectona grandis L.f	Cultivated	July-January	Leaf is **a**nti-inflamatory, cooling, depurative, haemostatic, wound haeling, useful in inflammation, leprosy, pruritus, skin disease, stomatitis, spitting of blood, leaf extract inhibits tuberculosis bacterium.
	Vitex negundo L.	Infrequent	March-October	Leaves useful in cephalalgia, sprains, orchitis, gout, splenohepatomegaly, otorrhoea, inflammation, ulcer, leaf smoked for relief in catarrh and head aech, leaf decoction used as medicinal bath in catarrhal and rheumatic affections. Leaves show anticancer activity against Ehrlick ascites tumourous cells.
Vitaceae 1 genus, 1 sp.	*Cayratia pedata* (Lamk.) Juss. Ex Gagnep	Rare	May-December	Leaf is astringent, refrigerant; leaf decoction is used to check uterine reflexes. Leaf is used to treat ulcers.

Fig. 1. Rare medicinal plants found in Jalpaiguri District, West Bengal, India. A. *Abrus precatorius*; B. *Alangium chinensis*; C. *Anacardium occidentale*; D. *Artemisia nilagirica*; E. *Bixa orellana*; F. *Butea monosperma*; G. *Calotropis gigantea*; H. *Cardiospermum helicacabum*; I. *Clerodendrum indicum*; J. *Dillenia indica*; K. *Dracaena angustifolia*; L. *Morus australis*; M. *Ocimum basilicum*; N. *Punica granatum*; O. *Solanum xanthocarpaum*; P. *Withania somnifera*.

The study area has a high concentration of medicinal plants, but this area is under threat due to rapid deforestation and urbanization. Effective conservation plan is suggested to protect the resources.

ACKNOWLEDGEMENTS

We are thankful to the tribal people in Jalpaiguri District for their valuable help in the documentation of indigenous ethnomedicinal knowledge.

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