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Tree diversity and ethnomedicinal plants for the benefit of the inhabitants of Remuna Block Balasore District, Odisha

Baishnab Charan Muduli and Subhadarshani Dhall

Abstract
Fabaceae is the leading family with eight species (11.4%), followed by other 13 families of species were used local people. the study conducted here indicated that the highest number (90.43%) of medicinal plants was collected from wild in the study area and habitat of the species is trees (46.29%) and aquatic, epiphyte species (0.9%). It was observed that the highest density of trees was covered which is used by the natives with leaves (35.21%) reported as the most commonly used plant part followed by tubers and internodes (0.7%) used. A total of 24 broad-based diseases were recorded, of which cold, cough and diarrhoea were the most common with 12 types of species are used out of a total of 108 species. The phytosociological analysis of trees recorded dominant family was Moraceae which contained 5 species and *Azadirachta indica* A. Juss are most abundantly found. Hence, there is a need to collect and document such valuable knowledge from the tribal and remote areas before it is completely exhausted and also to raise awareness among the tribal communities for conservation and sustainable utilisation of plant wealth. The aim of the present study is to document the plant species diversity of Remuna block in the tribal area and its associated villages. The study revealed that medicinal plants of 108 species belonging to 98 genera belonging to 56 families were documented among which. Present research investigation studied the characteristics and scope of the medicinal plants that are utilised in the health care system of inhabitants of Remuna. Balasore district of Odisha is rich in various plant species that are important economically, medicinally, commercially and for psychosocial development. In addition, some interviews were conducted with village leaders and villagers to collect information.

Keywords: Ethnomedicinal, Species, informants, phytosociological, floras of Odisha

1. Introduction
Plants are the best friends of mankind. Human life on this planet would not be completed without a look at the role of plant have been an integral part of human society since the start of civilization. Tropical forest ecosystems, occupying only 7% of Earth's land, house two-thirds of global terrestrial biodiversity and offer significant human benefits at local, regional, and global levels. (Gardner *et al.* 2009) [1]. Since time immemorial the human society has developed in close association, with the plant's life. The term of "Ethnobotany" refers to all studies that are related to the reciprocal relationship between plants and traditional people (Hufford 2012) [3]. Ethnobotany is the study of a region's plants & their practical uses through the traditional knowledge of a local culture and people. Odisha state, known for its ancient and diverse cultural traditions, relies on traditional ethnomedicine for its rural inhabitants' healthcare needs (Rout *et al.* 2009) [11]. These plants are increasingly useful for therapeutic purposes in regions where modern medical services are either unavailable or difficult to access. A majority of Remuna peoples still dependent on medicinal plant to fulfil their healthcare problems after so many developments of medical sciences. The local peoples are the storehouses of traditional knowledge, which is rapidly disappearing. So, there is an urgent need to document this knowledge, or otherwise it will be lost forever.
Beginning of civilization people have been used plant medicine and also plant continue to be major source of medicines, as they have been throughout human society. Plant species which are used for remedy of any ailment called medicinal plant. Traditional healers use plants in treatment of diseases like bleeding, boils bronchitis, cold, cough, malaria, Diahhorea, Dysentery, Ear Complications, Headache, Leucoderma, Pneumonia, Renal complications, piles, scorpion bite, snake bite, and skin diseases plants are also used other condition not ably reproductive health conditions.

Plant species which are used for remedy of any ailment called medicinal plant. According to WHO (2001) [15] more than 80% of world population rely on traditional system of medicine for their primary health needs and over 2100 plant species are useful in preparation of medicine worldwide. Several floristic and ethnobotanical investigations on plants used for health care have been done in Odisha (Panda *et al.* 2014, Padhan *et al.* 2015, Samal *et al.* 2016, Mallick *et al.* 2020) [10, 9, 12, 6]. The documentation of the variety and ethnomedicinal usage has been made infrequently (Panda *et al.* 2015, Mohanty *et al.* 2020) [9, 8].

Ethnobotanical study is properly carried out in this region of Remuna block, Balasore. Therefore, present work is undertaken with following objectives. 1. To present an inventory of the plants and plant parts used exclusively the management of various diseases used by traditional healers by the various tribes of Remuna block of Balasore district. 2. To documents the ethnobotanical data from exiting literature and from actual field work. 3. Floristic status of tree diversity.

2. Material and Methodology

2.1 Study site: Balasore is one of the coastal districts of Odisha. It is located in the northernmost part of the state. The district is located at 21° 3' to 21° 59' north latitude and 86° 20' to 87° 29' east longitude. It is one of the ethnically blessed districts of Odisha. It consists of 12 blocks of which Remuna block is one of the tribal dominated areas of Odisha. Its geographical coordinates are 21.52'99" N and 86.88'35" E. Remuna block covers an area of 130 sq. km, of which 99.54 sq. km are rural areas and 30.47 sq. km are urban areas.

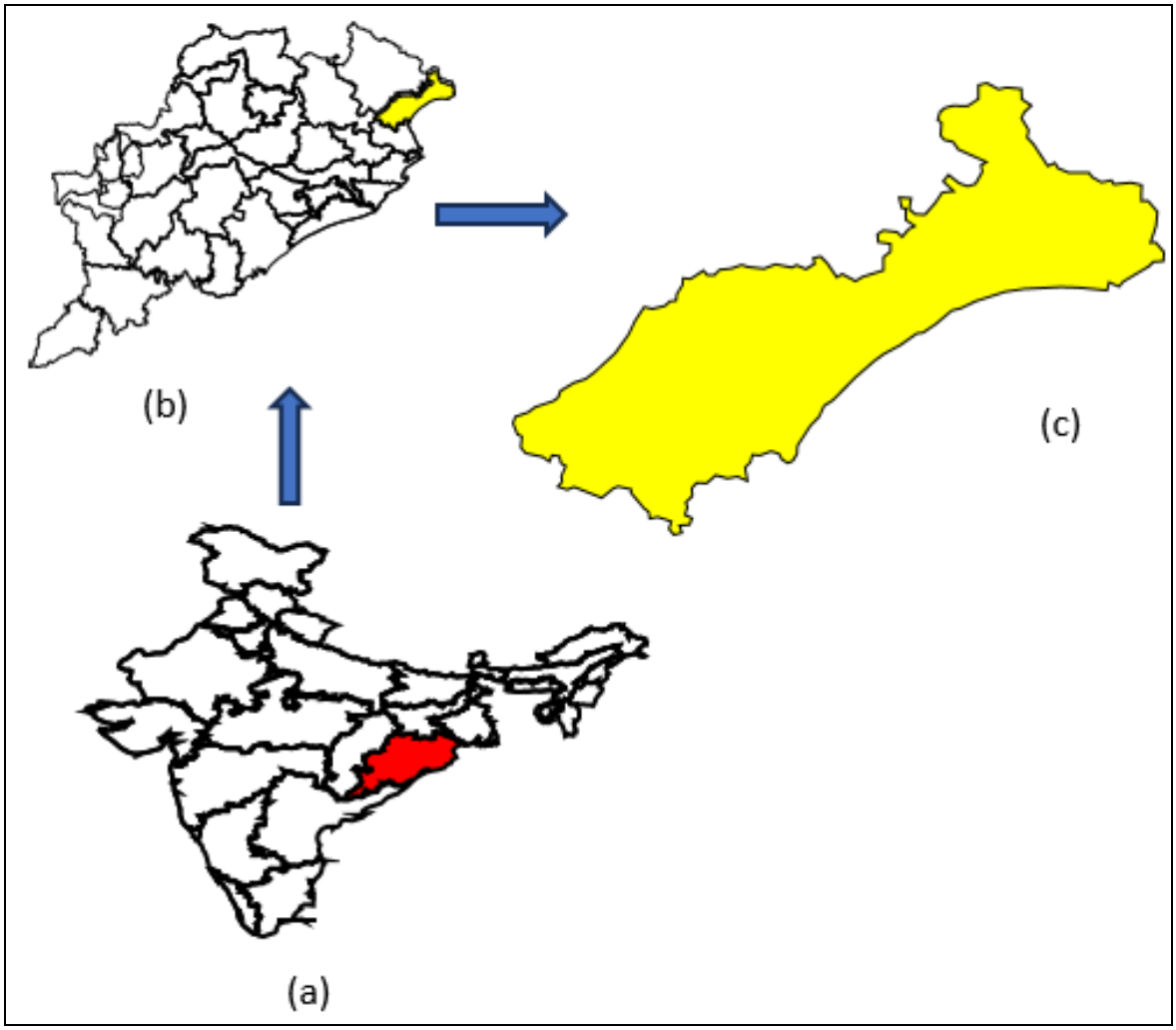

Fig 1: Map of the study area (a-India, b-Odisha, c-Balasore District)

2.2 Field Study: Various villages in the vicinity of Fakir Mohan University like Nuapdhi, Makhapada, Mardarajpur, Patripal, Jaganathpur, Bhagabatpur, Remuna etc. in Remuna block of Balasore district were visited to collect information on medicinal uses of different plant species. Intensive ethnobotanical explorations were conducted to gather first-hand information on new sources of medicines, food and folk knowledge for biodiversity conservation. Excursions to these areas were planned so that species of ethnobotanical interest could be collected either at the flowering or fruiting stage. To better understand the local customs, beliefs, habits and uses of plants, various groups of people such as family heads, healers, old experienced and knowledgeable informants and medicine men of different tribes were repeatedly interviewed. Local medicine men or village chiefs accompanied the author during the field trip to the study area (Figure-2). Photographs were taken in the field for better documentation of traditional knowledge. Voucher plant specimens were collected for further study and preservation. Herbarium specimens of all the ethno botanically important plants were preserved as per standard methodology (Jain & Rao, 1977) [4] and identified with the help of the flora of Odisha (Haines, 1921-25; Saxena & Bramham, 1994-96) [13]. The herbarium specimens were sent to Fakir Mohan University, Balasore, and Odisha for proper identification. Each plant species recorded in the different quadrants of village commons was identified by family, genus, and species.

2.3 Information sources: The information collected was considered notable when the researcher himself observed its actual application or three informants in the same or different villages reported a similar use. Herbal practitioners in the research region were interviewed, providing detailed information on medicinal plants, their families, local names, parts used, preparation techniques, and therapeutic purposes.

2.4 Vegetation assessment: Phytosociological characteristics of tree species were studied by randomly laying out 10 quadrats of 10 x 10 m sizes for trees covering the entire study area which tree species are medicinal used local people (Kershaw 1973 and Mishra 1968) [5, 7]. In the 100 m^2 quadrats the number of individuals of each tree species was counted.

Fig 2: Interview by village peoples to used plant part for different diseases and collecting field data

3. Results

The data on medicinal plants, which was collected from inhabitants in and around Remuna Block, Balasore district were analysed. The investigation revealed the medicinal plants of 108 species under 98 genera belonging to 56 families, which are commonly used for various ailments by various types of disease (Table 1).

Table 1: List of important ethnomedicinal plants of Remuna Block

Sl. No.	Botanical Name	Local Name	Family	Habit	Diseases	Part Used	Mode of Administration
1	*Adhatoda viscica* (L.) Nees	Basanga	Acanthaceae	Tree	Diarrhoea Cough Fever	Leaves	Leaves are grind and juice is taken orally. Leaves juice mixed with honey taken orally 4-5 days.
2	*Azadirachta indica* A. Juss	Neem	Meliaceae	Tree	Malaria&chi cken pox Jundice Diabetes	Leave Bark Leave	Leaves is sleeping in this period. Bark is boiled with water this water is drink. Aqueous extract of leaves 15ml is taken once a day in empty continuously one month.
3	*Aegle marmelos* L.	Bela	Rutaceae	Tree	Diarrhoea Acidity	Leaves Leaves	3-4 leaves taken orally. 5-7 leaves juice is taken orally in daily morning.
4	*Achyranthus aspera* L.	Apamaranga	Amaranthanceae	Shrub	Dysentery indigestion tooth ache	Root Stem	25 g of root juice with 50g of sugar in water taken twice.
5	*Atrocarpus heterophyllus* Lam.	Panasa	Moraceae	Tree	Ulcer, Diarrhoea, stomach pain	Leave	Leaves ash is used.
6	*Annona squamosa* L.	Maghua	Annonaceae	Tree	Abortion of 2-3month pregnancy	Root	Dried root powder 5 gm is taken once in morning for 5days.
7	*Bauhinia variegate* L.	Kanchana	Caesalpinaceae	Tree	Reducing business of the body	Root bark	Rootbark decoction 15 ml is taken once a day continuously one month in empty stomach.
8	*Bacopa monnieri* (L.) Pennell	Brahmi	Plantaginaceae	Herb	Memory power	Whole plants	Plant juice is taken daily morning.
9	*Bombax celba* L.	Simili	Bombaceae	Tree	Ireggular mensuration	Fresh root	Paste of young plant 15 gm mixed with unboiled cow milk 2 ml is taken once a day in early morning for a week.
10	*Calotropis gigantea* (L.) Alt.	Arakha	Asclepidaceae	Shrub	Eye affected snake bites	Latex of milk root	Latex is dropped in eye. Latex is applied on the bitten are 3days
11	*Canjanus cajan* L.	Harada	Fabaceae	Tree	Warkness Jundice	Leaves & fruits	Mature seed are cooked as a pulses & given. Leaves & twing paste is applied through out of body.
12	*Occium teneuflorum* L.	Tulasi	Lamiaceae	Shrub	Common cold cough	Leaf juice	Leaves juice mixed with honey early morning 5-7 days. Leaves juice with London piper equal amount with honey is mixed and taken orally 1times per day.
13	*Ficus hispida* L. *F Suupl.*	Dimiri	Moraceae	Tree	Galactohogue	Fruit	Boil green fruit given to mothers as a for better milk.
14	*Ficus benganlisis* L.	Bara	Moraceae	Tree	Teeth pain	Milk latex	Milk latex mixed with common salt brushed daily morning.
15	*Psidium guajava* L.	Pijuli	Myrtaceae	Tree	Head ache Diarrhoea	Leaf	Dried flower powder is prescribed to smoke as ciggarette. Paste of leaves crush and taken orally.
16	*Piper nigrum* L.	Golamaricha	Piperaceae	Tree	Cold, cough, acidity	Fruit	Fruit juice is mixed with honey taken 2times per days.
17	*Ricinus comunis* L.	Jada	Euphorbiaceae	Tree	Joint pain	Seed	Seed oil used in the area of joint pain 2 times per day

18	*Terminalia arjuna* (Roxb.ex DC) wigh&Arn.	Arjun	Combertaceae	Tree	Malaria	Stem bark	Decoction of stembark 20ml is taken once a day in empty stomach continuously 5 days.
19	Zyziphus mauritiana Lam.	Barakoli	Rhamnaceae	Tree	Abdominal pain during pregnancy	Stem bark	Stem bark paste is taken 2time per day.
20	*Zingiber officinale* L.	Ada	Zingiberaceae	Herb	Anorexia Throat cancer	Root Rhizomes	Root crushed and mixed with onion. Dried ginger is mixed with sugar and honey taken orally.

4. Discussion

Plants have been utilized for medicinal purposes since the earliest days of civilization. Many of these tropical plants are used to treat and help cure a wide variety of diseases and all kinds of ailments. The accumulation of knowledge of plant use is passed on from generation to generation. First step of ethnobotany is collecting detailed knowledge about the local and indigenous people of the 100 persons interviewed in this study, women (65) were predominantly represented in the sampling than men (35). Fabaceae was the leading family with eight species (11.4%) followed by Verbenaceae, Moraceae, Acanthaceae, Rutaceae, Asteraceae, Rubiaceae, Apocyanaceae, Zingiberaceae, Euphorbiaceae, Solanaceae, Cucurbitaceae, Caselpinaceae, Rhmanaceae etc. Various studies conducted in Ethiopia reported that most of medicinal plants are being harvested from non-cultivated areas. cultivating most of the plants species because they are using as remedies The local people have not yet started cultivating most of the plants species because they are using as remedies. Growth form analysis of medicinal plants revealed that Trees constitute the highest proportion being represented by 50 species (46.29%), Herbs represented by 18 species (17.14%), Shrub represented by 33 species (30.55%), and Climbers represented by 5 species (4.62%), Aquatic species represented by 1(0.9%), while there was one species (0.9%) of epiphyte (Figure-3). This finding shows that the most represented life forms of medicinal plants in the study area were Trees followed by shrub. People of the study area harvest different plant parts for the preparation of traditional remedies (e.g., leaves, roots, seeds, barks, and fruits). Leaves (35.21%) were reported as the most widely used plant part followed least used tuber (0.7%) and internode, male inflorescence, oils (0.7%). Leaves are used 50 species and tuber are 1species used (Figure-4 and 5).

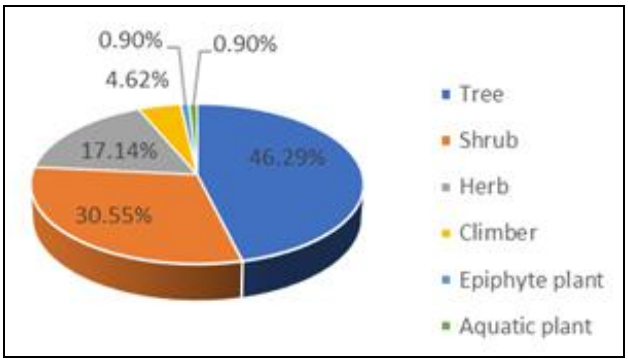

Fig 3: Life forms of medicinal plants

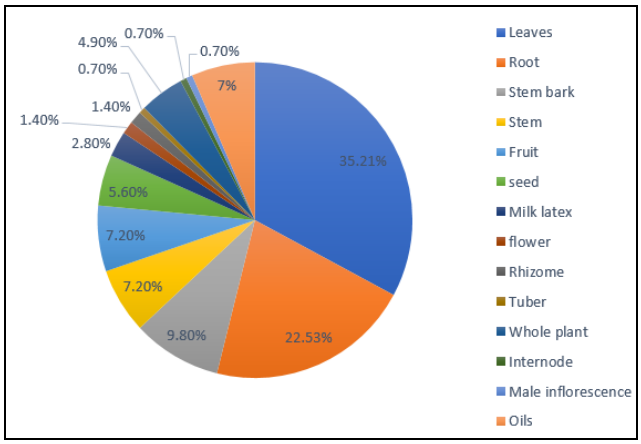

Fig 4: Percentage of different part of the plant used.

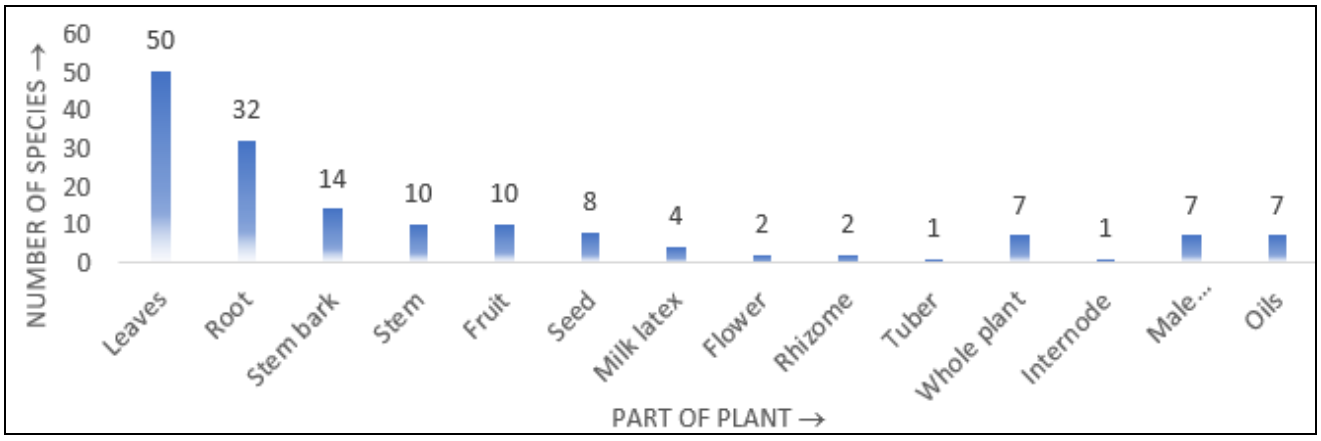

Fig 5: Number of species of different parts of the plant are used in human diseases

Process of preparation, Dosage, and Administration Techniques: Participants shared diverse knowledge of various herbal preparation methods during the data collection process. The results showed that the most remedies were prepared from a single plant or plant parts (73%) and preparation from combined plant species was 27%. The majority of the remedies (78.6%) in the study area were prepared from fresh parts of medicinal plants followed by dried form (15.7%) and (5.7%) prepared either from dry or fresh plant parts.

Among all the collected medicinal plants, maximum numbers are used to cure some common ailments but some plants are found to be used for the treatment of very critical diseases such as cancer, skin cancer, hydrocele, leprosy, piles, diabetes, tuberculosis etc. and the medicine-men of the tribe claim that through the proper treatment, as prescribed by them, the diseases are fully cured. In the present study a sum total of 24 broad based diseases are recorded (Figure-6).

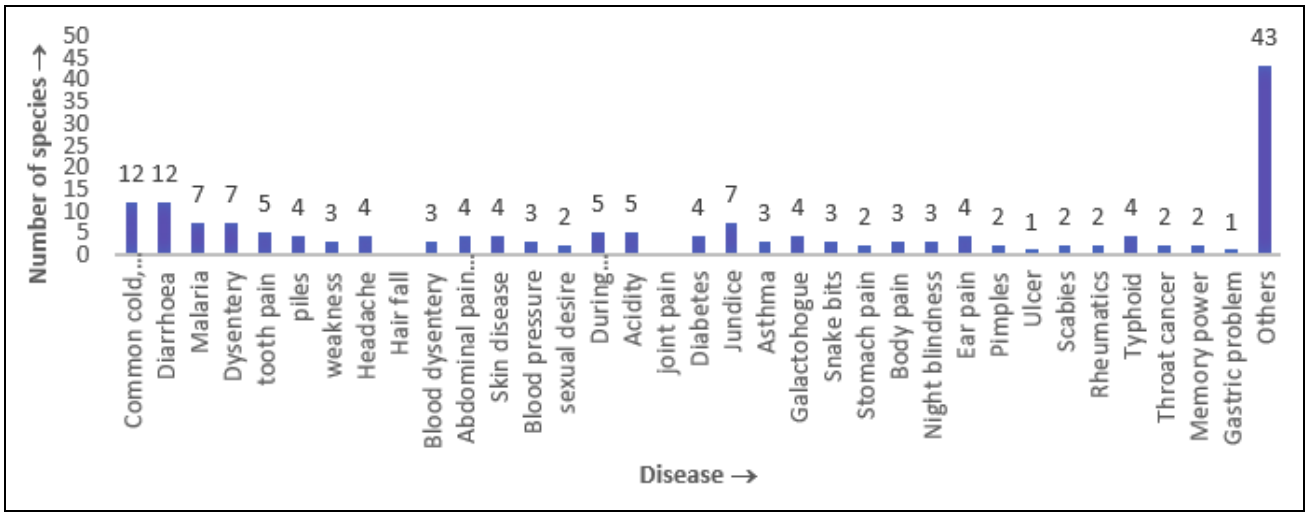

Fig 6: Number of species are used in disease

4.1 Floristic composition: The present study on the phytosociological analysis of tree diversity were recorded the presence of a total of 48 number of tree species under 43 genera belonging to 32 families. The foremost dominant family was Moraceae which contained 5 species followed by fabaceae, verbenaceae, acanthaceae are 3 species respectively of the total tree diversity across the study sites. *Azadirachta indica* A. Juss are 387 no. of trees highest followed by *Mangifera indica* L. 356 and least 15 no. of trees are found in study area is *Santalum alba* L. the families fabaceae highest number of tree and santalaceae is few trees was recorded (Table-2, Figure-7).

Table 2: List of plants species was recorded in remuna block

SL. No.	Plant Species	Family	Number of Tree	Number of tree species
1	*Azadirachta indica* A. Juss	Meliaceae	387	1
2	*Adhatoda viscica* (L.) Nees	Acanthaceae	234	3
3	*Andrographis paniculata* (Burm.f) Wall ex. Nees			
4	*Justica adhatoda* L.			
5	*Aegle marmelos* L.	Rutaceae	189	2
6	*Citrus lemon* (L.) Osbeck			
7	*Accacia catechu* (L.F.) Willd	Mimosaceae	79	1
8	*Alangium salviflorum* (L.F.) Wing.	Alangiaceae	35	1
9	*Annona squamosa* L.	Annonaceae	352	2
10	*Annona reticulata* L.			
11	*Anthocephalus cadamba* L.	Rubiaceae	214	1
12	*Bauhinia variegate* L.	Caesalpinaceae	321	2
13	*Cassia fistula* L.			
14	*Bambusa stricta* Roxb.	Poaceae	54	1
15	*Borasscus flabellifer* L.	Arecaceae	123	1
16	*Bombax celba* L.	Bombaceae	24	1
17	*Canjanus cajan* L.	Fabaceae	563	3
18	*Pongamia pinnata* (L.) Pierre			
19	*Tepharosia purpurea* L. Pers.			
20	*Careya arboreal* Roxb.	Barringtonuaceae	56	1
21	*Crateva nurvala* Buch. Ham.	Capparaceae	78	1
22	*Curcuma angestifolia* Roxb	Zingiberacea e	68	2
23	*Curcuma amada* Roxb.			
24	*Elephantopus scabar* L.	Asteraceae	56	1
25	*Lawsonia inermis* L.	Lythraceae	45	1
26	*Musa parasidica* L.	Musaceae	473	1
27	*Mangifera indica* L.	Anacardiaceae	540	2
28	*Spondidas pinnata* (L. F) Kurz.			
29	*Moringa oleifera* L.	Moringaceae	123	1
30	*Phyla nodiflora* (L.) Greene	Verbenaceae	423	3
31	*Clerodendrum viscosum* vent.			
32	*Vitex negundo* L.			
33	*Phyllanthus emblica* L.	Euphorbiaceae	336	2
34	*Ricinus comunis* L.			
35	*Shorea robusta* Gaertn.fruct	Diptericarpaceae	55	1
36	*Santalum alba* L.	Santalaceae	15	1
37	*Terminalia arjuna* (Roxb.ex DC) wigh&Arn	Combertaceae	67	1
38	*Zyziphus mauritiana* Lam.	Rhamnaceae	59	1
39	*Punica granatum* Lin.	Punicaceae	28	1

40	*Atrocarpus heterophyllus* Lam.	Moraceae	531	5
41	*Ficus hispida* L. F Suupl.			
42	*Ficus religiosa* L.			
43	*Ficus benganlisis* L.			
44	*Strebulus asper* Lour.			
45	*Nyctanthes arbor* tiustis L	Oleaceae	19	1
46	*Psidium guajava* L	Myrtaceae	349	1
47	*Plumeria rubra* L.	Apocyanaceae	352	2
48	*Rauvolfia serpentina* L. Bentham ex kurz.			

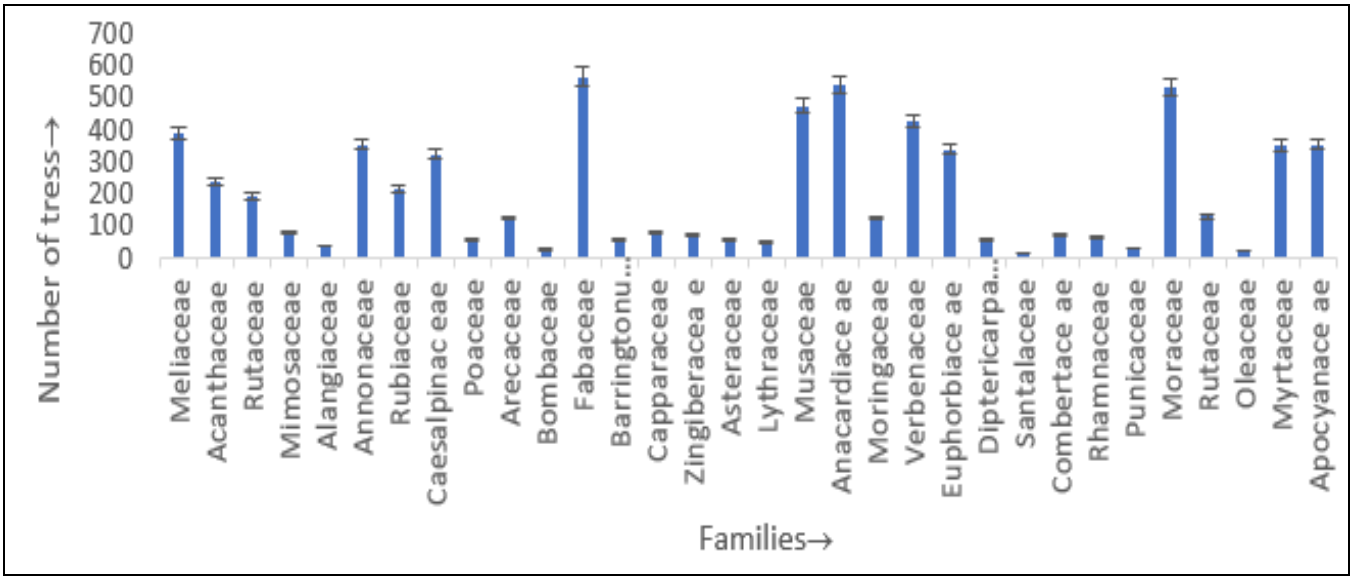

Fig 7: Phytosociological attributes of trees in the Remuna block

5. Conclusion

Due to lack of interest of young generation towards traditional knowledge as well as urbanization and unscientific exploitation of natural forests, the valuable knowledge and plant species are getting depleted leading to their extinction. Hence it is necessary to collect and document such precious knowledge from the tribal and remote areas before their complete depletion and also increase awareness among the tribal communities for conservation and sustainable use of plant wealth. Study site habitat of tree species is more and leaf's part are used mostly used for different diseases. Tree diversity (*Azadirachta indica* A. Juss) is mostly abundant are used local people for their economical, socially, ethno medical is used. Further the plants with medicinal value should be chemically analysed so that active constituents from them can be identified and used for the development of new drug.

6. Acknowledgement

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7. Authorship contribution statement

Baishnab Charan Muduli: Writing-original draft, methodology, investigation, formal analysis, field visit, data collection, software, resources data duration, Conceptualization.

Subhadarshani Dhall: Writing-review, resources, methodology, investigation, formal analysis, data duration.

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