Essential improvement of non-timber forest products in Myanmar

IOP Conf. Series: Earth and Environmental Science **591** (2020) 012031 doi:10.1088/1755-1315/591/1/012031

Essential improvement of non-timber forest products in Myanmar

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Abstract. Non-timber forest products were studied by interviewing the informants during the survey trip to the Tanintharyi Nature Reserve located in Dawei Township and Yephyu Township, Tanintharyi Region, Myanmar. The land area of the reserve forest is 1700 km^2. Bioprospecting of non-timber forest products focusing on rural area development and systematic utilization of natural resources for sustainable development are popular nowadays. The extraction of economically important natural resources, leaving the forest structurally and functionally intact, has derived as an advanced strategy. The present study is the information of non-timber forest resources of Tanintharyi Nature Reserve located in the southern part of Myanmar, conducted from December 2017 to August 2018 by interviewing the informants of botanical folk knowledge. Totally 55 families, 113 genera, and 143 species were recorded as herbal medicines used locally by Dawei and Myeik (ancient Bamar) ethnic groups. This result will be helpful for the systematic search of biochemical and genetic information to develop commercially valuable products for pharmaceutical and cosmetics.

1. Introduction

The term bioprospecting was described by United Nations Development Program in 2016 as follows: "Biodiversity prospecting or bioprospecting is the systematic search for biochemical and genetic information in nature to develop commercially valuable products for pharmaceutical, agricultural, cosmetics, and other applications." It must fulfill the use of the genetic resources of Nagoya protocol (2011) or as stated in the National law or policy. The human role of biodiversity, together with associated traditional knowledge, creates a space for the better use of the expertise in the development of new professionalism [1]. These mutually beneficial bioprospecting collaborations have enabled to secure legal rights to collect genetic resources in a manner that exceeds norms of ethical business practices [2, 3]. However, local needs tend to discover a new product for sustainable development. Although bioprospecting can happen wherever there is biodiversity, it tends to be focused on where biodiversity is at its richest, as it raises the chances of finding something useful. Hence, the Tanintharyi Nature Reserve that possesses tropical rain forests is focused on bioprospecting.

The area experiences tropical monsoon weather with a distinct wet season, from May to October, followed by an extended dry season. According to the recorded data of the temperature during the last three decades from Dawei Meteorology station, the average temperature varies from 22° C to 32° C. The mean relative humidity is 79%. Annual rainfall and intra-annual distribution of rainfall in coastal

area is generally as high as 5,300 mm. About 90% of the total annual rainfall is received during the rainy season (from May to October), which lasts about five and a half months.

In Myanmar, the Tanintharyi region is wealthy in natural resources, and local people rely on non-timber forest products for their regular needs. Therefore, sustainable development of local people and institute of natural forest are required to emphasize. Furthermore, as one of the global biodiversity hot spots, Tanintharyi Region has no accurate record of ethnobotany survey for non-timber forest products as bioprospecting. To reach the goal of bioprospecting in this area, medicinal folklore over the years has proved to be the precious guide. That may consequently lead to the present-day screening of drugs. In recent years, the use of ethnobotanical information in medicinal plant research has gained considerable attention in segments of the scientific community [4]. To inform the knowledge of sustainable development and utilization of natural resources to local people, then we urgently need to address on bioprospecting of non-timber forest products for enhancement of the livelihoods.

The local knowledge that is unique to a culture or society is called traditional or indigenous knowledge. It is passed down generation by generation, usually by word of mouth and cultural rituals. Moreover, it has been the basis for agriculture, food preparation, health care, education, conservation, and the wide range of other activities that sustain societies in many parts of the world [5]. This research contributes to the understanding of the socio-economic importance of the plants in the study area. It works to identify the factors involved in the deprivation that leads to value-added products in the Tanintharyi Nature Reserve. In this research, 143 species comprised of113genera and 55 different families were recorded to be possible value-added products. Most of them are used as antimicrobial agents, carminative, laxative, tonic and appetizer. Some are used as antipyretic, to treat rheumatism, asthma, birth control, antidotes, diuretic, and liver or kidney problems. The rationale is to extract the highest commercial value from genetic resources and indigenous awareness while creating a fair compensation system that can advantage all.

2. Materials and methods

2.1. Study Area

Tanintharyi Region is located in south-eastern Myanmar, the southern boundary of Mon State, west and north of Thailand, and east of the Andaman Sea. Tanintharyi Nature Reserve is situated in the Yebyu and Dawei Townships of the Tanintharyi region. Itis a protected area and was established in 2005 with a total area of 1700km^2 (Figure 1).

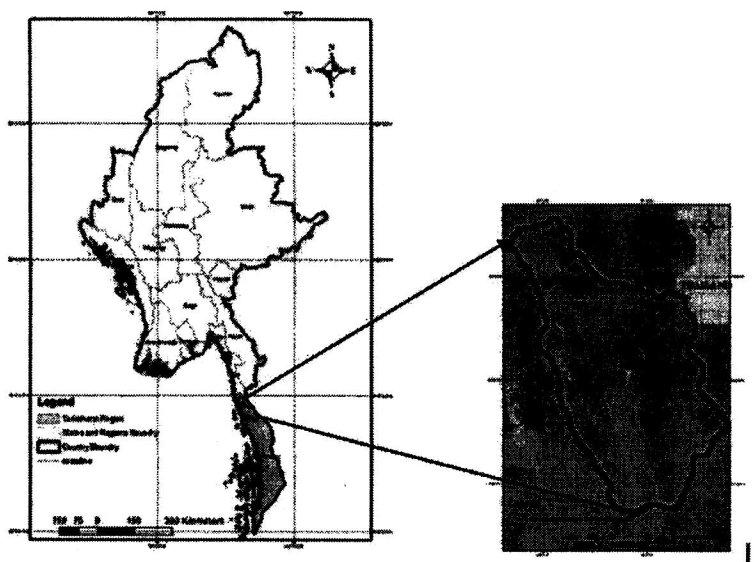

Figure 1. Location of Tanintharyi nature reserve in Myanmar.

2.2. Geographic and forest type overview

Topography varies along this east-west slope from flat or hilly coastal zones to mountainous areas of up to 2000 m in elevation. Lateritic soils and laterites occur at an altitude below 100m above sea-level. The humus content is 1.5 to 3%, and the pH value is between 4 and 5 in those below 100m of altitude. Yellow-brown forest soils are prevalent under wet tropical monsoon forests at altitudes between 100 and 450 m above sea-level. The humus content of this area is, on average, between 2 and 4%. The pH value is between 4.5 and 6.5, and the water holding capacity is 30-35%. At higher altitudes, yellow-brown mountain forest soils are covered. Although broadleaf evergreen forests occupy in much of the region, certain areas contain mixtures with evergreen and deciduous tree species. Leaf drop occurs during the dry season for deciduous tree species but can be highly variable among years, species, and locations.

2.3. The ethnic composition of Tanintharyi region

The majority of inhabitants in the Tanintharyi Region are supposed to be members of the Bamar ethnic group. However, some identify themselves as members of sub-groups, such as the Dawei and Myeik people. While almost all in the Tanintharyi region speak Myanmar language, there are various local dialects, in which some vary quite dramatically from that elsewhere. Different ethnic minorities are also present, including the Karen, Mon, Salon, and Bashu (Malay).

2.4. Data collection

The method of selecting informants depends upon the distribution of botanical folk knowledge in the population. This knowledge is considered the property of older individuals and semi-professional herbal specialists of a community, called Tine-yin-say sayar. For the medicinal uses, there is no direct correspondence between local and current medical disease categories. To avoid this problem, we consulted about the local terms and symptoms of diseases with physicians of the same ethnicity who have been working for several years. The entry of each species includes the Latin binomial, author, plant habit, part used, and general brief uses. Species, genera, and families are arranged alphabetically.

3. Results and discussion

The result of the present investigation indicates the findings of the interaction established with the Dawei and Myeik ethnic groups of Tanintharyi Region in 2017-2018. The 143 ethnobotanical important plant species collected during the present survey belong to 113genera and 55 families.

3.1. Plants and their medicinal application

The present work mainly focused on ethnomedicinal uses of non-timber forest products from the Tanintharyi Region by Dawei and Myeik societies. 55 families, 113 genera and 143 species were recorded as traditionally used medicines. It does not indicate that a species mentioned by only one or two informants lacks value, but it may purely imitate the disappearance of this precise knowledge [6]. Among those species, some are locally restricted; their usable knowledge may be helpful for new findings in the scientific area. Recorded plant species with their scientific name, habit, status, part use, and uses are listed in Table 1. The family name and scientific name are arranged in alphabetical order.

Fabaceae is the most predominant for medicinal uses (12.58%), and it is consistent with the claim as the best-represented floristic family of the region. The members of Fabaceae produce a high diversity of secondary metabolites, which serve as defense compounds against herbivores and microbes [7]. Hence, the knowledge of Tanintharyi local people is rational.

Other predominant families are Rubiaceae (5.59%), Rutaceae and Apocynaceae (4.89%), Annacadiaceae and Moraceae (4.19%), and Annonaceae, Malvaceae, and Myrtaceae (3.49%) respectively. Iridoids, anthraquinones, triterpenes, indole alkaloids, as well as other varying alkaloid subclasses, have shown to be the most common in Rubiaceae family [8]. The leaves of Rutaceae species have monoterpenes and flavonoid aglycones [9]. The members of Apocynaceae, well represented in Southeast Asia, showed a great diversity of alkaloidal structures [10]. The leaves and barks of fifteen species of Anacardiaceae showed the presence of toxic phenols such as catechols, resorcinols, and biflavonoids [11]. The chemotaxonomy of the Moraceae discussed about flavonoids,

flavonoids with isoprenoid substituents, and stilbenes [12]. Therefore, the most widely used bio-resources were considered possible to conduct value-added products.

Table 1. List of plant resources.

S.N.		Scientific name	Common name	Status	Habit	Part used	Uses
A							
1.		***Acanthaceae***					
	1.1	*Avicennia alba Blume*	La-me	Wd	Shrub	leaves	Birth control
	1.2	*Avicennia officinalis L.*	Thamee-laung	Wd	Tree	leaves	Cures ulcer
	1.3	*Rhinacanthus communis* Nees	Htaw-labat	Wd	Herbs	leaves	Antimicrobial, tonic
2.		**Aloaceae**					
	2.1	*Aloe vera* (L.) Burm.f.	Shazaung-let-pat	wd, cl	Herbs	leaves	Asthma, carminative, blood purification
3.		**Amaranthaceae**					
	3.1	*Alternanthera nodiflora* R. Br.	Kanabaw	Wd	Herbs	The whole plant	Laxative, skin diseases, anti-inflammatory
4.		**Amaryllidaceae**					
	4.1	*Crinum asiaticum* L.	Koyan-gyi,	wd, cl	Herbs	Leaves, bulb	Release swollen, antitoxin
5.		**Anacardiaceae**					
	5.1	*Anacardium occidentale* L.	Thiho-thayet	cl	Tree	Bark, root, fruit	Tonic, antimicrobial for toothache
	5.2	*Bouea burmanica*Griff.	Mayan	Wd	Tree	Fruits	Hemorrhage diarrhea, appetizer
	5.3	*Buchanania lanzan* Spreng.	Lunpho	wd	Tree	Roots, fruits, seeds	Blood purification, carminative, laxative, tonic
	5.4	*Mangiferaindica* L.	Tha yet	wd, cl	Tree	Fruits, bark, roots	Astringent, appetizer, tonic,
	5.5	*Spondias dulcis* Forst. f.	Gwe-cho	wd, cl	Tree	Fruit	Appetizer
	5.6	*Spondia spinnata* (L.) Kz.	Gwe	wd, cl	Tree	Fruit, leaves, bark	Appetizer, antimicrobial
6		**Annonaceae**					
	6.1	*Annona muricata* L.	Duyin-awza	wd, cl	small tree	Fruit	Tonic
	6.2	*Annona reticulate* L.	Thinbaw-awza	wd, cl	small tree	Fruit	Tonic
	6.3	*Annona squamosa* L.	Awza	Cl	small tree	Fruit	Tonic
	6.4	*Cananga odorata* (Lam.) Hook. f. & Thomson	Saga-sein	wd/cl	Tree	Flower oil	Headache, joint ache
	6.5	*Miliusa velutina*(Dunal) Hook. f. & Thomson	Tha-butgyi	Wd	Tree	bark	Antitoxin (Scorpion)
7.		**Apocynaceae**					
	7.1	*Allamanda cathartica* L.	Shwe-pan-new	wd/cl	Shrub	Bark, leaves, roots	Liver diseases, laxative, antitoxin (snake)
	7.2	*Catharanthus alba*(L.) G. Don.	Thinbaw-ma-hnyo-pan	wd/cl	Herbs	The whole plant	Control diabetes, antitoxin, hemorrhage dysentery
	7.3	*Nerium indicum* Mill.	New-tha-gee	wd/cl	Shrub	roots	Pain release, tonic, scabies
	7.4	*Plumeria alba* L.	Tayoksaga	Wd/cl	Tree	flowers	Diuretic, skin diseases, carminative

B							
	7.5	*Rauvolfia cambodiana* Pierre ex. Pit.	Say yoe shit pyit	Wd	Shrub	roots	Apply to cure joint ache externally
	7.6	*Rauvolfia serpentina* (L.) Benth.	Bonma-yaza	wd/cl	Shrub	Roots	Antimicrobial, release hypertension
	7.7	*Thevetia peruviana* (Pers.) Schum.	Set hna yarthi	wd/cl	Shrub	Leaves, roots	Catch cold, easy labor bone
8.		***Araceae***					
	8.1	*Aglaonema pumilum Hook.f.*	Aseik naing gamon	Wd	Herbs	The whole plant	Antidotes for scorpion sting and snake bites
9.		**Arecaceae**					
	9.1	*Areca catechu* L.	Kunthi-pin	wd/cl	Tree	fruits	Appetizer, carminative
	9.2	*Borassus flabellifer* L.	Htan	wd/cl	Tree	Fruits	Diuretic, gonorrhea,
	9.3	*Caryota mitis* Lour.	Min-baw	Wd	Tree	Fruit	Expectorant, laxative, headache
	9.4	*Nypa fruticans* Wurmb.	Dani	Wd	Tree	fruits	Worn healing, diarrheal
10.		***Asparagaceae***					
	10.1	*Cordyline fruticosa Goepp.*	Zawgyi taung hmwe	Wd	Shrub	leaves	A decoction of leaves is used orally for cough
11.		**Asteraceae**					
	11.1	*Blumea balsamifera* (L.) DC.	Phon-ma-thein	Wd	Shrub	leaves	Paralysis, skin diseases
	11.2	*Eclipta alba* (L.) Hassk.	Kyeik-hman	Wd	Herbs	leaves	Antimicrobial, expectorant, anti-inflammatory, skin diseases, gonorrhea
	11.3	*Chromolaena odorata* L.	Bizat	Wd	Herbs	Leaves, roots	Diuretic, laxative
12.		**Balsaminaceae**					
	12.1	*Impatiens balsamina* L.	Dan-pan	wd/cl	Shrubs	Leaves, flowers	Antimicrobial, worn healing
13.		**Bignoniaceae**					
	13.1	*Millingtonia hortensis* L. f.	Egayit	wd/cl	Tree	Leaves, roots	Hypertension; Plague; Stimulating effect on cardiovascular system; Purify blood;
	13.2	*Oroxylum indicum* (L.) Kurz	Kyaung-sha	wd/cl	Tree	Stem bark, fruits, roots	gastric ulcers, tumors, respiratory diseases, diabetes, and diarrhea and dysentery
14.		**Bixaceae**					
	14.1	*Bixa orellana* L.	Thi din	Wd	Shrub	roots	Slurry the roots with rice wash water and orally used for asthma
15.		**Bombacaceae**					
	15.1	*Durio zibethinus* Murray	Duyin	wd/cl	Tree	fruits	Tonic, Cure insomnia, release stress
16.		**Calophyllaceae**					
	16.1	*Mesua ferrea* L.	Gan-gaw	wd/ Cl	Tree	anther	Itching, appetizer, antimicrobial
17.		**Canaceae**					
	17.1	*Canna indica* L.	Budatharana	Wd	Herbs	root	Gonorrhea, demulcent
18.		**Capparaceae**					
	18.1	*Crateva religiosa* Forst. F.	Ka dat	Wd	Tree	Leaves	Fever
19.		**Caricaceae**					
	19.1	*Carica papaya* L.	Thinbaw	wd/cl	Tree	Leaves, fruits	Laxative, anticancer

C						
20.	**Casuarinaceae**					
20.1	*Casuarina equisetifolia* Forst.	Pinle-kabwe	wd/cl	Tree	Twigs, roots, barks	Anthelmintic, antibacterial, anticancer, astringent
21.	**Clusiaceae**					
21.1	*Garcinia mangostana* L.	Min-gut	wd/Cl	Tree	Bark, fruit peel	Astringent, worn healing, diarrhea, antimicrobial
22.	**Colchicaceae**					
22.1	*Gloriosa superba* L.	Simidauk	Wd	Climber	bulb	Expectorant, diuretic, antimicrobial, abortive effect
23.	**Combretaceae**					
23.1	*Getonia floribunda* Roxb.	Kywet-nwe	Wd	Climber	Stem, leaves	Antimicrobial, astringent, Intestinal worms, fever, ulcer
23.2	*Anogeissus acuminate* Wall.	Yone	Wd	Tree	Leaves, fruits	Skin diseases, anti-inflammatory, appetizer, tonic, analgesic
23.3	*Terminalia bellerica* Roxb.	Thit-Seint	Wd	Tree	Bark, seeds	Anti-inflammatory, astringent, respiratory tract disease, carminative
23.4	*Terminalia catappa* L.	Banda	wd/cl	Tree	Fruit, bark, gum	Laxative, emollient on sore
24.	**Convolvulaceae**					
24.1	*Ipomoea cairica* (L.) Sw.	Not known	Wd	Climber	leaves	Antimicrobial activity
24.2	*Ipomoea quamoclit* L.	Myet-lay-ne	wd/cl	Climber	leaves	Pile, release fever
25.	**Dilleniaceae**					
25.1	*Dillenia indica* L.	Thabyu	Wd	Tree	fruits	Asthma, astringent, appetizer
26.	**Dipterocarpiaceae**					
26.1	*Dipterocarpus alatus* Roxb.	Ka-nhyn-phyu	Wd	Tree	Gums, bark	Diuretic, tonic, liver diseases, tumor
26.2	*Dipterocarpus tuberculatus* Roxb.	In	Wd	Tree	Gums, leaves	Itching, ringworm, eczema, diuretic,
26.3	*Hopea odorata* Roxb.	Thin-gyan	Wd	Tree	gum	Worn healing, toothache
27.	**Dracaenaceae**					
27.1	*Dracaena fragrans* (L.) Ker. Gawl.	Zaw-gyi-taung-hmwe	Wd	Shrub	leaves	Blood vomiting
28.	**Euphorbiaceae**					
28.1	*Acalypha indica* L.	Kyaung-se-pin	Wd	Herbs	leaves	Emetic, pneumonia, asthma, antimicrobial
28.2	*Croton roxburghianus N.P.Balakr.*	Thetyin-gyi	Wd	Shrub	bark,	Anti-inflammatory, liver diseases, antitoxin, release fever,
28. 3	*Sapium baccatum* Roxb.	Lin-lun	wd	Tree	Fruits, barks, leaves	Appetizer, tonic, kidney diseases, liver diseases
29.	**Fabaceae**					
29.1	*Bauhinia acuminata* L.	Swe-daw	wd/cl	Small tree	Bark, flower, root, leaves	Asthma, antimicrobial activity
29.2	*Bauhinia monandra* Kurz	Swe daw	wd/cl	Shrub	Leaves, bark	Febrifuge, laxative.
29.3	*Bauhinia purpurea* L.	Swe daw ni	wd/cl	Shrub	Leaves, bark	Analgesic, antimicrobial

D						
29.4	*Caesalpinia pulcherrima* (L.) Sw.	Seinban-gale	wd/cl	Shrub	Root leaves, flower, seeds, bark	Abortifacient, antimicrobial, release fever, carminative
29.5	*Caesalpinia sappan* L.	Teinnyet	Wd	Tree	Leaves, barks, wood	Blood purifier, analgesic
29.6	*Cassia fistula* L.	Ngu shwe	wd/cl	Tree	Fruits, bark	Constipation, common cold, an intestinal disorder
29.7	*Cassia siamea* Lam.	Mezali			Flower, leaves	Analgesic, antihypertensive
29.8	*Dalbergia kurzii* Prain	Thit pok	Wd	Small tree	The whole plant	Decoction use orally for antipyretic
29.9	*Delonix regia* (Bojer ex Hook.) Raf.	Seinban	wd/cl	Tree	The whole plant	Carminative, expectorant,
29.10	*Erythrina arborescens* Roxb.	Kathit	wd	Tree	Leaves, roots, bark, flower	Expectorant, carminative, diarrhea, release hypertension
29.11	*Peltophorump terocarpum* (DC.) Back. ex K. Heyne	Thinbaw-mezali	wd/cl	Tree	bark	Anticancer
29.12	*Pterocarpus macrocarpus*Kurz	Padauk	wd/cl	Tree	gum	Antimicrobial, skin diseases
29.13	*Senna alata* (L.) Roxb.	Pwe gine mezali	Wd/cl	Shrub	Leaves,	Purgative, antifungal
29.14	*Senna timoriensis* DC.	Taung mezali	Wd/cl	Tree	seed pod, bark	Anthelmintic, scabies
29.15	*Senna tora* L.	Not known	Wd/cl	Herbs	Leaves, roots	laxative
29.16	*Sesbaniagrandiflora* (L.) Poir.	Pauk pan-byu	wd/cl	Tree	Flowers, leaves, fruits	Carminative, expectorant, blood purification, antimicrobial
29.17	*Tadehagi triquetrum* (L.) H. Ohashi	Lauk-thay	Wd	Shrub	leaves	Kidney diseases, diarrhea, dysentery, skin diseases
29.18	*Tamarindus indica* L.	Magyi			Leaves, bark, fruits, seed	Antiallergic, antimicrobial, antibiotic,Antiemetic, antispasmodic, hypoglycemic
30.	**Lamiaceae**					
30.1	*Hyptis suaveolens* (L.) Poit.	Not known	Wd	Herbs	The whole plant	Anti-diabetes
31.	**Lauraceae**					
31.1	*Cinnamomum multiflorum* Wight.	Ka-ra-way	Wd	Small tree	Leaves, barks	Anti-inflammatory, digestive system disorder
31.2	*Cinnamomum inunctum* Meissner	Ohn-Don	Wd	Tree		Anti-inflammatory, digestive system disorder
31.3	*Litsea glutinosa* (Lour.) C.B.Rob.	Amyauk-san-bin	wd	Tree	Root bark	Ant diabetes, anti-inflammatory tonic
32.	**Lecythidaceae**					
32.1	*Couroupita guianensis* Aubl.	Ban Bwe	wd	Tree	flowers	Antitoxin
32.2	*Careya arborea* Roxb.	Pan-ei	Wd	Tree	leaves	A decoction of leaves is used to cure diarrhea
33.	**Lythraceae**					
33.1	*Lagerstroemia indica* L.	Pyinma-yetthey	Cl	Shrub	Barks, leaves, flower	Release fever

E							
	33.2	*Lagerstroemia speciosa* (L.) Pers.	Saga-war	wd	Tree	Barks, leaves, seeds	Laxative, astringent, release fever
34.		**Magnoliaceae**					
	34.1	*Michelia champaca* L.	Saga-phyu	wd/cl	Tree	Leaves, flowers, roots, barks, fruits	Diuretic, heal ulcer, cough, gastric
	34.2	*Michelia doltsopa* Buch Ham.	Thone-ban-hla	wd/cl	Tree	Leaves, flowers	Diuretic, heal ulcer, cough, gastric
35.		**Malvaceae**					
	35.1	*Hibiscus mutabilis* L.	Khaung-yan	Wd	Shrub	Flowers, leaves, roots	Lung diseases, anti-inflammatory
	35.2	*Hibiscus rasa-sensis* L.	Chinbaung-ni	wd/cl	shrub	leaves	Astringent, menstrual diseases,
	35.3	*Hibiscus sabdariffa* L.	Kara met	Cl	shrub	leaves	Diuretic, appetizer
	35.4	*Mansonia gagei* J. R. Drumm.	Let-Khote	Wd	Tree	wood	Menstrual disorder
	35.5	*Sterculia foetida* L.	Thitto	Wd	Tree	Barks, seeds	Diuretic, laxative, carminative, release fever
36.		**Meliaceae**					
	36.1	*Sandoricum koetjape* (Burm. f.) Merr.	Not known	Wd	Tree	Bark, fruits	Worn heeling
	36.2	*Swietenia macrophylla* King.	Mahogany	wd	Tree	Fruits,	Pesticide
37.		**Mimosaceae**					
	37.1	*Albizia lebbek* L. Benth.	Anya-koko	Wd	Tree	Barks, leaves	Asthma, antimicrobial, anti-inflammatory, cough
	37.2	*Leucaena glauca* (L.) Benth.	Away-yar	Wd	Tree	bark	Pain release
	37.3	*Mimosa pudica* L.	Tikayon	wd	Herbs	The whole plant	Antitumor, hemorrhage dysentery, release kidney stone
38.		**Moraceae**					
	38.1	*Antiaris toxicaria* Leschen.	Hmya seik	Wd	Tree	latex	Cure for toothache
	38.3	*Artocarpus gomeziana* Wall.	Myauk u	Wd	Tree	Stem wood	Externally use to cure scabies and irritation of the skin.
	38.4	*Artocarpus heterophyllus* Lam.	Peinne	wd/cl	Tree	fruit	Tonic
	38.5	*Artocarpus rigida* Blume	Sone-padat	wd/cl	Tree	Fruit, latex	Tonic, latex cures dysentery
	38.6	*Fucusauri culata* Lour.	Sin tha phan	Wd	Tree	Fruits	Ripe fruits are orally used for the tonic of heart
39.		**Moringaceae**					
	39.1	*Moringa oleifera* Lam.	Dan-da-lun	wd/cl	Tree	Root bark, leaves, flowers, seeds	Antimicrobial, carminative, expectorant, skin diseases
40.		**Myrtaceae**					
	40.1	*Eucalyptus camaldulensis* Dehnh.	Eucalyp	Cl	Tree	leaves	inhaler for headache
	40.2	*Eugenia contracta* Wall.	Tha-pyay	Wd	Shrub	Leaves, bark,	Hemorrhage dysentery, antimicrobial
	40.3	*Psidium acidum* Mart.	Malaka-chin	wd	Small tree	Leaves, fruits	inhaler for headache, anti-inflammatory

F							
	40.4	*Psidium guajava* L.	Malaka	wd/cl	Small tree	Leaves, fruits	Appetizer, inhaler for headache
	40.5	*Syzygium grande* (Wight) Walp.	Thabye-gyi	wd/cl	Tree	Leaves, bark,	Hemorrhage dysentery, antimicrobial
41.		**Ochnaceae**					
	41.1	*Ochna wallichii*Planch.	Not known	Wd	Tree	stem	Antimicrobial agent
42.		**Oleaceae**					
	42.1	*Jasminum laurifolium* Roxb.	Taw-sabe	wd/cl	Climber , creeper	flowers	Diabetes, heart disease, skin diseases, toothache
	42.2	*Nyctanthes arbor-tristis* L.	Seik-hpalu	wd/cl	Small tree	Barks, flowers,	Expectorant, release cough, skin diseases, fever, liver diseases
43.		**Oxalidaceae**					
	43.1	*Averrhoa carambola* L.	Zaung-ya	Wd/cl	Small tree	fruits	tonic
44.		**Poaceae**					
	44.1	*Coixla cryma-jobi* L.	Kyeik pin	Wd	Herbs	rhizome	Externally plaster for a bone fraction
	44.2	*Cynodon dactylon* L. Pers.	Myae zar myet	Wd	Herbs	The whole plant	A decoction is used orally for fever
	44.3	*Eleusine indica* (L.) Gaertn.	Myet hna kwa	Wd	Herbs	The whole plant	A decoction is used orally for urination, kidney diseases, and heart tonic
45.		**Piperaceae**					
	45.1	*Piper betle* L.	Kun	wd/cl	Climber	leaves	Diuretic, carminative, antitoxin, aphrodisiac, cure cough
	45.2	*Piper nigrum* L.	Nga-yok-kaung	wd/cl	Climber	fruits	Expectorant, carminative, asthma, stomachache,
46.		**Rhizophoraceae**					
	46.1	*Carallia brachiata* (Lour.) Merr.	Mani awga	Wd	Tree	The whole plant	A decoction is used as a bath and orally for menstrual disorder
47.		**Rubiaceae**					
	47.1	*Canthium parviflorum* Roxb.	Say than bayar	Wd	Small tree	Roots	Slurry the roots with water and externally apply for rheumatism
	47.2	*Gardenia jasminoides* J. Ellis	Zi-za-war	wd/cl	Shrub	Leaves, flowers	dyspepsia, flatulence, nervousdisorders, and abdominal pains
	47.3	*Ixora coccinea* L.	Pon-na-yake	wd/cl	Shrub	Roots, leaves, flowers, barks	Anti-diarrheal, anticancer, anti-dysenteric,
	47.4	*Ixora congesta*Roxb.	Pan-zayeik	wd/cl	Small tree	Roots, leaves, flowers	an astringent and to treat dysentery and tuberculosis.
	47.5	*Morinda angustifolia* Roxb.	Nipar say	Wd	Shrub	Leaves, stem bark, root bark	Antimicrobial activity, tonic, febrifuge
	47.6	*Morinda citrifolia* L.	Ye-yo	wd/cl	Small tree	Fruits, leaves	anti-inflammatory and anti-oxidative effects,
	47.7	*Nauclea cadamba* Roxb.	Ma u let tan shay	Wd	Tree	barks	Release fever, tonic
	47.8	*Renellia speciosa* Hook f.	Dawei lee taung myit	Wd	Shrub	roots	Tonic for men, cure rheumatism

G						
48.	**Rutaceae**					
48.1	*Aegle marmelos* (L.) Correa.	Oak shit	wd/ cl	Tree	leaves	A decoction of leaves is used for diarrhea in children and cough, leaves extracts to be applied around the eyes for an eye infection, fruit wall slurry with lime for dysentery
48.2	*Citrus grandis* (L.) Osbeck	Kywe kaw	wd/cl	Small Tree	Fruits, leaves	Appetizer
48.3	*Citrus hystrix D.C.*	Shauk nu	Wd	Tree	Leaves, fruits	Alcohol extract of fruits apply externally for paralysis, skin diseases, leaves used in cooking for its aroma
48.4	*Citrus limon* (L.) Burm. F.	Than-ba-yo	wd/cl	Small tree	fruits	Antimicrobial, cure lung diseases, pneumonia
48.5	*Citrus medica* L.	Shauk	wd/ cl	Small tree	Shoots, fruitsseeds,	Appetizer, antiemetic, cure asthma, cough, stomachache,
48.6	*Murraya paniculata* (L.) Jack.	Yu-za-na	wd/cl	Small tree	Leaves, barks, roots	Cure diarrhea, dysentery, antitoxin, liver diseases, ulcer
48.7	*Zanthoxylum rhetsa* (Roxb.) DC.	Thit noe	Wd	Tree	stem	A decoction of the bark is taken internally as a cure for pains in the chest. Bark extract is externally used for stomachache
49.	**Sapindaceae**					
49.1	*Nephelium lappaceum* L.	Kyet-mouk	wd/cl	Tree	fruits	Antimicrobial activity
G						
49.2	*Arytera littoralis* Blume	La-Mu	Wd	Tree	fruits	Astringent, worn healing activity
50.	**Sapotaceae**					
50.1	*Mimusops elengi* L.	Khayay	wd/cl	Tree	The whole plant	Astringent, expectorant, toothache, headache
51.	**Scrophulariaceae**					
51.1	*Scoparia dulcis* L.	Dana-thukha	Wd	Shrub	The whole plant	Release fever, antiemetic, toothache
52.	**Solanaceae**					
52.1	*Solanum torvum* Sw.	Kazaw-kha	Wd	Shrub	fruits	Antimicrobial activity
53.	**Thymelaeaceae**					
53.1	*Aquilaria agallocha* Roxb.	A-kyaw, Thit-hmwe	Cl	Tree	Gum	Release fever, tonic, skin diseases
54.	**Verbanaceae**					
54.1	*Stachytarpheta indica* Vahl	Aseik-taya	Wd	Shrub	leaves	Cures ulcer, diarrhea
55.	**Zingiberaceae**					
55.1	*Alpinia zerumbet* (Pers.) B. L. Burtt. & R. M. Sm.	Pa de gaw thay	Wd	Herbs	Rhizomatic roots	Slurry with water and externally applied on stomach and anti-inflammatory
55.2	*Cacuma comosa* Roxb.	Na nwin kha	Wd	Herbs	rhizome	Dry powder is mixed with honey and used orally as carminative; externally applied on worn.

wd = wild; cl = cultivated.

3.2. Plants of non-medicinal uses

Fruits are another source of nutrition that is affluent in vitamins and minerals, and the forest dwellers depend on the seasonal wild edible fruits to meet their needs. During the survey, 26 varieties of wild edible fruits in different seasons throughout the year, were used. Most of the edible plants used were wild vegetables, for example, *Cratevareligiosa* Forst. F., *Dilleniaindica* L., *Bauhinia acuminata* L.,*Cassia siamea* Lam., *Sesbaniagrandiflora* (L.) Poir., *Tamarindusindica* L., *Hibiscus sabdariffa* L., etc. These common wild vegetables in the area could be found in the local markets.

3.3. Bioprospecting associated with forest resources

The focus of bioprospecting in the Tanintharyi Region will be on discovering antimicrobial and antioxidants. It is because of their ability to help prevent, halt, and to repair damage from diseases that are triggered by overactive internal defense reactions in our bodies. Antimicrobial and antioxidants naturally occurring in many plants found in forests could form the basis of new therapies for many diseases [13]. Plant products are used to treat a wide variety of health problems, including fevers, fungal infections, burns, gastrointestinal problems, pain, respiratory problems, wounds, and are used as antidotes to toxins from organisms such as poisonous snakes.

3.4. Bioprospecting the renewable forest resources

A broad range of renewable resources, such as wood and fiber from trees, starch, and other polysaccharides from the plant's storage organs, are available from the forest. There is constant availability of resources such as grasses, fruits, seeds, barks, shrubs, and other plant parts with medicinal value for human health care. These resources are replenished in the next season by the quick propagation of the plant species by vegetative organs or from the seeds (reproductive organs). They are thus available to utilization in the following year.

In this research, bioprospecting mainly centered on flora from the forest ecosystem of the Tanintharyi region. Flora, especially forest flora found in nature, has been employed for pharmaceutical and phytochemical purposes in different parts of the world for centuries. For example, plants from the family Annonaceae provide many cytotoxic and insecticidal compounds, such as styrylpyrone derivatives, acetogenins, and aporphine derivatives [13]. The pharmaceutical firms and scientists continue to find the useful application of compounds from nature. The economic values of the resources are enormous and beneficial not only the pharmaceutical company but also the host country and indigenous people.

4. Conclusion

In this research, 143 species comprised of 113 genera and 55 families were conducted. Among them, Fabaceae family members are dominant to be used for medicinal purposes; the second dominated families are Rubiaceae, Rutaceae, Annacadiaceae, Apocynaceae, and Moraceae. The majority reported medicinal uses were meant for gastrointestinal disorders, particularly haemorrhoides and colic's, then dermal wounds and infections, especially infected wounds, urinary and kidney problems, and respiratory troubles. These diseases are assumed to be microbial infections. Hence, the collected data should be continued to discover the antimicrobial activity.

Acknowledgments

This study was supported by the Japan Asian Science Technology and Innovation Platform. The department of forestry, Ministry of Natural Resources and Environment Conservation allowed and helped the fieldwork.

5. References

[1] Hanazaki N, Nakamura E M, Lindner B and Boef W S 2013 *Community biodiversity management promoting resilience and the conservation of plant genetics resources* ed W S de Boef et al (UK: Taylor & Francis) Vol. III p 406

[2] Christoffersen L P and Mathur E J 2005 Bioprospecting ethics & benefits: a model for effective benefit-sharing *Ind Biotechnol.* **1**(4): 255-259

[3] Rose J, Quave C L and Islam G 2012 The four-sided triangle of ethics in bioprospecting: pharmaceutical business, international politics, socio environmental responsibility and the importance of local stakeholders *Ethnobiology and Conservation* **1**(3): 1-25
[4] Heinrich M 2000 Ethonobotanical and its role in drug development *Phytother Res* **14**: 479-488
[5] Senanayake S G J N 2006 Indigenous knowledge as a key to sustainable development *J. Agric. Sci.* **2**(1): 87-94
[6] Ghorbani A 2005 Study on pharmaceutical ethnobotany in the region of Turkmen Sahra, North of Iran: (Part 1): general result *J. Ethnopharmacol.* **102**: 58–68
[7] Wink M 2013 Evolution of secondary metabolites in legumes (Fabaceae) *S Afr J Bot* **89**: 164-175
[8] Martins D and Nunez C V 2015 Secondary metabolites from Rubiaceae species *Molecules* **20**: 13422-13495
[9] Waterman P G and Hussain R A 2008 Chemosystematics in the Rutaceae: a chemotaxonomic survey of flavonoids and monoterpenes in leaves of Acmadenia species *Bot J Linn Soc* **86**(3): 227–235
[10] Sevenet T *et al* 1994 A preliminary chemotaxonomic review of Kupsia (Apocynaceae) *J Ethnopharmacol.* **41**: 147-183
[11] Aguilar-Ortigoza C J, Sosa V and Aguilar-Ortigoza M 2003 Toxic phenols in various Anacardiaceae species *Econ. Bot.* **57**(3): 354-364
[12] Vankataraman K 1972 Wood phenolics in the chemotaxonomy of the Moraceae *Phytochemistry* **11**(5): 1571-1586
[13] Senthilkumar N and Murugesan S 2012 Bioprospecting the renewable forest resources: an overview *Current Biotica* **5**(4): 522-540