NDC E-BIOS (Online) Volume 2, pp 18-31 (2022)
ISSN: 2583-6447

ORIGINAL ARTICLE

PLANT DIVERSITY OF RANGO FOREST OF KALIMPOMG DISTRICT AT INDIA-BHUTAN BORDER, WITH REFERENCE TO MEDICINAL IMPORTANCE

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Abstract: *Knowledge about the medicinal plants is important to know the natural resources of a particular geographic area. The forests at the foothills of Eastern Himalaya have rich diversity of medicinal plants. Keeping this in view, a survey on terrestrial plants with medicinal and economic importance was conducted in Rango Forest of Kalimpong district of West Bengal, situated at the bank of river Jaldhaka at the border of India and Bhutan. A total of 123 plants species of medicinal importance were enumerated by field study during autumn season of 2022. Among the recorded species, 109 were flowering plants (51 families) and remaining 11 were pteridophytes (7 families). We had recorded 53 herbaceous species, along with 19 shrubs, 43 tree members and 7 species of epiphytes with traditional medicinal uses by local people. During the study, information about medicinal uses of the plants were collected from local people. The study will provide valuable information about plant resources with medicinal importance from the study area for the first time.*

Key words: Medicinal plant diversity, Rango Forest, India Bhutan Border.

Communicated: 24.11.2022 Revised: 29.11.22 Accepted: 29.11.22

1. INTRODUCTION

Rango is a village at the foothill (doors) of eastern Himalaya beside Jaldhaka river at the elevation of 450 ft. The place is situated at India-Bhutan border in the Kalimpong district of West Bengal, India (Figure 1-2). The forest of Rango is the extension of the south-eastern flank of the Neora Valley national park on the valley of river Jaldhaka. The forest in doors is well-known for high level of plant biodiversity with an assemblage of numerous herbs, shrubs, trees and cryptogams, forming a green cover [1,2].

2. METHOD OF FIELD STUDY

The composition of standing herb, shrub, tree and epiphytic vegetation of Rango Forest was studied in the Autumn season (October-November). Plant species occurring in the study area were photographed and

identified their local vernacular name and scientific name using reference books, articles and internet sources [3-10]. Information about their medicinal uses were collected by interviews with experienced herbal healers and senior citizens of the locality.

The overall collected information was depicted through the lists of herbs, shrubs, trees, epiphytes along with their traditional medicinal uses (Table 1).

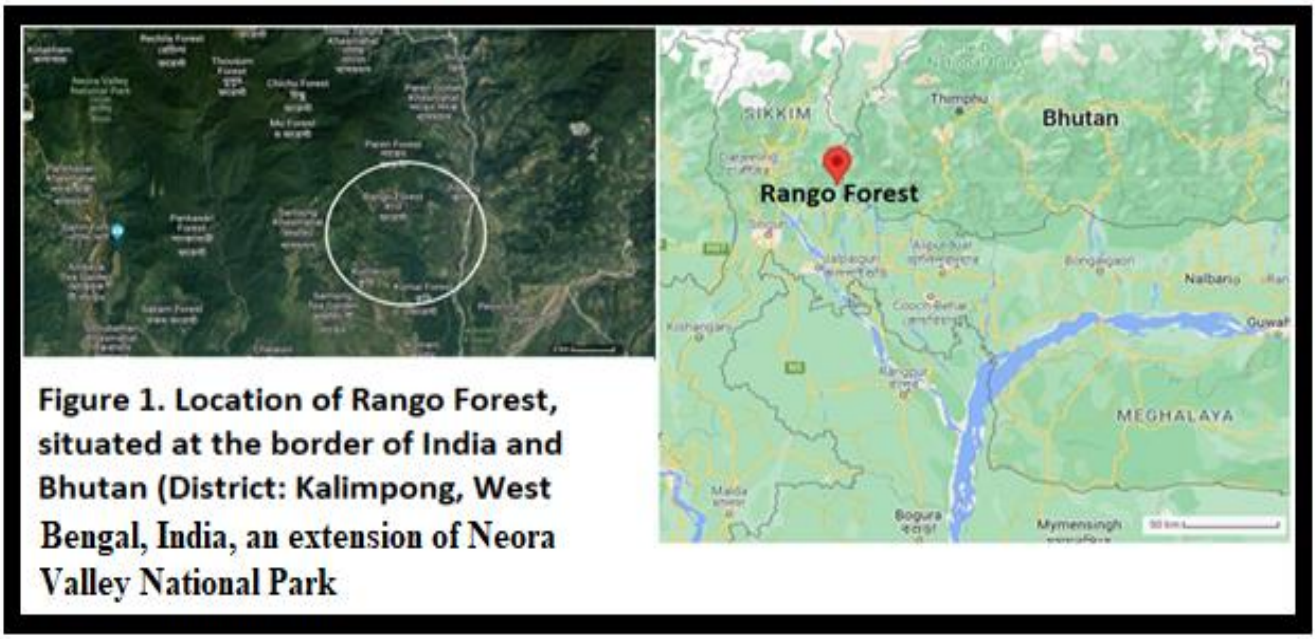

Figure 1. Location of Rango Forest, situated at the border of India and Bhutan (District: Kalimpong, West Bengal, India, an extension of Neora Valley National Park

Figure 2. Landscape of Rango Forest showing the vegetation

3. RESULTS AND DISCUSSION

In the survey, a total of 123 plants species of medicinal importance were enumerated by field observation, during autumn season of 2022. Among the recorded species, 112 were from flowering plants (51 families) and remaining 11 were non-flowering plants, pteridophytes (8 families). In the study, algae and bryophytes were not included (Figure 3-4).

We had recorded 56 herbaceous species, along with 19 shrubs, 43 tree members and 7 species of epiphytes with traditional medicinal uses by local people (Table 1, Figure 5 -7). There are similar reports of rich medicinal plant diversity from others places of Jalpaiguri district, in the valley of river Jaldhaka [5]. The wild plants are often used as sole ethnomedicinal source for different health issues for the local community, including the tribal people of the villages of the forest fringes in the foothills of eastern Himalaya [11].

Table 1. Naturally growing medicinal plants in Rango Forest, situated at Kalimpong district of West Bengal, at India Bhutan Border

Herbs

	Scientific Name	Family	Local name	Traditional Medicinal Use/ Economic Use
Flowering Plants				
1	*Acmella paniculata (Wall. Ex. DC.)*	Asteraceae	Tara phul	Treatment for toothache and gum problem, induces salivary response.
2	*Aerva Aspera*	Amaranthaceae	Apang	Treatment of fever, pain, asthma, diabetes, dysentery, disorders of kidney, liver, eye etc.
3	*Ageratum houstoniarum L.*	Asteraceae		Healing for common/ burned wound, arthrosis, headache, and dyspnea
4	*Ananas comosus (L.) Mer*	Bromeliaceae	Anaros	As anti-inflammatory, antioxidant nervous system function monitor.
5	*Andrographis paniculata Burm. f. Wall. Ex Nees*	Acanthaceae	Kalmegh	Treatment of cough and cold, diarrhea, jaundice, as liver tonic and antioxidant.
6	*Anisomelis ovata W. T. Aiton*	Lamiaceae	Gobura	Analgesic with anti-inflammatory, antioxidant, antimicrobial, anti- rheumatic effect.
7	*Bidens Pilosa* L.	Asteraceae	Kumur	Cardiotonic, anti-inflammatory action.
8	*Chenopodium murale L.*	Chenopodiaceae	Betho	Edible roots and seeds are helpful in iron deficiency.
9	*Chrysopogon aciculatus (Retz.) Trin*	Poaceae	Chorkanta	Useful as lawn grass, fodder fro grazing and to control soil erosion.
10	*Clematis angustifolia Jacq.*	Ranunculaceae		Used to treat bone and skin disorders.
11	*Colocasia esculenta (L.) Schott*	Araceae	Kochu	Anti-arthritis, diarrhea, internal hemorrhage, neurological disorders.
12	*Commelina benghalensis Linn.*	Commelinaceae	Kanshire	Treatment of constipation, leprosy, insomnia, cataracts, night blindness, inflammation, burns, conjunctivitis, abscesses, acne, etc.

13	*Croton bonplandianum Baill.*	Euphorbiaceae	Bon Tulsi	Gastro intestinal disorders, liver problems, and skin diseases, rheumatism, epileptic problems.
14	*Curcuma amada Roxb.*	Zingiberaceae	Amada	Anti-inflammatory, anti- abdominal adiposity, **appetizer.**
15	*Cyrtococcum patens (L.) A, Camus*	Poaceae	Bowgrass	Antispasmodic, anticonvulsant, analgesic, used in treating nervous disorders and fevers.
16	*Cynodon dactylon (L.) Pers.*	Poaceae	Durba ghash	Treatment of cramps, stomach problem, epilepsy, hemorrhage, hypertension, measles, sores, urogenital stone, warts and wounds.
17	*Cyperus rotundus L.*	Cyperaceae	Mutha ghash	Treatment of diarrhea, diabetes, inflammation, malaria, and irritable bowel disorders
18	*Desmodium motorium (Houtt.) Merr.*	Fabaceae	Bon charal	Treatment of postnatal complaints, chronic fever, cough, and nausea.
19	*Dicentra spectabilis*	Papaveraceae	Kham Alu	Tubers are used as food and to treat skin infections.
20	*Eclipta prostrata (L.) L.*	Asteraceae	Kesut	Treatment of skin problem, hair loss/whitening and spleen enlargement.
21	*Epibolium parviflorum f. apricum E. S, Marshall*	Onagraceae		Useful to treat minor burns, skin rashes, ulcers due to its anti-bacterial, anti-inflammatory and anti-oxidant properties
22	*Eragrostis spectabilis Pursh Steud.*	Poaceae		Used as livestock fodder
23	*Eragrostis tenella (L.) P. Beauv. Ex. Roem & Schult*	Poaceae	Surrsuri ghash	Animal fodder
24	*Globba bulbifera Roxb.*	Zingiberaceae		Small bulbils used as a flavoring agent, can be eaten fresh or dried. Useful as appetizer, treating mouth ulcer, etc.
25	*Gomphrena celosioides Mart.*	Amaranthaceae	Botam phool	Herbal analgesic
26	*Hyptis suaveolens (L.) Poit.*	Lamiaceae	Bileti Tulsi	Use for the treatment of inflammation, peptic ulcers, and infections.
27	*Impatiens balsamina L.*	Balsaminaceae	Dopati	Used to treat rheumatism, inflammation of nails, scurvy, carbuncles, bruises, etc
28	*Impatiens parviflora DC.*	Balsaminaceae	Bon dopati	Treatment of warts, ringworm infection and nettle stings.
29	*Imperata cylindrica (L.) Raeusch.*	Poaceae	Ulu ghash	Edible and useful for immuno-modulatory, antibacterial, antitumor, and liver protection activities both *in vivo* and *in vitro*.

30	*Ipomoea purpurea (L.) Roth*	Convolvulaceae	Anguli lata	Antihelminthic, laxative.
31	*Kylinga nemoralis (J. R. Forst. & G. Forst.) Dandy ex Hutch. & Dalziel*	Cyperaceae		Antivenom, gives relief in malarial chills.
32	*Leucas grandis vatke*	Lamiaceae	Shwet Dron	Antidiabetic
33	*Mimosa pudica L.*	Fabaceae	Lojjaboti	Roots are used as a poultice and toothache. Decoction of leaves used for the treatment for infections of the toes, piles, dysentery, and intestinal worms.
34	*Oxalis corniculata L.*	Oxalidaceae	Amrul	Leaves have anti-inflammatory, anticonvulsant, antifungal, anticancer, antidiabetic, hepatoprotective, and wound healing properties
35	*Oxalis debilis Kunth*	Oxalidaceae	Beguni Amrul	Treatment of dysentery and diarrhea and diabetes (leaf decoction).
36	*Paederia foetida L.*	Rubiaceae	Gandal pata	Treatment of rheumatism, paralysis, abscesses, gout, infertility, colic pain.
37	*Polygonum hydropiper L.*	Polygonaceae	Jol lonka	Used for analgesic and astringent activities.
38	*Potentilla indica (Andrews) Th. Wolf*	Rosaceae	Junglee Strawberry	Treatment of boils and abscesses, burns, weeping eczema; extract of flowers is used to improve the blood circulation.
39	*Rungia pectinata (L.) Nees*	Acanthaceae		Leaves are anti-inflammatory, pail killer, immunity booster and is given to children for smallpox.
40	*Scoparia dulcis L.*	Scrophulariaceae	Ghuma	Treatment of diarrhea, kidney problems, and fever.
41	*Senna oxidentalis (L.) Link.*	Fabaceae		Used as purgettive
42	*Sida acuta Burm f.*	Malvaceae	Berela	Treatment of neurological disorders, leucorrhoea, tuberculosis, malarial and other fevers, uterine disorders, renal inflammation, asthma, ulcers etc.
43	*Solanum sisymbriifolium*	Solanaceae	Kantikori	Antihypertensive, diuretic, analgesic, hepatoprotective
44	*Triumfetta rhomboidea Jacq.*	Malvaceae		Antioxidant,Anti-diarrheal effect.
45	*Urena lobata L.*	Malvaceae	Jangli ghagra	Root extract used for treatment of inflammation, enteritis, rheumatic pain, tonsillitis.
46	*Urtica sp.*	Urticaceae	Bichhuti	Treatment of joint pail and skin disease.
47	*Verbena officinalis L.*	Verbenaceae		Treatment for infection, inflammation and fever
48	*Vernonia cinerea (L.) Less*	Asteraceae	Sahadevi Plant	Abdominal pain killer, treatment of cough and skin disease

		Pteridophytes		
46	*Angiopteris evecta (G. Forst.) Hoffm.*	Marattiaceae	Fern	Leaf extract is useful as expectorant; Roots are used to stop bleeding after a miscarriage.
47	*Diplazium esculentum*	Athyriaceae	Dheki shak (fern)	Useful to treat diabetes, rheumatism, dysentery, fever, measles, hypertension, and glandular swellings etc.
48	*Dryopteris filix-mas (L.) Schott*	Dryopteridaceae	Fern	Useful to treat inflammation, rheumatoid arthritis, wounds and ulcers.
49	*Lygodium microphyllum (Cav.) R. Br*	Lygodiaceae	-	Plant extract is useful to deduce pain, inflammation, pyrexia, diarrhea and helminth management.
50	*Polystichum lentum (D. Don) T. Moore*	Dryopteridaceae	-	Used as bedding material in animal farm.
51	*Pteris longifolia L.*	Pteridaceae	-	Useful for treatment of sexual dysfunction, aging, anxiety, osteoporosis, syphilis and glandular swelling.
52	*Pteris vittata L.*	Pteridaceae	-	Useful for phytoremediation of soil for its ability to remove arsenic (As) from soil and accumulate in aerial parts.
53	*Selaginella monospora Spring*	Selaginellaceae	-	Traditionally useful to treat cardiovascular diseases and cancer.

Shrubs

Sl. Name	Scientific Name	Family	Local name	Traditional Medicinal use/Economic use
1	*Abutilon grandifolium (Wild.) Sweet*	Malvaceae		Plant extract is used as digestive, laxative, diuretic, analgesic, anthelmintic. Decoction used in toothache and tender gums.
2	*Artimisia triloba (L.) Dunal*	Annonaceae	Dudhia	Fruit: Used as laxative; Leaves: diuretic, cures ulcer and abscesses
4	*Boehmeria macrophylla D.Don*	Urticaceae	Baghnokh	Treatment for boils and dermatitis.
5	*Calamus viminalis Reinw. Ex. Walp*	Arecaceae	Bet	Fruits are edible. It provides cane for basketry and furniture-making, .
6	*Cassia tora L.*	Fabaceae		used as laxative, anti-leprosy and skin disorders
7	*Clerodendrum viscosum Vent.*	Verbenaceae	Ghentu	Used in tumors, skin diseases, snake bite, scorpion sting, intestinal infections, and kidney dysfunction
8	*Hibiscus rosa-*	Rubiaceae	Bon coffee	Useful as skin toner and antioxidant
9	*Justicia adhatoda L.*	Acanthaceae	Vasak	Very much useful in treating cold, cough, asthma, as sputum liquefier & bronchodilator etc.

10	*Justicia jendurossa*	Acanthaceae	Jagatmadan	Treatment of rheumatism, bronchitis, inflammation, facial and one sided body paralysis.
11	*Mimosa invisa Colla.*	Fabaceae	Giant sensitive plant	Treatment of urogenital disorders, piles, and wounds.
12	*Murraya koenigii (L.) Sprenge*	Rutaceae	Karipata	Treatment of piles, inflammation, itching, fresh cuts, bruises, and edema.
13	*Lantana camara L.*	Verbenaceae	Putush phool	Fungicidal and insecticidal agent.
14	*Melastoma malabathricum L.*	Melastomaceae		Treatment of diarrhoea, dysentery, hemorrhoids, wounds, toothache, and stomachache.
15	*Osbeckia nepalensis Hook. f.*	Melastomataceae		Treatment of type 2 diabetes mellitus
16	*Phlogacanthus thyrsiflorus (Roxb.) Nees*	Acanthaceae	Am Vasak	Antibacterial, antifungal, anti-diabetic, anti-inflammatory effect.
17	*Tabernaemontana divaticata R. Br. Ex Roem. & Schult.*	Apocynaceae	Jongli Paati togor	Useful to treat snake and scorpion poisoning; root is used to treat hypertension, scabies and toothaches. Seed pulp is used as vegetable dye.
18	*Ziziphus rugosa Lam.*	Rhamnaceae	Bon boroi	Treatment of skin diseases, mouth ulcers, diarrhea, syphilis, misconception, flatulence, hysteria etc.
19	*Solanum viarum Dunal*	Solanaceae		Treatment of leprosy, toothache, and diabetes.

Trees

Sl. No.	Scientific Name	Family	Local Name	Traditional Medicinal Use/ Economic Use
1	*Acacia catechu (L. f.) Willd*	Fabaceae	Khayer	Useful as mouthwash, to treat sore throat, dental and oral infections.
2	*Ailanthus integrifolia Lam.*	Simaroubaceae	Gokul	Wood used for local house building and furniture.
3	*Albizia lebbec (L.) Benth*	Fabaceae	Kalo Shirish	Treatment of migraine, conjunctivitis, diarrhea, jaundice.
4	*Albizia procera (Roxb.) Benth.*	Fabaceae	Swet Shirish	Leaf decoction is used to treat ulcers and as insecticide.
5	*Alstonia Scholaris (L.) R. Br.*	Apocynaceae	Chhatim	The bark is used to cure skin problems, leprosy, stomach infection and rheumatism.
6	*Artocarpus heterophyllus Lam.*	Moraceae	Khathal	Useful as antibacterial, antifungal, antidiabetic, anti-inflammatory, and antioxidative agent.

7	*Azadirachta indica A. Juss.*	Meliaceae	Neem	Treatment of all kind of skin problem, useful as immunity booster, blood purifier, insect repellent.
8	*Baccaurea ramiflora Lour.*	Phyllanthaceae	Lotka	Treatment of rheumatism and abscesses.
9	*Bauhinia malabarica Roxb.*	Fabaceae	Sada Karmai	Fruit is edible; Plant used to treat cough, gout, glandular swellings,goiter, etc.
10	*Bombax ceiba L.*	Malvaceae	Shimul	Bark extract/decoction is used to treat fever, stomach problems.
11	*Cassia fistula L.*	Fabaceae	Bandorlathi	Treatment of jaundice, piles, rheumatism, skin eruptions, ring worms and eczema.
12	*Cinnamomum tamala (Buch. -Ham.) T. Nees & C. H. Eberm*	Lauraceae	Tejpata	Used as food flavoring agent, mouth freshener; Treatment of black skin spots, dental caries.
13	*Citrus indica Yu. Tanaka*	Rutaceae	Jongli Kamala	Fruit juice is used to treat jaundice; also used for spiritual purposes in Garo hills of Meghalaya.
14	*Dillenia pentagyna Roxb.*	Dilleniaceae	Bon Chalta	Treatment of cancer, diabetes, and diarrhea .
15	*Erythrina stricta Roxb.*	Fabaceae	Madar	Used in rheumatism, asthma, contact allergy and skin infections.
16	*Ficus benghalensis L.*	Moraceae	Bot	Plant extract and latex is used to treat epilepsy, insomnia, anxiety, etc.
17	*Ficus racemose L.*	Moraceae	Dumur	Treatment of diabetes, liver disorders, diarrhea, inflammation, hemorrhoids, respiratory, and urinary problems.
18	*Ficus religiosa L.*	Moraceae	Ashwathha	Useful to treat asthma, diabetes, epilepsy, stomach issues, and sexual difficulties.
19	*Gmelina arborea Roxb. Ex Sm.*	Lamiaceae	Gamar	Treatment of nerve problem, dizziness, weakness, heart diseases, piles etc.
20	*Holarrhena pubescens Wall. Ex G. Don*	Apocynaceae	Kurchi	Bark is useful to treat diarrhea, dysentery and cholera
21	*Lagerstroemia speciosa (L.) Pers.*	Lythraceae	Jarul	Traditionally used to control blood sugar, kidney & bladder problems and hypertension.
22	*Lannea coromandelica (Houtt.) Merr*	Anacardiaceae	Jiga	Treatment of hepatitis, diabetes, ulcers, heart disease.
23	*Litchi chinensis Sonn.*	Sapindaceae	Lichu	Fruit is edible. Used to treat cough, gastric problem, diabetes, obesity, testicular swelling.
24	*Litsea elongata (Nees) Hooker f.*	Lauraceae	Thulo pahenlay	Essential oil is extracted from leaves and fruits

25	*Lyonia ovalifolia var. elliptica (Siebold & Zucc.) Hand.-Mazz.*	Ericaceae	Anyaar/Angeri	Treatment of skin diseases and external parasites
26	*Magnolia champaca (L.) Baill. Ex Pierre*	Magnoliaceae	Champa	Used to treat bronchitis, dyspepsia, rheumatism, dysmenorrhea and inflammation
27	*Morinda angustifolia Roxb.*	Rubiaceae	Koriphul	Treatment of urethritis, tumors, elephantiasis, insect bites etc.
28	*Moringa oleifera Lam.*	Moringaceae	Sojne	Used as cardiac and circulatory stimulants and anti-cancer agent.
29	*Neolamarckia cadamba (Roxb.) Bosser*	Rubiaceae	Kadam	Treatment of wounds, conjunctivitis, irritable bowel syndrome and urinary tract infection.
30	*Peltophorum pterocarpum (DC.) Backer ex K. Heyn*	Fabaceae	Radhachura	Used to treat insomnia, constipation, muscular pains, sores etc.
31	*Phyllanthus emblica L.*	Phyllanthaceae	Amloki	Fruit used to treat diarrhea, jaundice, cough & cold and inflammation.
32	*Pongamia pinnata (L.) Pierre*	Fabaceae	Karanjo	Treatment of tumors, piles and ulcers; Root decoction used to treat gonorrhea, vaginal & skin diseases, teeth problems.
33	*Shorea robusta C. F. Gaertn.*	Diptero-carpaceae	Shal	Wood yielding tree; leaves and bark are used to treat wounds, ulcers, leprosy; Fruits help to treat seminal weakness, skin problems.
34	*Syzygium cumini C. F. Gaertn.*	Myrtaceae	Khude jam	Bark is used as digestive, astringent to the bowels, blood purifier, anthelmintic, etc.
35	*Tamarindus indica L.*	Fabaceae	Tentul	Treatment of wound, abdominal infection, malaria and respiratory problems and used as laxative.
36	*Tectona grandis f. Abludens Koord. & Valeton*	Lamiaceae	Shegun	Timber yielding tree; *flowers used for the treatment of bile over secretion and urinary discharges.*
37	*Terminalia arjuna (Roxb. Ex DC.) Wight & Arn*	Combretaceae	Arjun	Bark is used to treat anginal pain, hypertension, heart problem and dyslipidemia. Plant parts have antibacterial, antitumoral, and antifertility and anti-HIV activities.
38	*Terminalia chebula Retz.*	Combretaceae	Horitoki	Treatment of dementia, constipation, and diabetes etc.
39	*Trema orientalis (L.) Blume*	Ulmaceae	Chikon	Treatment of *diabetes mellitus*.
40	*Vitex heterophylla Roxb.*	Lamiaceae	Panchpatey	Treatment of inflammation and asthma.
41	*Ziziphus jujuba Mill.*	Rhamnaceae	Kul	Treatment of respiratory, skin and gastrointestinal problems.

Epiphytes				
Sl. No.	Scientific Name	Family	Local Name	Traditional Medicinal Use/ Economic Use
Pteridophytes				
1	*Drynaria quercifolia (L.) J. Sm.*	Polypodiaceae	Fern	Treatment of skin disease, urinary disorders, obesity, snake bite, insomnia and digestive disorders.
2	*Lepisorus sp.*	Polypodiaceae		Useful as analgesic
3	*Vittaria elongata*	Pteridaceae		Used as purgative, diuretic, and wound healing agent
Flowring Plants				
4	*Bulbophyllum Sp.*	Orchidaceae	Orchid	Used to treat leukoderma and skin allergy
5	*Cymbidium sp.*	Orchidaceae	Orchid	Used for bridal costume and wedding work
6	*Mikania micrantha Kunth*	Asteraceae		Useful for its analgesic, anti-inflammatory, antimicrobial properties.
7	*Vanda tessellata (Roxb.) Hook. ex G.Don*	Orchidaceae	Rasna	Treatment of dysentery, inflammations, rheumatism, bronchitis, etc.

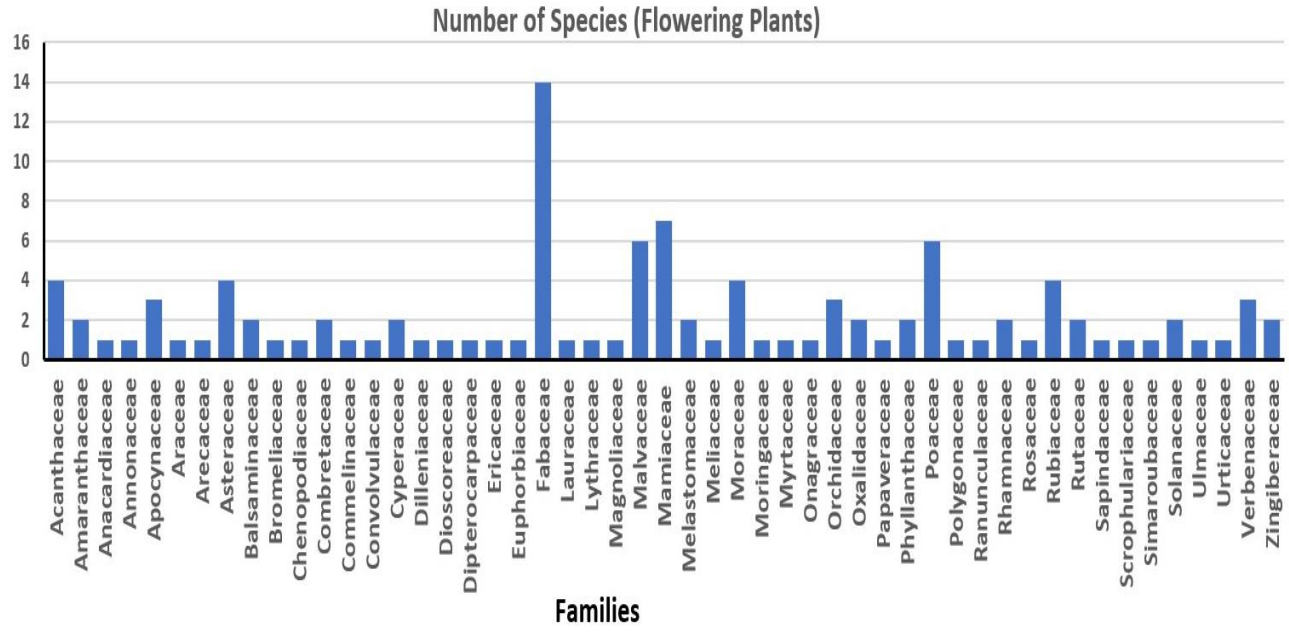

Figure 3. Status of different flowering plant families in the herb, shrub, tree and epiphytic vegetation of Rango Forest.

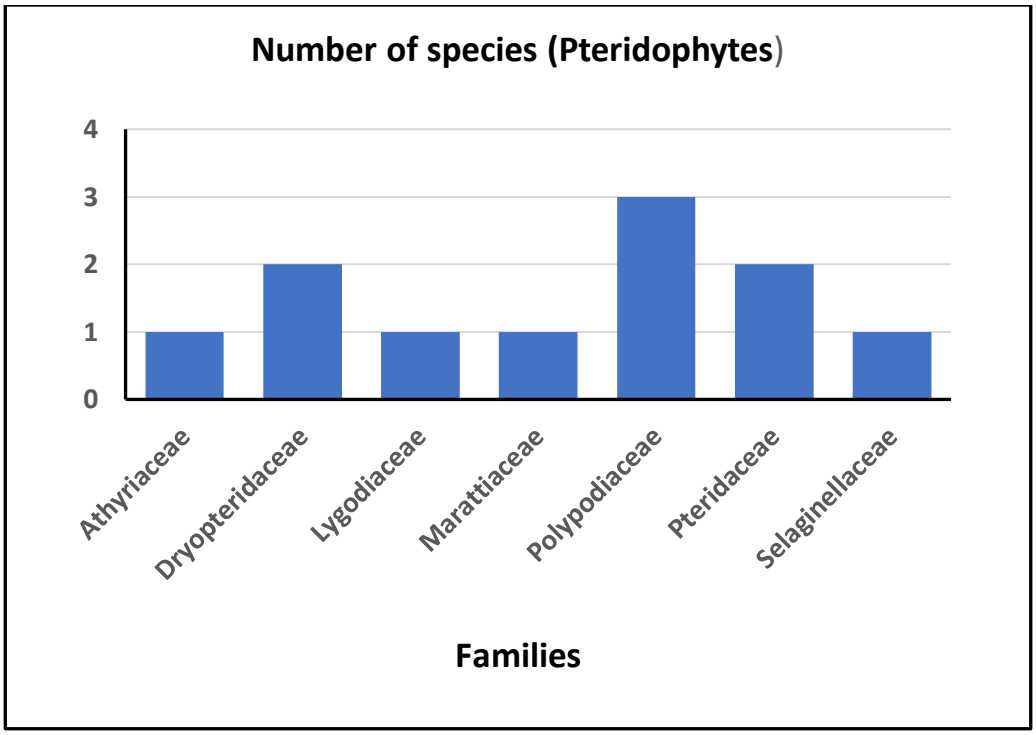

Figure 4. Status of different pteridophyte plant families in the vegetation of Rango forest.

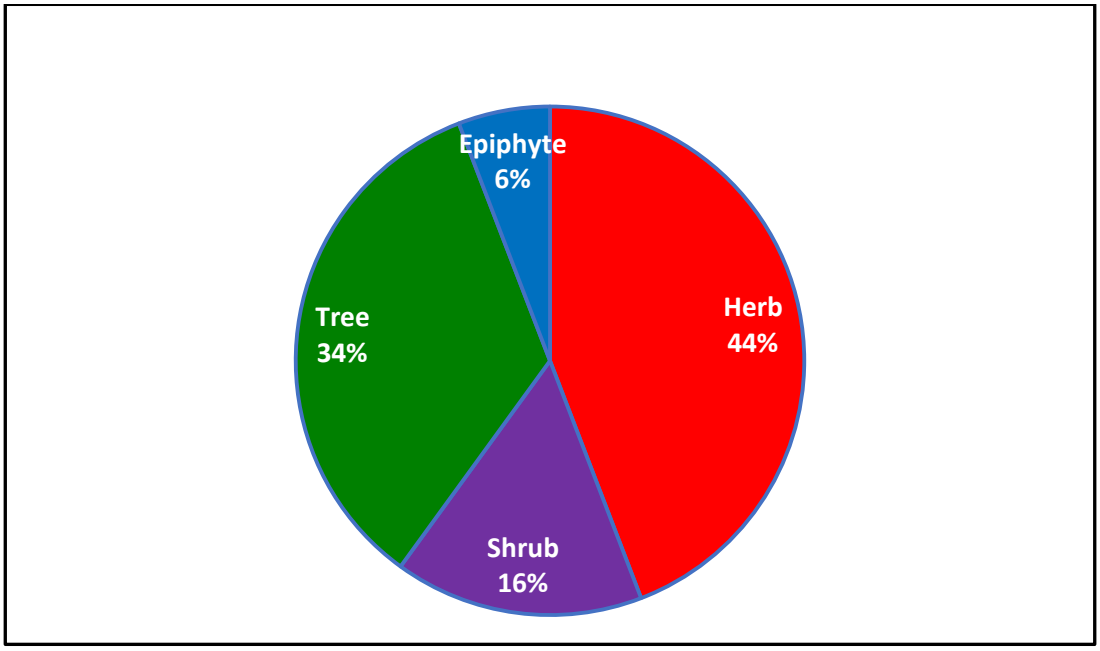

Figure 5. Percentage distribution of herb, shrub, tree and epiphytic species at Tango Forest (n = 123)

Figure 6. Field photographs of flowering plants in Rango Forest (Left to right): First row - *Aerva aspera, Ageratum houstoniarum, Bidens Pilosa, Cassia* sp. 2nd Row - *Crytococcum patens, Ipomoea purpurea,* Mimosa pudica, *Polygonum hydropiper; 3rd row - Scoparia dulcis, Senna occidentalis, Triumfetta rhomboidea, Urtica* sp.

Figure 7. Field photograph of the pteridophytes in Rango Forest [(1) *Dryopteris filix-mas and (2) Vittaria elongata*]

4. CONCLUSION

The present study depicts that Rango Forest has a rich diversity of medicinally important plants. Such plants are often used by the people of the locality, as these easily available and distant location of the hospital/clinic with modern health care facilities. The information of these medicinally important plant resources is transmitted orally for generations in the communities. However, habitat destruction of the vegetation cover is posing a serious threat for such a traditional and natural resource for human benefit.

The conservation of the wild plant diversity of the study area is highly recommended for the future sustainable use of the local natural resource [12]. The study provides a brief documentation about the ethno-medicinal aspect of the local plant diversity of Rango Forest area. The laws and legislation of the government along with awareness development will help in the conservation of the biodiversity as well. If any threatened or endangered species is recorded in further in-detail study, it should be conserved by *ex-situ* conservation.

5. CONFLICT OF INTERENT

Authors have no conflict of interest about the publication of this article.

6. ACKNOWLEDGEMENT

Authors are thankful to Dr. Soma Bandyopadhyay, Principal, Narasinha Dutt College, Howrah, for the encouragement to conduct the study. Authors also wish to thank Dr. Subhajit Bandyopadhyay, Associate Professor in Botany, Narasinha Dutt College, for his valuable suggestions for plant identification.

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