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Assessment of ethnomedicinal plants in Attoor, Kanyakumari, Tamil-Nadu

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Abstract

Utilization of plants for medicinal purposes in India has been documented long back in ancient literature. South India holds more hidden treasure of plant resources for healthcare. Information on the uses of plants as traditional medicine has not been documented in Tamil Nadu till today. Ironically, information on the uses of plants for medicines and lack of interest among the younger generation as well as their tendency to migrate to cities for lucrative jobs, wealth of knowledge from this area is declining. In this backdrop, the present work attempts to record the use of medicinal plants by the local people and traditional healers who have sound knowledge of herbal remedies. Therefore, documenting indigenous knowledge through ethno-botanical studies is important for the conservation of biological resources and their sustainable utilization. Despite the increasing acceptance of traditional medicine in Attoor, Kanyakumari district, this rich indigenous knowledge on traditional remedies is not adequately documented. Documentation of plants used as traditional medicines in Attor is urgent so that the knowledge can be preserved; the utilized plants are conserved and used sustainably. The current investigation therefore, attempts to fill some of the gaps in indigenous knowledge related to the use of herbal medicines in Attoor, Kanyakumari District emphasizing their role in basic health care.

Keywords: Medicinal plants; Documentation; Kanyakumari; Traditional remedies; Health care

1. Introduction

Ethnobotany is the study of relationship between plants and people [25]. Since pre-historic times, medicinal plants have been used virtually as a source of medicine. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several synthetic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments.

India has luxurious and diverse flora which represent an invaluable repository of medicinal plants. India has huge species diversity with several of the species being endemic to their native ranges. Medicinal plants have served as the main source of medicine in India [32]. Medicinal plants are used for preventive, promotive and curative purposes. Medicinal plants have been preliminary selected on the basis of local traditional knowledge [22]. The traditional system of medicine along with folklore tradition continues to benefit a large section of the population, especially in rural areas, despite the arrival of the modern medicine. The traditional knowledge of herbs is famous among the indigenous and local people. The traditional healers are the main source of information on medicinal importance of plants [31]. The rural population has immense faith for traditional and magical herbs. The rural people have traditional indigenous knowledge about the use of medicinal plants to cure various diseases. Traditional indigenous knowledge comprises practices based on observations [28].

The World Health Organization (WHO) suggested that as many as 80% of the world's people depend on traditional medicine for their primary health care needs. There are significant economic benefits in the development of indigenous

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medicines and in the use of medicinal plants for the cure of various diseases [2]. The knowledge of medicinal plants has been accumulated on the basis of different medicinal systems such as Ayurveda, Unani and Siddha [26]. Among these systems, Ayurveda and Unani are the most developed and widely practiced systems in India. Herbal drugs obtained from plants are safe in treating various ailments with few side effects [1]. The golden fact is that use of herbal treatments is independent of any age groups and the sexes [19].

Recently, experimental proved that plants offer immense scope for researchers engaged in validation of traditional claims for the development of novel drugs [29]. Since interest in traditional medicine has been increasing world over, ethnobotanical studies have gained prominence to explore the traditional knowledge particularly in developing countries [17]. Therefore collection of ethnobotanical information and documentation of traditional knowledge has gained prominence from the prospective of drug development [24].

In the recent years, research on medicinal plants has attracted a lot of attentions globally. Large evidence has accumulated to demonstrate the promising potential of medicinal plants in various traditional, complementary and alternate systems of treatment of human diseases [9]. Research teams in pharmaceutical industries are focusing on medicinal plants because of great potential of these plants fighting against various diseases. Plants are rich in a wide variety of secondary metabolites such as tannins, terpenoids, alkaloids and flavonoids [8].

Documentation of medicinal plants is very important. Documenting indigenous knowledge through ethnomedicinal studies is significant for the conservation and utilization of biological resources [2a]. The knowledge on the use of medicinal plants is enormous but if this traditional knowledge is not rapidly researched and recorded, indications are that it will be lost with succeeding generations [15]. So our study focused on the documentation of traditional knowledge of medicinal plants used by indigenous people will lead to gather information in future aspects.

2. Material and methods

2.1. Study Area

Tamil Nadu is the 11th largest state in India with a geographical area of 130058 km^2. Of the total forest area (2148 km^2) of Tamil Nadu, 3305 km^2 are under protected area (15%) which includes, 8 Wildlife Sanctuaries, 12 Bird Sanctuaries, 5 National Parks, 3 Biosphere Reserves and one Tiger reserve [6].

Kanyakumari district of South Tamil Nadu is located in the foot hills of Southern Western Ghats. It occupies an area of about 1684 sq.km. It is also the meeting point of three bodies of water. It is the confluence of the Western Coastal Plains and Eastern Coastal Plains [30].

In view of exploitation and conservation of folk knowledge, an attempt has been made to study the medico-ethnobotanical aspects from the Thiruvattar taluk of Attoor lying between 8º 32' N latitude and 77º 17' E longitude. It occupies an area of about 5.35 km^2. Climatic conditions are moderately hot and humid. Maximum temperature is recorded in March and April. Annual temperature generally ranges from 16 to 38ºC. Annual rainfall is 110 cm – 125 cm. Maximum rainfalls occurs from May to July during the Southeast Monsoon and October to November during Northeast Monsoon.

A total of 12505 people inhabit Attoor, Tamil and Malayalam are the main languages. Out of the total population 6322 are males while 6183 were females. There are about 1370 families in this area. Rice (*Oryza sativa* L.) is the staple food for the rich and the poor. Some poor people use tapioca (*Manihot esculenta* Crantz) as food. Beverages like tea and tradition coffee (chukku coffee / dried ginger and palm sugar) are widely still used in these areas.

Forest serves as a store house to a variety of naturally growing medicinal and aromatic plant species. The temperature and rainfall seems to be favourable for the luxuriant growth of the plant resources. The people dwelling in the village houses have a scattered settlement pattern. These villagers are primarily agriculturists as well as raise livestock for milk, egg, meat and manure.

In Attoor, either the knowledge from herbalists is passed secretively from one generation to the next through words of mouths or their descendants inherit the medico-spiritual manuscripts.

2.2. Data Analysis

The ethnobotanical surveys were carried out in the study area (Attoor) over a period of 05 months (June-October 2016). During the course of the study, field trips were conducted to spread across seasons so as to get maximum information and also to cross check the information provided by the local informants during the earlier visits.

Method of selecting informants depended upon the distribution of local people having folk knowledge. A total of 15 informants, comprising 9 males and 6 females were identified between the ages of 48 to 75. They were requested to show the plant species on site. These informants have sound knowledge on the medicinal plants found in their surrounding areas and they practice medicine within their families. The wealth of medicinal plant knowledge among the people of this area is based on hundreds of years of beliefs and observations. This knowledge has been transmitted orally from generation to generation; however it seems that it is vanishing from the modern society since younger people are not interested to carry on this tradition.

Information on different ethno-medicinal plants *viz*., their local names, parts used, condition of parts used (fresh/dried), methods of medicine preparation, dose regimen, route of administration and application in the treatment of a particular diseases were recorded. The collected specimens were identified with the help of valid references [11]. After the identification samples were authenticated person and the voucher specimens were deposited in college botany department herbarium.

3. Results and discussion

In the present study, 101 plant species belonging to 34 families (**Table: 1**) were reported after undertaking the survey and having conversation with elder persons of various age groups. It was found that dominated medicinal plants of this region are main source of primary health care.

Majority of the elder persons have sound knowledge of medicinal plants and use these plants in their daily life. These plants are used in the forms of decoction, juice, powder, paste and whole plant extract. Plants of the family Leguminosae (9 sp.) were largely represented followed by Euphorbiaceae (6 sp.), Liliaceae and Solanaceae (5 sp. Each), Apocynaceae, Asclepiadaceae and Labiatae (4 sp. Each) Cucurbitaceae, Malvaceae, Myrtaceae, Piperaceae and Rutaceae (3 sp. Each), Acanthaceae, Amaranthaceae, Anacardiaceae, Capparidaceae, Compositae, Nyctaginaceae, Oleaceae, Palmaceae, Rubiaceae, Umbelliferae, Verbenaceae and Zingiberaceae (2 sp. Each). The rest of the families recorded one species only (**Figure 1**). These medicinal plants are mainly used for the treatment of mouth ulcer, body pain, cough, bronchitis, piles, asthma, pimples, skin diseases, dysentery, constipation, diabetes, jaundice, headache, stomache, leucoderma, gum problem, knee pain, tetanus and wounds healing.

Table 1 List of Medicinal plants used in Attoor.

Binomial name	Growth habit	Vernacular name	Part used	Uses
Acanthaceae				
Adhatoda vasica Nees.	Shrub	Adhatodai	Roots, leaves and flowers	Good remedy for cough and cold. Leaves cure fever
Andrographis paniculata Nees.	Herb	Nilavembu	Whole plant	Leaf paste is applied bitten site of snake, beetles and scorpion.
Acoraceae				
Acorus calamus	Herb	Vasambu	Rhizome	Rhizome treats paralyzed limbs and rheumatic swellings.
Amaranthaceae				
Achyranthes aspera Linn.	Herb	Nayuruvi	Whole plant	A decoction of the plant is useful in pneumonia.

Alternanthera sessilis [L.] R.Br.	Herb	Ponnankannikeerai	Whole plant	The plant extract is used to cure burning sensation
Anacardiaceae				
Anacardium occidentale L.	Tree	Kollavu	Kernel, bark and leaves	Kernel is used in skin diseases and leprosy.
Mangifera indica L.	Tree	Maavu	Fruit	The kernel juice is snuffed once for 3 days to stop nasal bleeding.
Annonaceae				
Annona squamosa L.	Tree	Munthiri, Sitapalam	Root, leaves, fruit and seed	The root extract is used to reduce mental depression and spinal disorder.
Apocynaceae				
Carissa carandas L.	Shrub	Karakkai	Root and leaves	Leaf decoction is used for fever.
Tabernaemontana divaricata [Linn.]	Shrub	Nanthiyavattam	Root, flowers and latex	Paste of root is applied to treat eye diseases.
Thevetia peruviana [Pers.]	Tree	Manjal Arali	Whole plant	Plant extract is poured into ear to treat ear pain.
Vinca rosea Linn.	Herb	Nithya kalyani	Whole plant	The root powder taken orally to treat diabetes.
Araceae				
Amorphophallus campanulatus Bl.	Herb	Chena	Corns	The root paste is useful to cure boils.
Arecaceae				
Areca catechu L.	Tree	Pakku	Nut	The nut is used in treating sore throat.
Asclepiadaceae				
Calotropis gigantea R.Br.	Shrub	Erukku	Root and bark	Useful in treating leprosy.
Gymnena sylvestre R.Br. ex Schult.	Shrub	Sarkarai kolli	Roots and leaves	The root powder is applied on the bitten spot of snake bite.
Hemidesmus indicus [L.] R.Br.	Shrub	Nannari	Roots, leaves and stem	Juice from root keeps the body cool.
Pergularia extensa N.E. Br.	Climber	Veli paruthi	Whole plant	The plant is used in the treatment of cough and asthma.
Boraginaceae				
Heliotropium indicum L.	Herb	Telkodukkai	Whole plant	Paste of whole plant is useful for ulcer, sores and wounds.
Brassicaceae				
Brassica juncea [L.] Hook&Thoms.	Herb	Kadugu	Seed	Mustard is acrid, thermogenic, anodyne, carminative, digestive and anthelmintic. It is useful in dyspepsia, flatulence, inflammations and skin diseases.

				Mustard is also used to eliminate intestinal worms.
Capparidaceae				
Cleome viscosa Linn.	Herb	Naikadugu	Leaves and seeds	Leaf juice is used in earache and eye troubles. Seed paste made by using vinegar and lime juice or water is a remedy for skin diseases.
Gynandropsis gynandra DC.	Herb	Thivalai	Leaves	Inhalation of crushed juice from leaves removes head ache. Paste of leaves and flowers cures diarrhoea.
Caricaceae				
Carica papaya L.	Tree	Pappali	Fruit and leaves	The dried and salted fruit reduces enlarged spleen and liver. It treats wounds of urinary tract. Leaf juice is taken orally to treat malaria.
Compositae				
Eclipta prostrata Hassk.	Herb	Karisalan kanni	Leaves, flower, seed, root and stem	For skin diseases, paste made from powder of root with sesame oil are applied. If the menstrual bleeding is more than normal, decoction made from leaves should be taken. This will reduce the bleeding. Leaf extract is mixed with coconut oil and applied on hair regularly for healthy black hair.
Tridax procumbens L.	Herb	Muriyam pachilai	Leaves	Leaf paste is applied on cuts and wounds.
Cucurbitaceae				
Cucumis sativus Linn.	Climber	Vellari	Fruit	The fruit are diuretic and good for burning sensation. The tender fruits are useful to dissolving and removing kidney stones.
Cucurbita pepo DC.	Climber	Maththan	Fruit and seed.	Fruits are used in burns, inflammations, boils and migraine. Seeds are anthelmentic.
Momordica charantia L.	Climber	Pavakai	Fruit	The fruits are anti-diabetic, anthelmintic and anti-inflammatory. They are useful in skin disease, leprosy and ulcer.
Euphorbiaceae				
Acalypha indica Linn.	Herb	Kuppaimeni	Whole plant	The roots and leaves are used to treat skin diseases, constipation, ulcer and bronchitis. Paste of leaves is used to cure bed sores.
Jatropha curcas L.	Shrub	Kattamanakku	Leaves, seeds and oils	The leaf paste is useful in foul ulcer, tumours and scabies. The latex is good for wounds and ulcer.
Manicot esculenta Crantz.	Shrub	Maravalli kilangu	Tuberous roots	The tuberous roots are sweet, appetizer, aperients, vulnerary and tonic. They are useful in dyspepsia, constipation, wounds, foul ulcer and general debility.

Phyllanthus emblica L.	Tree	Nelli	Bark, leaves and fruits	The bark is useful in the treatment of jaundice and diarrhoea. The leaves are used to treat inflammations and dysentry. The fruits are useful in the treatment of diabetes, cough, bronchitis, peptic ulcer, flatulence, jaundice, leucoderma, cardiac disorder and fever.
Phyllanthus niruri Linn.	Herb	Keela nelli	Whole plant	Fresh leaves are ground and mixed with a cup of cow or goat milk and taken internally to cure for jaundice. Paste of whole plant is good for ulcer. The leaf made into paste with salt; if it is applied on skin reduces itching in skin diseases. It is a good medicine for skin disease and asthma. Fresh juice of the leaf filtered can be used eye drops in redness of eye.
Ricinus communis L.	Shrub	Aamanaku	Seed	The oil extracted from the seed is antipyretic and thermogenic. It is used as an effective purgative.
Geraniaceae				
Biophytum sensitivum [L.]DC.	Herb	Mukkutti	Whole plant	It is useful in asthma and snake bite.
Graminae				
Cynodon dactylon [Linn.] Pers.	Creeper	Arukapul	Whole plant	Juice is applied to bleeding cuts and wounds.
Veteveria zizanioides [L.] Nash.	Herb	Vetiver	Fibrous root	It is used against stomachache and ulcer.
Labiatae				
Coleus amboinicus Lour.	Herb	Navara Pachilai	Leaves	Leaf juice is to treat cough and throat pain.
Leucas aspera [Roth.] Spreng.	Herb	Thumbai	Whole plant	Flower juice can be used as nasal drops in headache, cold and in snakebites.
Mentha arvensis L.	Herb	Pudina	Leaves	Pudina tea is good for cough and cold.
Ocimum sanctum Linn.	Herb	Thulasi	Leaves	Juice is taken orally for cough and cold
Lauraceae				
Cinnamomum zeylanicum Blume.	Tree	Karuva pattai	Bark	The bark decoction is used to treat bronchitis and cold
Leguminosae				
Abrus precatorius Linn.	Climber	Kunnimuthu, Kuntumani	Roots, leaves and seeds	Seed powder is taken orally to treat skin diseases and fever.
Cassia angustifolia Vahl.	Tree	Thirunelveli senna	Leaves	It is used as a purgative.
Cassia fistula L.	Tree	Konna	Fruit, bark and root	The bark is used in treating skin diseases.

Clitoria ternatea Linn.	Climber	Sangu pushpam	Leaves and roots	Seed paste is applied in swollen joints.
Mimosa pudica L.	Herb	Thoddal surungi	Whole plant	Whole plant is used to cure burning sensation.
Pterocarpus marsupium Roxb.	Tree	Vengai	Leaves, flowers, gum and heartwood	The heartwood is astringent, bitter, acrid and cooling.
Saraca indica L.	Tree	Ashoka	Bark	The bark extract is given to treat many uterine disorders
Sesbania grandiflora [Linn.] Pers.	Tree	Agathi keerai	Leaves, flowers and fruits	Leaves are astringent, cooling, bitter and tonic,
Tamarindus indica L.	Tree	Puli	Fruit and bark	It enhances appetite and improves digestion
Liliaceae				
Allium cepa L.	Herb	Ulli	Bulb	Bulbs are used for wound pain and malarial fever.
Allium sativum L.	Herb	Poondu	Bulb	The raw bulb is taken orally for stomach pain.
Aloe vera L.	Herb	Kattazhai	Leaves	For removal of dandruff, pulp is applied to the scalp.
Asparagus racemosus Willd.	Climber	Satavari	Tuberous root	Decoction of root is administered orally to cure gall stone.
Gloriosa superba Linn.	Climber	Kaanthal	Rhizome	Rhizome is useful to promoting labour pain
Lythraceae				
Lawsonia inermis L.	Shrub	Maruthani	Roots, leaves, flowers and seeds	The root paste is applied for burning sensation, leprosy and skin diseases
Magnoliaceae				
Michelia champaca L.	Tree	Champakam	Flower and seeds	Flowers are used in nausea, fever and also act as diuretic.
Malvaceae				
Gossypium barbadense L.	Shrub	Paruthi	Leaves	Leaf infusion is drunk for the cold and rheumatism.
Hibiscus rosa-sinensis L.	Shrub	Chemparuthi	Roots, leaves and flowers	The roots are useful in treating cough, venereal diseases
Thespesia populnea [L.] Soland ex Correa.	Tree	Poovarasan	Root, bark leaves, flowers, and fruits	Powdered root paste applied over for skin diseases. It is used to treat dysentery

Meliaceae				
Azadirachta indica A.Juss.	Tree	Veppu	Leaves and bark	Plant is used in curing fever like malaria
Menispermaceae				
Cissampelos pareira Linn.	Climber	Malaithanki Pachilai	Roots and leaves	The dried leaves are used to treat piles.
Moraceae				
Artocarpus communis J.R.Forst.&G.Forst	Tree	Simapila	Fruit, root, seeds and leaves	The leaves are useful in fever, boils, and skin diseases.
Artocarpus heterophyllus Lamk.	Tree	Palaa	Fruit and leaves	Root is given internally for diarrhoea.
Moringaceae				
Moringa oleifera Lamk.	Tree	Murungai	Whole plant part	The flower, leaf, fruit, seeds all are used in renal disorders.
Musaceae				
Musa paradisiaca L.	Shrub/Herb	Vazhai	Root, stem, flower, fruit and leaves	Juice of stem is used to treat nostalgia. Banana fruit is mild laxative.
Myrtaceae				
Eucalyptus globulus Labill.	Tree	Yukkali	Leaves	Oil used as to treat pain, bronchitis and asthma.
Psidium guajava Linn.	Tree	Perai, Koyyaa	Fruit and leaves	The young leaves are used to maintain the sugar level
Syzygium aromaticum [Linn.] Merrill and Perry.	Tree	Kirampu	Dried flower buds [clove] oil	Dried flowers used to prevent dental carries. Clove is used as a spice.
Nyctaginaceae				
Boerhaavia diffusa L.	Herb	Mukki-rattai	Whole plant	Whole plant is used for treating asthma, and inflammations.
Mirabilis jalapa L.	Herb	Nalu mani	Roots and leaves	The paste of leaf and roots are applied to lesions, and boils.
Oleaceae				
Jasminum grandiflorum L.	Climber	Pichi	Leaves, flowers, root and stem	The flowers and leaves are good remedy for skin diseases
Jasminum sambac [L.] Ait.	Climber	Kundu malligai	Roots, leaves and flowers	The roots along with leaves are useful in Ophthalmopathy.
Palmaceae				
Borassus flabellifer L.	Tree	Panai	Leaves	Decoction is used for gonorrhea and respiratory ailments.
Cocos nucifera Linn.	Tree	Thengu	Fruit	Coconut milk is diuretic and destroys intestinal worms.

Piperaceae				
Piper betle Linn.	Creeper	Vettilai	Whole plant	The plant is useful in bronchitis, asthma, and rheumatism.
Piper longum L.	Creeper	Tippili	Fruit	The powder with honey purifies blood.
Piper nigrum Linn.	Creeper	Nalla milaku	Fruits	The fruits are useful in arthritis, asthma, fever and cough.
Punicaceae				
Punica granatum Linn.	Tree	Maathulai	Roots, bark, flowers, fruits	The root and bark decoction is used as cooling body and are good for tape worm.
Rubiaceae				
Coffea arabica L.	Shrub	Kappi	Beans	Coffee is a beverage gives relieve from headache; migraine
Ixora coccinea L.	Shrub	Thetti	Leaves, roots, flowers and fruits	The roots are astringent, acrid, sedative, stomachic and antiseptic.
Rutaceae				
Aegle marmelos Corr.	Tree	Vilvam	Fruits and leaves	Fruits used in the treatment of diarrhoea.
Citrus limon [L.] Burm.F.	Tree	Elumichai	Fruit	It is used for against nausea and treat scabies.
Murraya koengii [L.] Spreng.	Tree	Kariveppila	Leaves and bark	Decoction of the leaves controls fever and cough.
Santalaceae				
Santalum album Linn.	Tree	Chandanam	Heart wood	The heart wood is bitter, sweet, and diuretic.
Sapindaceae				
Cardiospermum halicacabum L.	Herb	Ulinja	Root, leaves and seed	The root decoction is useful in fever.
Sapotaceae				
Achras sapota L.	Tree	Sapota	Bark and fruits	The fruit is digestive and rich in vitamins.
Solanaceae				
Capsicum annuum L.	Herb	Kanthari	Fruit and leaves	The leaves paste applied externally for wounds.
Datura metel Linn.	Herb	Oomathai	Roots, leaves, flowers and seeds	Leaves and seed juice is useful in respiratory ailments.
Solanum melongena L.	Herb	Kathari	Fruit, root, seeds and leaves	Roots are used as anti-asthmatic and stimulant.

Solanum nigrum L.	Herb	Manathakkali	Whole plant	Whole plant part is taken as a food to treat cough.
Solanum trilobatum L.	Herb	Thuthuvalai	Leaves	The leaf juice is taken orally to treat cough and itching.
Sterculiaceae				
Theobroma cacao L.	Tree	Kakkavo	Fruit and seed	The seeds are used for made non-alcoholic beverage.
Umbelliferae				
Centella asiatica [L.]Urban.	Herb	Vallarai	Whole plant	Paste of the leaf applied over for chronic ulcers.
Coriandrum sativum Linn.	Herb	Malli	Fruits and leaves	Juice of the leaf can be used as nasal drop.
Verbenaceae				
Lantana camara L.	Shrub	Poochedi	Stem and root bark	Stem paste is used in the treatment of itches.
Vitex negundo L.	Shrub	Nochi	Roots, leaves and fruits	Leaves vapour gives relief from fever, cold and cough.
Vitaceae				
Cissus quadrangularis Linn.	Shrub	Pirandai	Stem	Applying the stem paste to the wound for fast healing
Zingiberaceae				
Curcuma longa L.	Herb	Manjal	Rhizome	Paste made from rhizome is useful to treat skin diseases.
Zingiber officinale Rosc.	Herb	Ingi	Rhizome	The rhizome is used as a digestive treat rheumatism.

Leaves were the most widely used plant part accounting for 46 species in a total of 101 reported plants. This was followed by root and fruit (31 species each), flower and seed (17 species each), whole plant (16 species), bark (14 species) stem (6 species), rhizome (4 species), oil and latex (3 species each), hardwood and bulb (2 species each) and bean, nut, corn, kernels and gum / resins (1 species each) (**Figure 2**). The preference of leaves to other plant parts could be due to the easiness of preparation [12] and the presence of more ingredients in leaves developed in response to phytophagous organisms since they are the most vulnerable parts of a plant [3]. It is seen from **Figure 3** that herbs (33.66%) were more frequently used for traditional medicine preparations as compared to trees [30.69%], shrub [18.81%], climbers (13.86%) and creepers (2.97%).

Plant remedies were often utilized in the form of extracts (38.54%), paste (28.12%), decoction (14.58%), powder form (13.54%) and oil [5.20%] (**Figure 4**). Other preparation methods included paste, chewing the raw material and inhaling smoke or vapour generated by burning some of the medicinal plant species. Most of the preparations were prescribed orally in warm water or soft porridge. Herbal preparation methods and dosage depend on the type of disease. Some plants were boiled while others were applied directly in fresh form. Some herbal medicines were applied topically, either as bath, massage or lotion. The herbal prescriptions were usually given to patients until patients reported positive results.

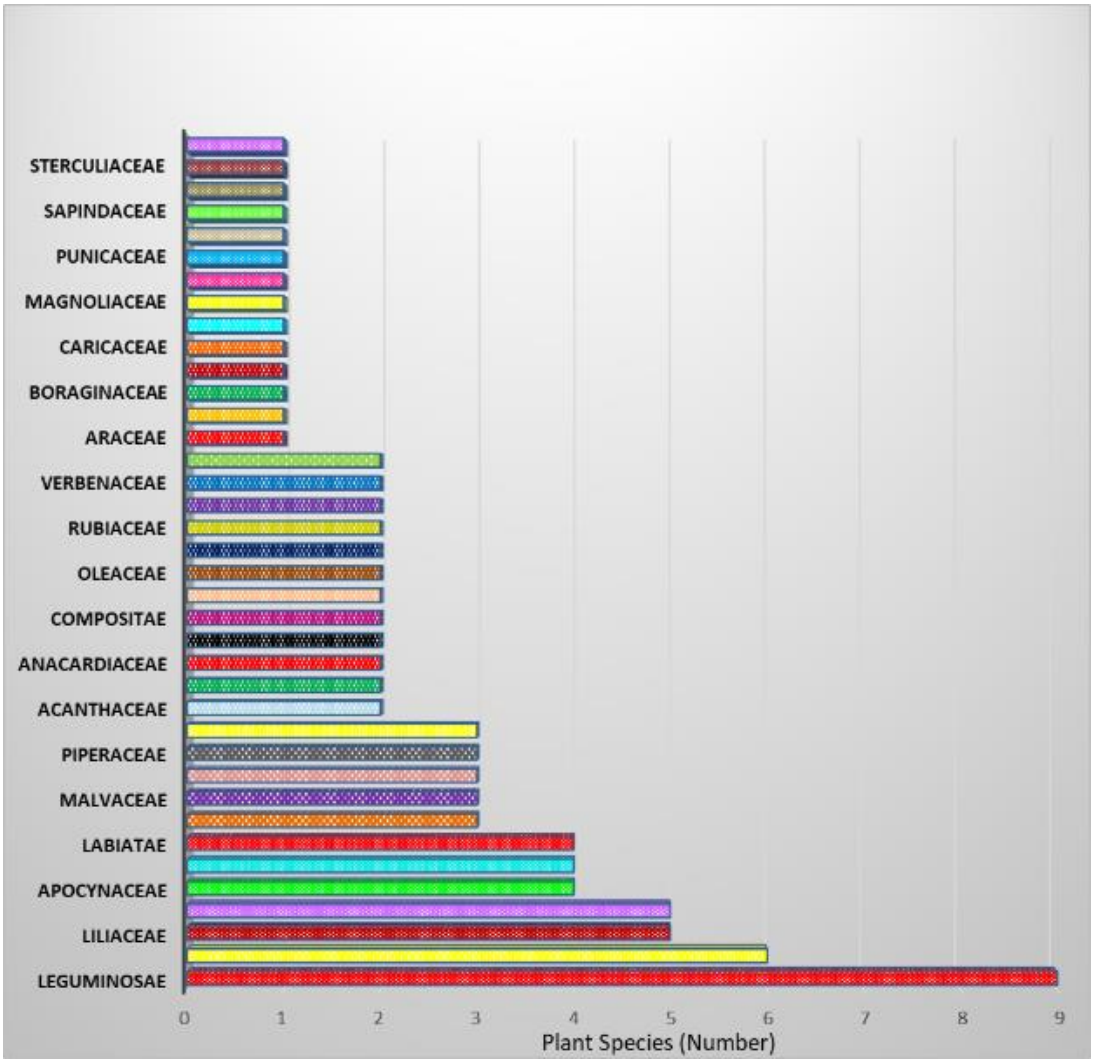

Figure 1 Family wise distribution of ethnomedicinal plants recorded from Attoor.

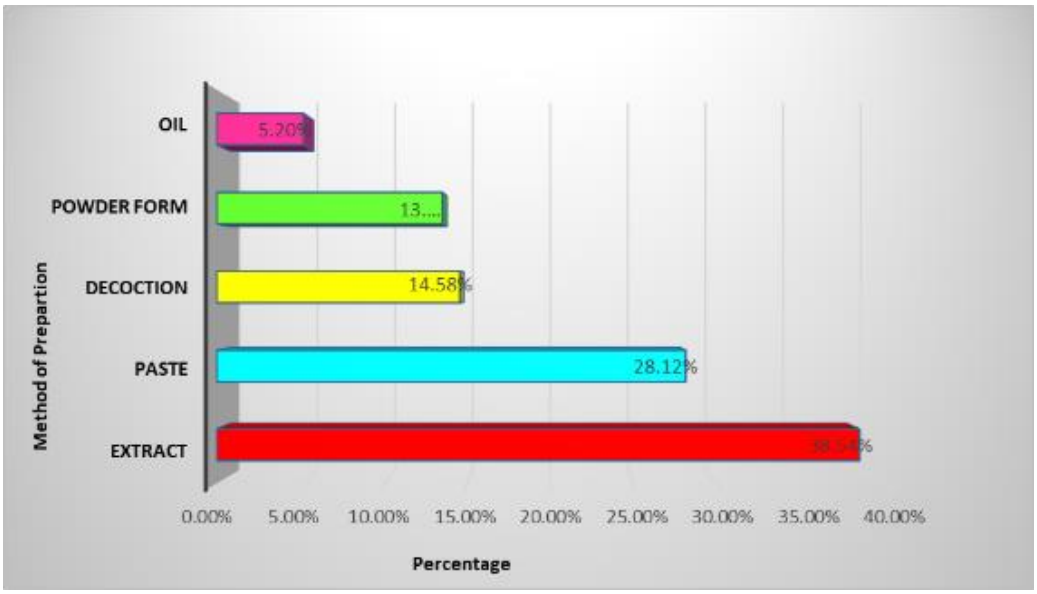

Figure 2 Method of preparation of the documented medicinal plants

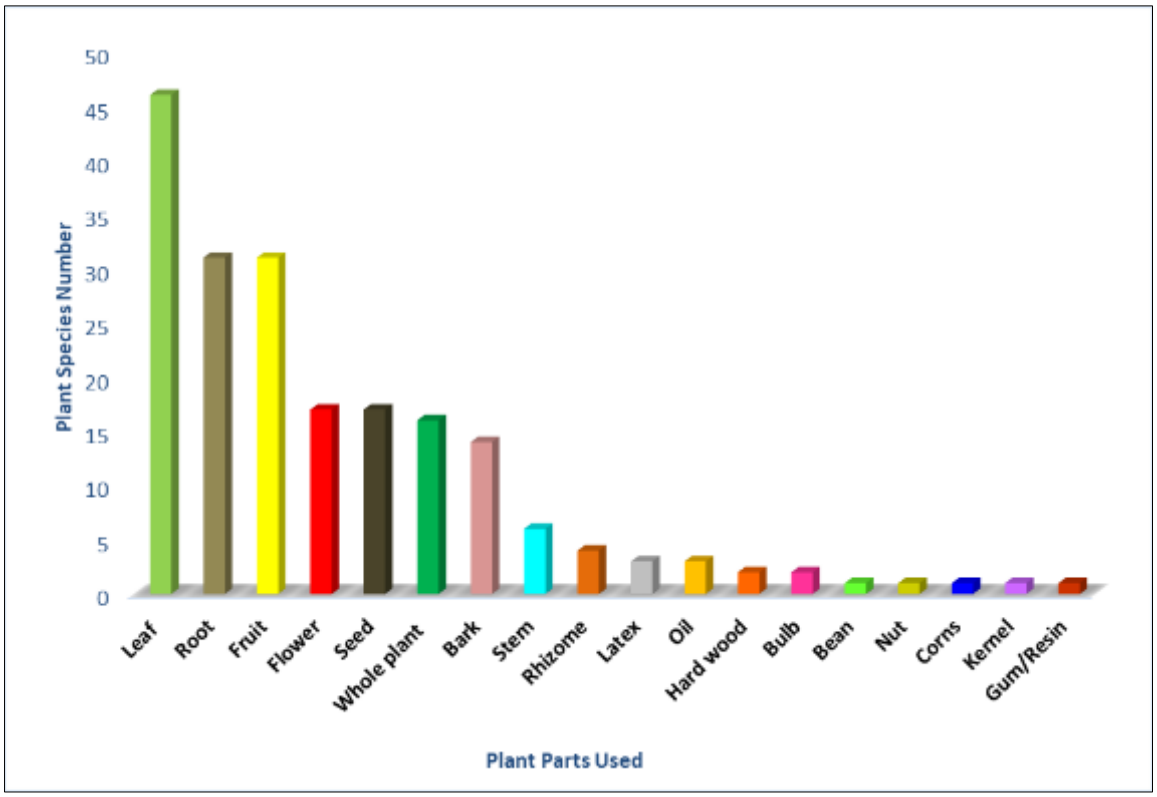

Figure 3 Use of different plant parts for the treatment of various diseases recorded from Attoor.

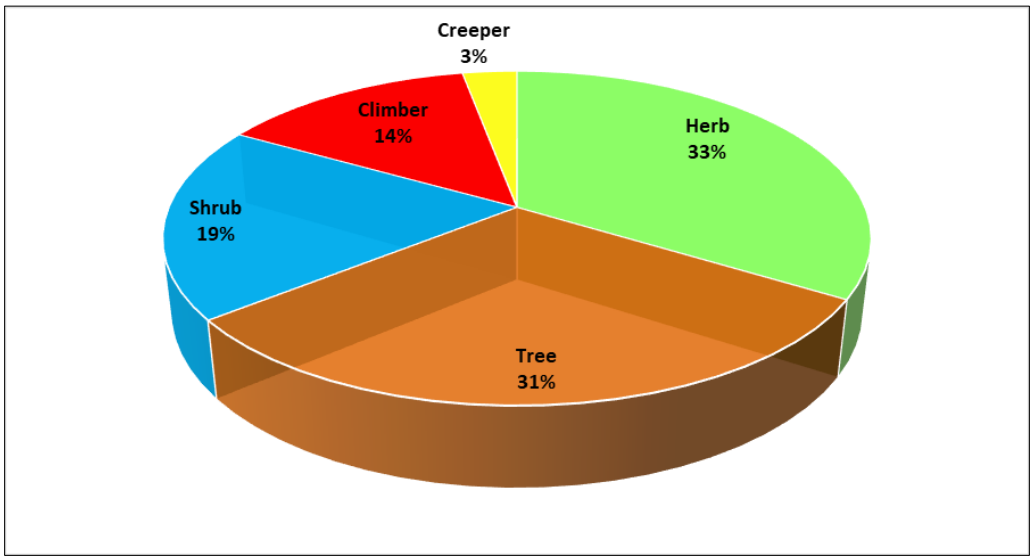

Figure 4 Growth forms (Habit) of the documented medicinal plant species

According to the traditional practitioner's herbal medicines are prescribed to patients differently for different age groups. The dose prescription for children is mostly smaller than for adults. The amounts of remedy and prescription rates are generally dependent on the degree and duration of the ailment. Further, they reiterated that their remedies were devoid of any adverse effects. Some of the recorded plant species such as *Allium cepa, A. sativum, Amorphophallus campanulatus*, *Artocarpus communis, Brassica juncea, Capsicum annuum, Centella asiatica, Cissus quadrangularis, Cucumis sativus, Cucurbita pepo, Manicot esculenta,Momordica charantia, Moringa oleifera,Murraya koenigii*, *Musa paradisiaca*, *Sesbania grandiflora*, *Solanum melongena, Solanum nigrum,* etc. are regularly taken as vegetables. While *Achras sapota, Anacardium occidentale, Annona squamosa, Artocarpus heterophyllus, Azadirachta indica, Borassus flabellifer, Carica papaya, Citrus limon, Cocos nucifera, Cucumis sativus, Mangifera indica, Musa paradisiaca, Phyllanthus*

emblica, Psidium guajava and *Punica granatum* are some important fruits in the food habit of the people. This plays a major role in meeting the nutritional requirements as well as alleviating several ailments.

Monotherapy preparations made from a single plant species were the most dominant. Other herbal concoctions were prepared from a combination of two and three species respectively. The use of multiple therapies in traditional medicine based on combining plants has recently been shown to increase the efficacy of the herbal medicine [34]. According to [5] the use of more than one plant species to prepare a remedy for ailments is attributed to the additive or synergistic effects that they could have during ailment treatment. In preparation of poly-herbal medicines, each medicinal plant is dried, powdered and stored separately and the amount taken from each for any given disease varies.

Medicinal plants have strong acceptance in Attoor inhabitant community. Due to the unavailability of modern health facilities, poverty, connectivity with urban centre, awareness, etc. people in rural areas are still relying on traditional medicines for their health care. Many communities use wild plant parts for the primary healthcare, due to belief in its effectiveness, easily available and lack of modern medicines. Apart from human use, many plant species were also used in animal husbandry as the primary source of healthcare [26, 18]. United Nations University proposal defines traditional knowledge system as "traditional knowledge or "local knowledge" is a record of human achievement in comprehending the complexities of life and survival in often unfriendly environments. Traditional knowledge may be technical, social, organizational, or cultural was obtained as part of the great human experiment of survival and development."

Some of the plants used by the Attoor people for ethno-medicine preparation are also used by some other tribes of Assam as well as from other states of North-Eastern India in their respective traditional medicine preparation. The use of *Andrographis paniculata* to cure stomach related issues can be cured by ailments made by Sonowal Kachari tribe of Assam [21]. The survey study conducted in Attoor region revealed that single medicinal plant treatment is dominant. [20] Conducted a study on ethnobotanical knowledge on single drug remedies from Idukki.

Common ailments such as headache, sore coughs are considered to be diseases with natural causes and hence their symptoms are treating that the household level, witout resource to magical practices [4]. In the present study six remedies (*Coriandrum sativum, Coffea arabica*, *Leucas aspera, Ocimum sanctum, Lantana camara* and *Vitex negundo*) were used to get relief from headache. Recently [16] reported that *Ceropegia candelabrum, Pergularia daemia* and *Vitex negundo* were used by tribals for the treatment of headache.

Traditional healers of Attoor used twenty five plant species to treat stomach problems [twenty-one plants to treat stomachache and four plants to cure digestive problems]. In North-Western Patagonia the people of Curruhuinca community were affected with digestive problems and the highest fidelity level was found for species utilized for treating digestive ailments [10] and [13] reported that there were 48 plants for the treatment of gastrointestinal disorders in North of Iran.

The tribal people of Western Madhya Pradesh of India used 13 plants for the treatment of jaundice [27]. In the present study Adhatoda *vasica, Phyllanthus emblica, P. niruri* and *Santalum album* was used for the treatment of jaundice. *Achras sapota, Areca catechu, Azadirachta indica,Jasminum grandiflorum* and *Syzygium aromaticum* were used to treat dental problems. Various studies have reported on the indigenous use of medicinal plants in the treatment of oral diseases [33, 14].

Anacardium occidentale, *Andrographis paniculata, Gymnema sylvestre, Momordica charantia,Musa paradisiaca, Phyllanthus emblica, Psidium guajava, Thespesia populnea* and *Vinca rosea* were used to treat diabetes by the local traditional healers. [7] reported that the tribal people of Darjeeling Himalayan and Sikkim region in India utilized 37 species of plants belonging to 28 different families as anti-diabetic agents. The linkage between the uses of similar plants by different groups of people across different geographical boundaries remains to be investigated. Hence, the epistemology of the traditional medicines used by these people needs to be reviewed by the epistemology of scientific knowledge.

4. Conclusion

The Attoor people have a close relationship with nature. The survey indicated that, the study area has plenty of medicinal plants to treat a wide spectrum of human ailments. Studies on traditional medicinal plants also revealed that the knowledge of medicinal plants is much limited to traditional healers, herbalists and elderly persons who are living in rural areas. Though this knowledge is passing orally from one generation to another but it has not been documented yet. So documentation of this knowledge is necessary for safeguarding this valuable information for the well-being of future generation.

Local people in this region, especially older age people heavily use these traditionally available medicinal plants for health and believe that these are easily available, less expensive and have no side effects as compared to modern medicine. This study also points out that certain species of medicinal plants are being exploited by the local residents who are unaware of the importance of medicinal plants in the ecosystem.

It can be concluded from the study that Attoor inherit a rich traditional knowledge and documentation of this knowledge as provided novel information from the area. They still depend on the plants for medicinal purposes and are very much concerned about their degradation in wild as they now have to travel even more far to collect these plants. The incoming of roads and coming up of the area as an important tourist destination has allured the younger generation towards market economy. This certainly will have larger implications. Thus the present documentation of traditional knowledge from an area where novel information has been generated will not only provide recognition to this knowledge but will also help in its conservation *vis-a-vis* providing pharmacological leads for the betterment of human society.

Compliance with ethical standards

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Disclosure of Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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