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Kannan M
Department of Botany,
Directorate of Distance
Education, Vinayaka Missions
University, Salem-636 308,
Tamil Nadu, India.

Senthil Kumar T
Department of Industry
University Collaboration,
Bharathidasan University,
Tiruchirappalli -620 024, Tamil
Nadu, India.

Rao MV
Department of Plant Science,
Bharathidasan University,
Tiruchirappalli-620 024,
Tamil Nadu, India.

Correspondence:
Senthil Kumar T
Department of Industry
University Collaboration,
Bharathidasan University,
Tiruchirappalli -620 024, Tamil
Nadu, India.

Utilization of plant resources for non-medicinal purposes by Malayali tribes of Kalrayan hills of Salem District, Tamil Nadu, India

Kannan M, Senthil Kumar T, Rao MV

Abstract

This paper focuses on multipurpose uses of forest resources for non-medicinal purposes (NMPs) by the Malayali tribes, the native people of Kalrayan Hills, Salem District, Tamil Nadu. Use of 146 plant species for various non-medicinal purposes, belonging to 115 genera under 53 families has been recorded. In the present study, we observed the traditional knowledge on the use of forest resources by the tribes is essential for their day-to-day life.

Keywords: Ethnobotany, Kalrayan hills, Malayali Tribes, Forest Resources, Non-medicinal uses.

1. Introduction

Plants provide humankind with our most basic resources, food, medicines, fiber and a whole array of other useful products^[1]. Apart from plants being used against a number of diseases as traditional medicine, plants are also used as building materials, fodder, weapons and other commodities of economical importance^[2]. The wood, bark, leaves, fruits, seeds and roots of trees yield food, fodder, shelter, medicine, fiber, resin, oils and other numerous products used for subsistence of people living in rural and tribal areas^[3].

The indigenous people are well acquainted with the properties and use of plants of their surrounding and they depend on the forest resources for several purposes like timber and non-timber forest products^[4]. This indigenous knowledge on the usage of plants for various purposes is passed verbally for generations^[5].

Because of modernization, all of this ethnobotanical knowledge is declining day by day, so there is an urgent need to document this knowledge^[6,7]. Hence, the present work was focused on the documentation of ethnobotanical status of the study area and to know the extent of utilization of plants for non-medicinal purposes (NMPs) by Malayali tribes of Kalrayan Hills, Salem Dt, Tamil Nadu, India. The Malayali tribes hereafter presented as tribes.

2. Materials and methods

2.1. Study area

Kalrayan (Kalvarayan) hills are a range of hills situated in the Eastern Ghats of the Southern Indian state of Tamil Nadu, lies between 11° 36' and 12° 01' N and 78° 29' and 78° 54' E. It runs over 3 districts viz. Salem, Viluppuram and a small region in Thiruvannamalai districts and it spreads over an area of 1158.4 km²^[8]. The altitude varies from 1000 to 3800 meters above mean sea level^[9].

Kalrayan hills are divided into 5 regions or "Nadu"s (Cluster of tribal villages) namely Chinnakalrayan Nadu, Periyakalrayan Nadu, Jadaya Gaundan Nadu, Kurumba Gaundan Nadu and Ariya Gaundan Nadu^[10]. Among them Chinnakalrayan Nadu and Periyakalrayan Nadu belong to Salem District and they comprise 58 and 44 tribal hamlets respectively (Source: Village revenue records). The remaining 3 regions belong to Viluppuram District.

Vegetation of Kalrayans is semi-deciduous to scrub forests where sandal wood grows naturally along with other dominant species like teak and bamboo. Indigenous species like *Pterocarpus marsupium*, *Terminalia chebula* and *Dalbergia latifolia* also found abundant in this region^[9].

2.2. Tribal community

The native people of the Kalrayans were called as Vedar. The warriors belonging to Karalar community had invaded from Kanchipuram and settled in Kalrayan hills. They are mingled

with Vedar community by marriage. The mixed population of Karalar and Vedar communities who at present are called "Malayali" (Village revenue records).

Tribal community of Kalrayan hills are basically farmers. Due to the poor irrigational sources, their agriculture is seasonal type. They are hard working and economically backward. Few of them are farmers and remaining people are doing works interrelated with agriculture. They also involved in the collection of honey, bee wax and other minor forest products.

2.3. Data collection

Ethnobotanical information on plants and their utilization for NMPs was collected from tribal heads, aged persons, farmers in the agricultural fields having familiarity and knowledge with plants through personal interviews, discussions and field observations by the regular field visits to various hamlets of Kalrayan hills following standard methods^[11]. The information was verified with the literatures available and the plants were identified and verified with the help of standard floras^[12, 13]. The voucher specimens are deposited in the Department of Botany, Vinayaka Missions University, Salem. Uses of forest resources for NMPs by the tribes of Kalrayan hills are documented and the information includes vernacular and binomial names of the plant, usage and useful part of the plant.

3. Result and discussion

As like food and medicines, plant also provides so many products for human consumptions and socio-cultural religious purposes. Tribal people dwelling in the forest area are living harmoniously with the nature and maintain a close association with the environment. They are invaluable source of knowledge on the use of forest wealth and the information on the utilization of this forest flora is passed on generation verbally^[14]. Besides the medicinal and food values plants play an important role in the socio-economic life of Malayalis^[15]. The tribes are using the plants for various purposes like, construction, house hold implements, fuel wood, agriculture tools, religious, decorative, ward off evil spirits etc.,^[16, 17]. The present paper describes the usage of forest resources by the tribes of Kalrayan hills for various NMPs excluding wild edibles. Apart from the wild plants some of the plants in the documentation included are under cultivation and or domesticated in home gardens.

During the study we documented the use of 146 plant species from 115 genera belonging to 53 families for NMPs by tribes of the study area. Out of 146 plant species, trees dominate

other forms with 83 species (56.8%) and 30 species (20.8%) are shrubs, 23 species (15.8%) are herbs and 10 (6.8%) are climbers. The reported plants were categorized based on their usage and arranged alphabetically under each category along with the information such as their botanical name, vernacular name, family, part of the plant used and usage. Usage categories of plants recorded are fodder, hedges, timbers, fuel wood, insect repellent, ornamental and shade plants, ecological indicators, ropes, green manures, thatching and construction materials, preparation of household and agricultural implements, socio-cultural religious purposes, soil conservators, ecological indicators etc.

3.1. Fodder plants

Grazing in forests has been often considered competitive and conflicting demands from the local land^[18]. The animals rose for milk and meat obtain their food by grazing in the forests. As in the winter season the green grass is not available and in the summer the hay is scanty, hence the necessity for the other sources as fodder is arises. The tribes are having good knowledge on the fodder plants and how and when they can be used. They consider 33 plant species belong to 32 genera under 22 families as fodder for their livestock (Table 1). Among them, dried lomentum of *Acacia arabica* is used as fodder for goats in dry seasons. The bulbils of *Agave angustifolia* and tender leaves of *Dendrocalamus strictus* are used as fodder for cattle in rainy season.

Commelina benghalensis is used to practice the feeding habit of young calves below one month of age. The reason behind this phenomenon is that the leaves of this plant are having more water content and fleshy in nature. As the calves are too young, they do not drink water directly hence the water content present in this plant material may reduce thirsty condition as well as the leaves are very fleshy for new calves to chew and digest them easily. Stem of *Vanilla walkeriae* is used as fodder for cattle having new calves because it increases the milking capacity of the cows.

Mostly the shrubs are preferred by goats and sheep and the trees are preferred for cattle. *Pennisetum purpureum* is under cultivation in the bund or borders of crop fields as soil binder which is also used as fodder. Besides the above plants, straw waste hay from the plants under cultivation such as *Eleusine coracana*, *Oryza sativa*, *Panicum miliaceum*, *Panicum milliure*, *Sorghum vulgare* and *Zea mays* are used as fodder. In addition, cultivated plants such as *Macrotyloma uniflorum*, *Manihot utilissima* and pods of grams are also used as fodder.

Table 1: Plants used as fodder by Malayali Tribes of Kalrayan hills

S.No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvelam	Mimosaceae	Dried lomentum is used as fodder for goats in dry seasons
2.	<i>Agave angustifolia</i> Haw.	Kathalai	Agavaceae	Bulbils are used
3.	<i>Albizia procera</i> (Roxb.) Benth.	Vagai	Mimosaceae	Leaf is used as fodder
4.	<i>Caesalpinia decapetala</i> (Roth) Alston	Mul Kondrai	Caesalpinaceae	Leaf is used as fodder
5.	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Vella Erukan	Asclepiadaceae	Leaf is used as fodder
6.	<i>Canthium parviflorum</i> Lam.	Kaarai mullu	Rubiaceae	Branchlets are browsed by the goats in rainy seasons
7.	<i>Combretum albidum</i> G.Don	Odai kodi	Combretaceae	Entire plant is used as fodder for goats
8.	<i>Commelina benghalensis</i> L.	Kanavazhai	Commelinaceae	To practice the feeding habit of young calves below one month of age
9.	<i>Commiphora caudata</i> Engl.	Pachai Kiluvai	Burseraceae	Leaves are used as fodder in rainy seasons for goats also
10.	<i>Cordia myxa</i> L.	Naruveli maram	Boraginaceae	Fodder for cattle
11.	<i>Delonix elata</i> Gamble	Vadhanarayanan	Cesalpiniaceae	Leaflets are used as fodder in rainy seasons for goats
12.	<i>Dendrocalamus strictus</i> Nees	Siruvurai/Aa Mungil	Poaceae	In dry seasons tender leaves are used as fodder for livestock. In addition at the time of delivery the leaves are used as fodder which facilitates the delivery
13.	<i>Ficus benghalensis</i> L.	Aalamaram	Moraceae	Leaf is used as fodder
14.	<i>Ficus virens</i> Aiton	Erali maram	Moraceae	Leaf is used as fodder

15.	<i>Gmelina asiatica</i> L.	Kumala maram	Verbenaceae	Leaf is used as fodder
16.	<i>Hibiscus sabdariffa</i> L.	Kendi Pulichai	Malvaceae	Entire plant is used as fodder for cattle and goats
17.	<i>Leucaena glauca</i> (Willd.) Benth.	Periya Thaharai	Mimosaceae	Leaf is used as fodder for goats also
18.	<i>Mallotus philippensis</i> (Lam.) Mull.Arg.	Thirucheelai maram	Verbenaceae	Leaf is used as fodder for cattle
19.	<i>Melia azedarach</i> L.	Malai Vembu	Meliaceae	Branch lets are used as fodder for cattle in dry seasons
20.	<i>Mimosa intsia</i> L.	Seengai ilai	Mimosaceae	Leaf is used as fodder for cattle especially for goats
21.	<i>Morinda tinctoria</i> Roxb.	Nuna maram	Rubiaceae	Leaf is used as fodder for cattle in dry seasons
22.	<i>Ophiuros exaltatus</i> (L.) Kuntze	Kenangu pul	Poaceae	Entire plant is used as fodder in rainy and dry seasons
23.	<i>Pennisetum purpureum</i> Schumach.	Neppier pul	Poaceae	This plant is under cultivation and used as fodder by few farmers
24.	<i>Phyllanthus reticulatus</i> Poir.	Poola chedi	Euphorbiaceae	Branch lets are used as fodder for goats
25.	<i>Pterocarpus marsupium</i> Roxb.	Vengai	Caesalpiniaceae	Entire plant is used as fodder
26.	<i>Quercus incana</i> Roxb.	Masikai	Fagaceae	Leaf is used as fodder
27.	<i>Schleichera oleosa</i> Merr.	Sakatta maram	Sapindaceae	Leaf is used as fodder
28.	<i>Tamarindus indica</i> L.	Puli	Caesalpinaceae	Leaf is used as fodder for goats in rainy seasons
29.	<i>Thevetia nerifolia</i> Juss. ex Steud.	Manjal Arali	Apocynaceae	Leaf is used as fodder especially for goats in rainy seasons
30.	<i>Triumfetta rhomboidea</i> Jacq.	Otti thalai	Tiliaceae	Leaf is used as fodder for goats
31.	<i>Vanilla walkeriae</i> Wight.	Kundu Perandai	Orchidaceae	Stem is used as fodder especially for cattle having new calves which increases the milking capacity
32.	<i>Ventilago maderaspatana</i> Roxb.	Veppana kodi	Rhamnaceae	Entire plant is used as fodder for goats
33.	<i>Ziziphus rugosa</i> Lam.	Kottai maram	Rhamnaceae	Leaf is used as fodder

3.2. Timber and construction plants

The tribes of Kalrayan hills are using 39 plants species belonging to 33 genera under 22 families as timber and for construction purposes (Table 2). *Bambusa arundinacea*, *Casuarina equisetifolia* and *Dendrocalamus strictus* are used as roofing material due to their light weight nature. As the

Diospyros ebenum is resistant to insects and termites, trunks of *Mangifera indica* and *Pterocarpus marsupium* are strong and durable, *Terminalia paniculata* is resistant to fire and *Tectona grandis* is durable and resistant to environmental factors such as sunlight rain, moisture etc., they are widely used for construction purposes as beams and posts.

Table 2: Plants of timber and construction purposes by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvellam	Mimosaceae	Used as timber and for construction purposes
2.	<i>Acacia catechu</i> (L.f.) Willd.	Sengarungali	Mimosaceae	Used as timber and for construction purposes
3.	<i>Acacia leucophloea</i> Willd.	Vel Velam	Mimosaceae	Used as timber
4.	<i>Alangium salviifolium</i> (L.f.) Wangerin	Alingi	Alangiaceae	Strong wood for construction and also for beams and posts
5.	<i>Albizia amara</i> (Roxb.) Boivin	Arappu	Mimosaceae	Used as timber
6.	<i>Albizia lebeck</i> (L.) Benth.	Vahai	Mimosaceae	Used for making doors and windows
7.	<i>Albizia procera</i> (Roxb.) Benth.	Koodu Mathura maram	Mimosaceae	Timber, construction and as posts and beams
8.	<i>Anogeissus latifolia</i> (Roxb.) Bedd.	Namai maram	Combretaceae	Wood as timber
9.	<i>Artocarpus heterophyllus</i> Lam.	Palaa maram	Moraceae	Strong wood used for making planks, wooden mortars
10.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Timber, construction, doors, planks, posts and beams
11.	<i>Bambusa arundinacea</i> Retz.	Mungil	Poaceae	Used as roofing material for construction
12.	<i>Borassus flabellifer</i> L.	Panai maram	Arecaceae	Timber, construction, beams
13.	<i>Canthium dicoccum</i> (Gaertn.) Teijsm. & Binn.	Negini maram	Rubiaceae	Timber and construction purposes
14.	<i>Cassia fistula</i> L.	Sarakondrai	Caesalpiniaceae	Timber, construction and beams
15.	<i>Casuarina equisetifolia</i> L.	Savukku	Casuarinaceae	Light weight timber for posts and construction purposes
16.	<i>Ceiba pentandra</i> Gaertn.	Ilavu maram	Bombacaceae	Light weight timber used for carvings
17.	<i>Chloroxylon swietenia</i> DC.	Porusa Maram	Rutaceae	Timber and construction purpose. Mature stem is used for making reapers for tiled houses and planks
18.	<i>Dalbergia latifolia</i> Roxb.	Eeti maram	Fabaceae	Strong wood for making planks
19.	<i>Dendrocalamus strictus</i> Nees	Siruvarai/Aa Mungil	Poaceae	Used as roofing material for construction
20.	<i>Diospyros ebenum</i> J.Koenig	Karungali	Ebenaceae	Durable and resistance to insects used for construction
21.	<i>Erythroxylum monogyne</i> Roxb.	Sempulichan	Erythroxylaceae	Timber and construction
22.	<i>Eucalyptus globulus</i> Labill.	Neelagiri maram	Myrtaceae	Mature stem is used for making reapers for tiled houses, beams, posts and as timber
23.	<i>Ficus benghalensis</i> L.	AalaMaram	Moraceae	Strong wood used for planks
24.	<i>Glochidion zeylanicum</i> (Gaertn.) A.Juss.	Thumbaran Maram	Euphorbiaceae	Timber
25.	<i>Gmelina asiatica</i> L.	Kumala maram	Verbenaceae	Timber
26.	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Malai Savukku	Proteaceae	Timber and construction
27.	<i>Ixora pavetta</i> Benth.	Koraa maram	Rubiaceae	Timber
28.	<i>Limonia acidissima</i> L.	Vila	Rutaceae	Construction purposes
29.	<i>Mangifera indica</i> L.	Maa	Anacardiaceae	Strong wood for making planks, doors and windows
30.	<i>Melia azedarach</i> L.	Malai Vaembu	Meliaceae	Light weight timber
31.	<i>Memecylon edule</i> Roxb.	Allan maram	Melastomataceae	Timber and construction
32.	<i>Polyalthia cerasoides</i> (Roxb.)	Senthala maram	Annonaceae	Light weight timber and wood is soft

	Bedd.			
33.	<i>Pterocarpus marsupium</i> Roxb.	Vengai	Cesalpiniaceae	Strong and durable wood for construction and planks
34.	<i>Tarema asiatica</i> Kuntze	Therani maram	Rubiaceae	Timber and construction
35.	<i>Tectona grandis</i> L.f.	Thekku	Verbenaceae	Strong and durable, resistant to environmental factors Suitable for making planks, doors, windows, beams, and posts
36.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Marutham	Combretaceae	Strong wood for construction
37.	<i>Terminalia crenulata</i> Roth	Karu Maruthu	Combretaceae	Wood is durable and suitable for timber and construction
38.	<i>Terminalia paniculata</i> Roth	Poo Maruthu	Combretaceae	Resistant to fire, good timber and used for construction
39.	<i>Vitex altissima</i> L.f.	Mayiladi	Verbenaceae	Strong and hard wood used for construction

3.3. Ropes and Strings

From the ancient days plants are used for tie purposes and as tagging materials. The wiry stems of climbers and fibrous materials obtained from the plant parts are used for making ropes and strings. The tribes of Kalryans hills are using ropes and strings of 12 plant species belonging to 10 genera under 9 families for tagging of thatching materials, construction purposes, agricultural activities such as ploughing, digging wells, water irrigation and for bundling of forest products such

as fodders, fuel woods, green manures etc (Table 3).

Bark fibers of *Acacia arabica*, *Acacia leucophloea* and *Cordia myxa* and wiry stems of *Ipomoea staphylina*, *Ventilago maderaspatana* and *Wattakaka volubilis* are used as ropes for making bundle while collecting forest products. For making ropes and strings leaf fibers of *Agave americana* and *Agave angustifolia* and mesocarp of *Cocos nucifera* are used.

Table 3: Plants used as ropes and strings by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvelam	Mimosaceae	Barks of young stems are used for tagging, tying purposes and for making strings
2.	<i>Acacia leucophloea</i> Willd.	Vel Velam	Mimosaceae	Fibers from the inner bark are used to make strings
3.	<i>Agave americana</i> L.	Periya Kathalai	Agavaceae	Leaf fiber is used for making ropes and strings
4.	<i>Agave angustifolia</i> Haw.	Kathalai	Agavaceae	Leaf fibre is used for making ropes and strings
5.	<i>Cocos nucifera</i> L.	Thennai	Arecaceae	Fiber of epidermal layer from the rachis of compound leaf is used for tying purposes. Coir obtained from mesocarp of coconut is used for making ropes
6.	<i>Cordia myxa</i> L.	Naruvili maram	Boraginaceae	Bark fiber is used for tagging purposes and making strings.
7.	<i>Ipomoea staphylina</i> Roem. & Schult.	Oonangodi	Convolvulaceae	Wiry stem is used as rope for bundling purposes of fuel wood and fodder
8.	<i>Rivea hypocrateriformis</i> Choisy	Mustai	Convolvulaceae	Stem is used for tagging purposes
9.	<i>Sida rhombifolia</i> L.	Marunthu thalai	Malvaceae	Stem fiber is used for making ropes
10.	<i>Tiliacora acuminata</i> (Lam.) Miers	Perukattu kodi	Menispermaceae	Entire stem is used as ropes for tagging purposes and for construction of temporary huts in field
11.	<i>Ventilago maderaspatana</i> Roxb.	Veppana kodi	Rhamnaceae	Long stems are used as ropes for making bundle while collecting forest products such as fuel wood, timber, fodder etc.,
12.	<i>Wattakaka volubilis</i> Stapf	Peria Kurinjan	Apocynaceae	Stem is used for bundle the forest products such as fuel wood, timber, fodder and for tagging of fencing materials

3.4. Thatching materials

Thatching is the craft of building a roof with dry vegetation and it is the very old and common roofing method. As it utilizes the local vegetation it is cost effective and this practice has been passed from generation to generation. The thatched roof is having weather-resistant properties which ensure the building with cool in summer and warm in winter. Thatching material ranges from plain grasses to water proof leaves. The Malayali tribes are using 10 plants species of 9 genera under 6 families for thatching purposes (Table 4).

For the preparation of temporary huts in the fields *Dodonaea viscosa* is used. Leaves of *Borassus flabellifer*, *Cocos nucifera* and entire plant *Ophiuros exaltatus* are used as roofing material for making permanent huts and houses. The fibers from the leaves of *Agave americana* and rachis of *Borassus flabellifer*, and strings from spath of *Cocos nucifera* are used for tagging the thatching materials on the roof. In addition, straw wastes of *Pennisetum typhoides*, *Sorghum vulgare* etc., are also used as roofing material for thatching of houses and huts.

Table 4: Plants used for the thatching purposes by Malayali Tribes of Kalrayan hills

S. No.	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Agave americana</i> L.	Periya Kathalai	Agavaceae	Leaf fiber is used for thatching
2.	<i>Agave angustifolia</i> Haw.	Kathalai	Agavaceae	Leaf fiber is used for thatching
3.	<i>Borassus flabellifer</i> L.	Panai maram	Arecaceae	Fiber obtained from the rachis is used for thatching. Compound leaves also used as roofing material
4.	<i>Cocos nucifera</i> L.	Thennai	Arecaceae	Compound leaf is used as roofing material for houses. Strings obtained from the spath are used for tagging of thatching materials
5.	<i>Dodonaea viscosa</i> Jacq.	Virali	Sapindaceae	Entire plant is used for roofing of temporary huts in fields
6.	<i>Ipomoea staphylina</i> Roem. & Schult.	Oonangodi	Convolvulaceae	Stem is used for tagging of roofing materials of huts in agricultural fields
7.	<i>Ophiuros exaltatus</i> (L.) Kuntze	Kenangu pul	Poaceae	Entire plant is used as roofing material for the huts and houses

8.	<i>Pennisetum typhoides</i> Stapf & C.E.Hubb.	Kambu	Poaceae	Entire plant is used as roofing material for the huts and houses
9	<i>Sorghum vulgare</i> Pers.	Cholam	Poaceae	Entire plant is used as roofing material for temporary huts in the fields
10.	<i>Tiliacora acuminata</i> (Lam.) Miers	Perukattu kodi	Menispermaceae	Ropes for thatching purposes

3.5. Implements

The articles used in agricultural and house hold activities are obtained from plants. Identification of plants for house hold and agricultural implements is not always easy. The native people of Kalrayans are having a vast knowledge on the plants and their selection for making household and agricultural implements. They select the plants on the basis of its durability, resistance to insects, termites and environmental factors such as heat, moisture and rain. In addition, they consider light weight or strong wood on the basis of requirements.

About 31 plant species belonging to 28 genera under 23

families have been recorded as the plants used for construction of household and agricultural implements by tribes (Table 5). They utilize the plants for making furniture, rolling pins, ladders, wooden mold for the preparation of 'achu vellam' (Pyramid shaped jaggery), planks, 'Ural' (wooden grinders or mortars), pestles, 'kunthani' (A hollow cylindrical structure used to protect the spread of grains while threshing with wooden mortar and pestles), Yetram (An apparatus used in agricultural practices for lifting water from well or lakes for irrigation using leather buckets) harrows, yokes, beams and grips of ploughs, baskets, pounders, cart wheels, handles for sickles, knives, hoes, spades and other agricultural tools.

Table 5: Plants used by Malayali Tribes of Kalrayan hills for the construction of household and agricultural implements

S.No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvellam	Mimosaceae	Tool handles for hoe and spade, construction of agricultural implements such as ploughs and grip handles, household implements
2.	<i>Acacia leucophloea</i> Willd.	Vel Velam	Mimosaceae	Wood is used to make decorative furniture, cartwheels and making pounders
3.	<i>Albizia lebeck</i> (L.) Benth.	Vahai	Mimosaceae	To make the mold for Achu Vellam, harrows, doors and windows, yokes, grip handle and beam of plough
4.	<i>Albizia procera</i> (Roxb.) Benth.	Koodu Mathura maram	Mimosaceae	House hold implements and making ploughs, harrow and yokes
5.	<i>Artocarpus heterophyllus</i> Lam.	Palaa maram	Moraceae	Harrows, household materials such as mortars, pestles, rolling pins etc.,
6.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Furniture and agricultural implements such as ploughs, tool handles for hoe and spades
7.	<i>Bambusa arundinacea</i> Retz.	Mungil	Poaceae	Trunk is used for making ladder and for tool handles of sickles, knives
8.	<i>Cassia fistula</i> L.	Konnai	Caesalpiniaceae	Making yokes and rolling pins
9.	<i>Cassine glauca</i> (Rottb.) Kuntze	Mundi	Celestraceae	Utensils, parts of carts and tool handles such as spade and axes
10.	<i>Chloroxylon swietenia</i> DC.	Porusa maram	Rutaceae	Construction of ploughs, yokes, karuthadi (beam of ploughs), harrow, yetram, tool handles, pounders, Kattil (bed)
11.	<i>Cordia wallichii</i> G.Don	Pantheeku	Boraginaceae	House hold and agricultural implements
12.	<i>Dalbergia latifolia</i> Roxb.	Kundasa maram/ Eetti maram	Fabaceae	Making yokes, shaft and beams of ploughs, harrow, yetram, planks, doors and windows
13.	<i>Dendrocalamus strictus</i> Nees	Siruvurai Mungil	Poaceae	House hold and agricultural tool handles
14.	<i>Diospyros ebenum</i> J.Koenig	Karungali maram	Ebenaceae	Making furniture, pounders, wooden grinders and tool handles. Used for yokes, yetram, pole beam and grip handle of plough
15.	<i>Ficus benghalensis</i> L.	AalaMaram	Moraceae	Tool handles and ploughs
16.	<i>Gmelina asiatica</i> L.	Kumala maram	Verbenaceae	Making furniture, wooden pounders
17.	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Malai Savukku	Proteaceae	Agricultural implements and tool handles
18.	<i>Hardwickia binata</i> Roxb.	Aacha maram	Caesalpiniaceae	Handles for hoe, spade and knife
19.	<i>Mangifera indica</i> L.	Maa	Anacardiaceae	Used for making household implements like Kunthani and Ural. Harrows for agricultural practices
20.	<i>Memecylon edule</i> Roxb.	Allan maram	Melastomataceae	Agricultural implements and tool handles
21.	<i>Michelia champaca</i> L.	Chembagam	Magnoliaceae	For making furniture
22.	<i>Mimusops elengi</i> L.	Muluvu maram	Sapotaceae	Used for making wooden mortar, pestles and ploughs
23.	<i>Morinda tinctoria</i> Roxb.	Manjanava maram	Rubiaceae	Used for making yokes because of its weightless characters
24.	<i>Polyalthia cerasoides</i> (Roxb.) Bedd.	Senthala maram	Annonaceae	Wood is soft. Used for rolling pins and agricultural tool handles
25.	<i>Putranjiva roxburghii</i> Wall.	Karipalai	Euphorbiaceae	Used for making furniture
26.	<i>Strychnos nux-vomica</i> L.	Etti maram	Loganiaceae	Making main body of ploughs and hence called as Kalappai Maram
27.	<i>Syzygium cumini</i> (L.) Skeels	Naval maram	Myrtaceae	Agricultural tool handles
28.	<i>Tectona grandis</i> L.f.	Thekku	Verbenaceae	Strong and durable. Resistant to climatic factors hence used for making furniture, Yetram etc.,
29.	<i>Terminalia chebula</i> Retz.	Kadukkai maram	Combretaceae	House hold and agricultural implements
30.	<i>Terminalia crenulata</i> Roth	Karu Maruthu	Combretaceae	Tool handles and agricultural implements
31.	<i>Wrightia tinctoria</i> R.Br.	Paala Maram	Asclepiadaceae	Used for making Kunthani and household implement

3.6. Fuel wood

Fire is one of the important inventions of human being and it is mainly used for cooking purposes. It is documented that the indigenous people of Kalrayan hills using the wood of 23 plant species belonging to 21 genera under 14 families as the source

of fuel (Table 6). They collect the fuel wood from the dead and dry parts of plants available in the adjacent forest areas. They are not cutting any live plants for fuel purposes. For fuel wood they prefer plants with low smoke, easily flammable, provides long lasting fire and readily available in the nearby area.

Table 6: Plants used as fuel wood by Malayali Tribes of Kalrayan hills

S.No	Botanical Name	Vernacular Name	Family
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvelam	Mimosaceae
2.	<i>Acacia catechu</i> (L.f.) Willd.	Sengarungali	Mimosaceae
3.	<i>Albizia amara</i> (Roxb.) Boivin	Arappu	Mimosaceae
4.	<i>Annona squamosa</i> L.	Seetha Palam	Annonaceae
5.	<i>Canthium dicoccum</i> (Gaertn.) Teijsm. & Binn.	Neguni maram	Rubiaceae
6.	<i>Cassia fistula</i> L.	Konnai	Caesalpiniaceae
7.	<i>Cassia siamea</i> Lam.	Pon Aavaarai	Caesalpiniaceae
8.	<i>Cassine glauca</i> (Rottb.) Kuntze	Karuvali	Celastraceae
9.	<i>Diospyros ferrea</i> (Willd.) Bakh.	Irumbuli	Ebenaceae
10.	<i>Erythroxylum monogynum</i> Roxb.	Sempulichan	Erythroxylaceae
12.	<i>Glochidion zeylanicum</i> (Gaertn.) A.Juss.	Thumbaran maram	Euphorbiaceae
13.	<i>Ixora pavetta</i> Benth.	Koraa Maram	Rubiaceae
14.	<i>Lantana camara</i> L.	Uni Mul	Verbenaceae
15.	<i>Madhuca longifolia</i> J.F.Macbr.	Iluppai	Sapotaceae
16.	<i>Mallotus philippensis</i> (Lam.) Mull.Arg.	Thiruchelai maram	Verbenaceae
17.	<i>Memecylon edule</i> Roxb.	Allan maram	Melastomataceae
18.	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Kona Kai	Mimosaceae
19.	<i>Premna tomentosa</i> Willd.	Poda Nari	Verbenaceae
20.	<i>Shorea roxburghii</i> G.Don	Kungiliam	Dipterocarpaceae
21.	<i>Strychnos potatorum</i> L.f.	Thaethan maram	Loganiaceae
22.	<i>Syzygium cumini</i> (L.) Skeels	Naval	Myrtaceae
23.	<i>Tamarindus indica</i> L.	Pulia maram	Caesalpiniaceae

3.7. Hedges

To protect their residence, cultivated crops and live stocks, the tribes of Kalrayan hills are using 27 plant species belonging to 23 genera under 15 families (Table 7) as hedges. The hedge plants used by them are of two types such as dry fences and live hedges. Most of the dry fences are plants having thorns whereas the live hedge plants are having dense foliage and few of them having thorns and spines also.

Plant species such as *Canthium parviflorum*, *Dichrostachys cinerea*, *Dodonaea viscosa* and *Lantana camara* are used both as dry fences as well as live hedges. *Bambusa arundinacea*, *Delonix elata*, *Dendrocalamus strictus*, *Dodonaea viscosa*, *Euphorbia tirucalli*, *Ipomoea carnea*, *Jatropha curcas*, *Ophiuros exaltatus* and *Thevetia nerifolia* are mainly used for the protection of residence and their pet animals. Remaining plants are used for the protection of cultivated lands.

Table 7: Plants used as hedges by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvelam	Mimosaceae	Dry fences
2.	<i>Agave americana</i> L.	Periya Kathalai	Agavaceae	Live fences
3.	<i>Agave angustifolia</i> Haw.	Kathalai	Agavaceae	Live fences
4.	<i>Bambusa arundinacea</i> Retz.	Peruvurai Moongil	Poaceae	Dry fences
5.	<i>Caesalpinia decapetala</i> (Roth) Alston	Mul Kondrai	Caesalpiniaceae	Live fences
6.	<i>Canthium parviflorum</i> Lam.	Kaarai Mullu	Rubiaceae	Live fences and Dry fences
7.	<i>Clausena dentata</i> M.Roem.	Nana Chedi	Rutaceae	Live fences
8.	<i>Clerodendrum inerme</i> (L.) Gaertn.	Pee Changu	Verbenaceae	Live fences
9.	<i>Commiphora berryi</i> Engl.	Mullu Kiluvai	Burseraceae	Live fences
10.	<i>Commiphora caudata</i> Engl.	Pachai Kiluvai	Burseraceae	Live fences
12.	<i>Delonix elata</i> Gamble	Vadhanarayanan	Caesalpiniaceae	Live fences
13.	<i>Dendrocalamus strictus</i> Nees	Siruvurai Mungil	Poaceae	Dry Fences
14.	<i>Dichrostachys cinerea</i> (L.) Wight & Arn.	Vettu thari	Mimosaceae	Live fences and Dry fences
15.	<i>Dodonaea viscosa</i> Jacq.	Virali	Sapindaceae	Live fences and Dry fences
16.	<i>Euphorbia antiquorum</i> L.	Sathurakkalli	Euphorbiaceae	Live fences
17.	<i>Euphorbia tirucalli</i> L.	Paachaam Paluppu	Euphorbiaceae	Live fences
18.	<i>Ipomoea carnea</i> Jacq.	Neyveli chedi	Convolvulaceae	Live fences
19.	<i>Jatropha curcas</i> L.	Kaatu Kottai	Euphorbiaceae	Live fences
20.	<i>Lantana camara</i> L.	Unnchedi	Verbenaceae	Live fences and Dry fences
21.	<i>Ophiuros exaltatus</i> (L.) Kuntze	Kenangu Pul	Poaceae	Dry fences
22.	<i>Opuntia dillenii</i> Haw.	Sappathikalli	Cactaceae	Live fences
23.	<i>Phyllanthus reticulatus</i> Poir.	Karum Poola chedi	Euphorbiaceae	Live fences
24.	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Kona Puliyangai	Mimosaceae	Dry fences
25.	<i>Scutia myrtina</i> Kurz	Thovatti Mul	Rhamnaceae	Dry fences
26.	<i>Thevetia nerifolia</i> Juss. ex Steud.	Manjal Arali	Apocynaceae	Live fences
27.	<i>Ziziphus mauritiana</i> Lam.	Ilanthai maram	Rhamnaceae	Dry fences

3.8. Green manure plants

The tribes of Kalrayan hills prefer plants as manures rather than the chemical fertilizers. They collect these eco-friendly green manure plants from the adjacent forest regions and as well as from the cultivated lands. They prefer the plants having

larger foliages without spines or thorns for green manure. There are about 13 plant species belonging to 12 genera under 8 families have been recorded as green manures used by the native people of Kalrayans (Table 8).

Table 8: Plants used as green manure by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Parts Used
1.	<i>Abutilon indicum</i> (L.) Sweet	Thutti	Malvaceae	Entire Plant
2.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Branch lets
3.	<i>Calotropis gigantea</i> (L.) W.T.Aiton	Erukku	Asclepiadaceae	Entire Plant
4.	<i>Cassia fistula</i> L.	Sarakonnai	Caesalpinaceae	Branch lets
5.	<i>Cassia siamea</i> Lam.	Pon Aavaarai	Caesalpinaceae	Branch lets
6.	<i>Clausena dentata</i> M.Roem.	Nana chedi	Rutaceae	Entire Plant
7.	<i>Cordia myxa</i> L.	Sela maram	Boraginaceae	Branch lets
8.	<i>Delonix elata</i> Gamble	Vaadhanarayanan	Ceasalpinaceae	Branch lets
9.	<i>Jatropha curcas</i> L.	Kaatu Kottai	Euphorbiaceae	Entire Plant
10.	<i>Pongamia pinnata</i> (L.) Pierre	Pungan	Fabaceae	Branch lets
11.	<i>Sida acuta</i> Burm.f.	Veeman thalai	Malvaceae	Entire Plant
12.	<i>Tephrosia purpurea</i> (L.) Pers.	Usi Thuvurai	Fabaceae	Entire Plant
13.	<i>Thespesia populnea</i> (L.) Correa	Poovarasu	Malvaceae	Branch lets

3.9. Shampoo and Hair care plants

The tribes of Kalrayan hills are depend on the plants for their hair care. They use 10 plant species from 7 different families as shampoo and hair care purposes such as hair oils and hair tonics (Table 9). The leaves of *Eclipta alba*, *Hibiscus rosa-sinensis*, *Sida cordata* and *Wedelia chinensis* are used for the

preparation of hair oil and hair tonics. Application of leaf paste of *Lawsonia inermis* for 30 minutes on hair will converts its colour from white to grey. In addition, the leaf paste of *Melia azedarach* is used for the removal of hair lice and the inflorescence of *Lawsonia inermis* is also used for the same purpose.

Table 9: Plants used for hair care by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Abrus precatorius</i> L.	Kundumani	Fabaceae	Application of seed paste on hair 15 minutes before taking bath will stimulates the hair growth and reduces the hair fall
2.	<i>Acacia concinna</i> DC.	Seevakai	Mimosaceae	Powder of the dry fruit is applied as paste in order to remove and prevent the dandruff and used as shampoo. Above paste is used as antiseptic and soap for skin problems also
3.	<i>Albizia amara</i> (Roxb.) Boivin	Arappu	Mimosaceae	Dried leaf powder is used as shampoo in the form of paste
4.	<i>Eclipta alba</i> Hassk.	Karisilan Kanni	Asteraceae	Application of leaf paste of dry powder acts as hair tonic
5.	<i>Hibiscus rosa-sinensis</i> L.	Sembaruthi	Malvaceae	Fresh leaf is ground in to paste and applied on hair 30 minutes before taking bath to avoid hair loss and dandruff
6.	<i>Lawsonia inermis</i> L.	Maruthani	Lythraceae	Once in a week leaf paste is applied on white hair and washed after 30 minutes. It turns the white hairs in to grey colour
7.	<i>Melia azedarach</i> L.	Malai Vembu	Meliaceae	Leaf paste for removal of hair lice
8.	<i>Phyllanthus emblica</i> L.	Malai Nelli	Euphorbiaceae	Fruit paste is used as shampoo to avoid hair fall
9.	<i>Sida cordata</i> (Burm.f.) Borss.Waalk.	Nila Thuthi	Malvaceae	In one liter coconut oil a handful of leaves are boiled and stored. Used as hair oil which maintain the hair in its regular colour
10.	<i>Wedelia chinensis</i> Merr.	Manjalkarisalakani	Asteraceae	In coconut oil 10-15 leaves are boiled and stored. This hair oil increases the normal hair growth

3.10. Tooth brush

Dental health is the basis for the source of health of entire body. Now-a-days so many brands and products are available as tooth paste in the market. But the tribes of Kalrayan hills prefer 8 different plant species from various families as tooth brush for their dental health and care (Table 10). Among them,

prop root of *Ficus benghalensis*, branchlets of *Acacia arabica*, and *Azadirachta indica* are widely used by them as tooth brush. It is noticeable in the plains also. The branchlets of *Delonix elata* and *Phyllanthus reticulatus* are used as tooth brush by tribal children as an alternate to *Azadirachta indica* due to the absence of bitterness in it.

Table 10: Plants used as tooth brush by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acacia arabica</i> (Lam.) Muhl. ex Willd.	Karuvelam	Mimosaceae	Branch lets are used as tooth brush
2.	<i>Achyranthes aspera</i> L.	Nayuruvi	Amaranthaceae	Branch lets are used as tooth brush
3.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Branch lets are used as tooth brush
4.	<i>Delonix elata</i> Gamble	Vadhanarayanan	Ceasalpinaceae	Small twigs are used as tooth brush by children
5.	<i>Ficus benghalensis</i> L.	AalaMaram	Moraceae	Prop root is used as tooth brush
6.	<i>Lantana camara</i> L.	Unnichi	Verbenaceae	Small twigs are used as tooth brush
7.	<i>Phoenix sylvestris</i> Roxb.	Eecha maram	Arecaceae	Rachis is used as tooth brush
8.	<i>Phyllanthus reticulatus</i> Poir.	Karum Poola chedi	Euphorbiaceae	Stem is used as tooth brush by tribal children as an alternate to neem plant due to the absence of bitterness in it

3.11. Insect repellents

The tribes of Kalrayan hills using 10 plant species under 8 different families as insect repellents (Table 11). The plant species such as *Melia azedarach*, *Ocimum basilicum*, *Ocimum canum* and *Vitex negundo* are grown near the residence and in home gardens for controlling insects. The smoke of burnt leaves of *Annona squamosa*, *Azadirachta indica* and *Strychnos*

potatorum and the leaf paste of *Chloroxylon swietenia* are effective against household insects. For the control of insects the leaf paste of *Cleistanthus collinus* is effectively used for cattle but this preparation is poisonous to human being. While storing the grains in the granaries and jute bags fresh twigs of *Azadirachta indica* are kept in between the grains which reduces the infestation of storage insects.

Table 11: Plants used as insect repellent by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Annona squamosa</i> L.	Seetha	Annonaceae	Smoke of burnt leaves is helpful in reducing the household insects
2.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Smoke of burnt leaves is allowed in the cattle sheds to repel the insects. While storing the grains in the granaries or jute bags fresh twigs of the plants are kept in-between the grains will reduces the infestation of storage insects
3.	<i>Chloroxylon swietenia</i> DC.	Porusa Maram	Rutaceae	Leaf paste is applied over body which repels mosquitoes
4.	<i>Cleistanthus collinus</i> (Roxb.) Hook.f.	Oduvanthala	Euphorbiaceae	Twigs are acts as insect repellent. Leaf paste is applied on cattle to avoid attack of insects. This paste is poisonous to human beings
5.	<i>Lawsonia inermis</i> L.	Maruthani	Lythraceae	Keeping the inflorescence on the head will reduces and repels the head lice
6.	<i>Melia azedarach</i> L.	Malai Vembu	Meliaceae	Keeping of fresh leaf materials inside the rooms will reduces the household insects
7.	<i>Ocimum basilicum</i> L.	Thiruneetru Pachilai	Lamiaceae	Growing the plant near to residence or keeping the dried plant material in houses will repels the insects and flies including mosquitoes
8.	<i>Ocimum canum</i> Sims	Nai Thulasi	Lamiaceae	Growing near the residence will helps in the repelling of mosquitoes
9.	<i>Strychnos potatorum</i> L.f.	Thaethan maram	Loganiaceae	The smoke of burnt leaves is used as mosquito and insect repellent
10.	<i>Vitex negundo</i> L.	Nochi	Verbenaceae	Growing near the residence help in the repelling of mosquitoes

3.12. Socio-cultural and religious purposes

The plants are well associated with the socio-cultural and religious activities of tribes of Kalrayan hills. They are utilizing 23 plant species for the spiritual purposes belonging to 22 genera under 18 families (Table 12). So many plants are considered by the ethnic people as sacred plants in the vicinity of their houses and temples ^[19]. Among them *Azadirachta indica* is considered as holy plant and it is in predominant place in all local festivals whereas the *Pluemeria rubra* is

grown in almost all temples. *Ocimum sanctum* is grown in home gardens as holy plant. In addition, some of the plants or their products are used at the time of chanting sacred words or magical words to cure illness or ward off evil spirits and this phenomenon is locally known as 'Paadam poduthal'. Plants are also used for a cultural ceremony called 'Nalangu vaithal' in which a function is conducted for ritual of blessing at the time of wedding or during 7th or 9th month of pregnancy.

Table 12: Socio-cultural religious plants of Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Acorus calamus</i> L.	Vasambu	Acoraceae	Rhizome is made in to small pieces and tagged in to a bangle like structure for new born for ward off evil spirit
2.	<i>Aerva lanata</i> (L.) Schult.	Poola chedi	Amaranthaceae	Entire plant is kept in front of the house in Pongal function and also it is believed that it gives protection against eveil spirits
3.	<i>Alangium salviifolium</i> (L.f.) Wangerin	Alingi	Alangiaceae	In Aadi (name of a tamil month) month festival stem is used to keep the coconut in the flame for boiling it
4.	<i>Albizia amara</i> (Roxb.) Boivin	Usila maram	Mimosaceae	Bark is used for Nalangu function
5.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Twigs with leaves are used in festival ceremonies
7.	<i>Calotropis gigantea</i> (L.) W.T.Aiton	Erukku	Asclepiadaceae	Tender twig is used for 'Paadam Poduthal'
6.	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Vella Erukan	Asclepiadaceae	The thread prepared from the bark fiber is tied on neck or hip of the new born for ward off evil spirit
8.	<i>Capparis zeylanica</i> L	Aathandai	Capparidaceae	In Aadi month festival it is added as the first ingredient in the coconut
9.	<i>Cardiospermum halicacabum</i> L.	Mudakkathan	Sapindaceae	Tender twig is used for 'Paadam Poduthal'
10.	<i>Carmona retusa</i> (Vahl.) Masam	Korangu Vethalai	Boraginaceae	Leaf is used for 'Nalangu' function
11.	<i>Cordia myxa</i> L.	Nelluri/ Neruvili	Boraginaceae	Leaf is used for keeping of food to God while worshipping
12.	<i>Cynodon dactylon</i> (L.) Pers.	Arugam pul	Poaceae	Entire plant is used for worshipping God
13.	<i>Euphorbia antiquorum</i> L.	Sathura Kalli	Euphorbiaceae	Released placenta of the cattle and goats are kept on the live plant. As the plant contains milky latex, tribal hope that the milking capacity of cattle and goats will be stable and continues
14.	<i>Ficus religiosa</i> L.	Arasa maram	Moraceae	Small twig will kept during marriage ceremonies
15.	<i>Lannea coromandelica</i> (Houtt.) Merr.	Othiya maram	Anacardiaceae	Leaf is used in 'Nalangu' function
16.	<i>Mimusops elengi</i> L.	Mahila maram	Sapotaceae	Grown in temples as sacred plant
17.	<i>Nerium oleander</i> L.	Arali maram	Apocynaceae	Grown in temples and the flowers are used for worshipping God

18.	<i>Ocimum sanctum</i> L.	Thulasi	Lamiaceae	Grown in home gardens as holy plant
19.	<i>Pandanusodoratissimus</i> L.f.	Thaalam	Pandanaceae	Tender leaves are used for worshipping home God and also used for ornamental purposes in temples
20.	<i>Pluemeria rubra</i> L.	Arali Maram	Apocynaceae	Grown in temples and the flowers are used for worshipping God
21.	<i>Pterocarpus marsupium</i> Roxb.	Vengai	Caesalpiniaceae	Latex is used as 'pottu' (bindi) for new born in order to ward off evil spirits
22.	<i>Wattakaka volubilis</i> Stapf	Peria Kurinjan	Apocynaceae	Leaf is used for keeping food to God in temples
23.	<i>Wrightia tinctoria</i> R.Br.	Paalai / Veppalai	Apocynaceae	Twigs are used in marriage and religious ceremonies. Released placenta of the cattle and goats are kept on the live plant. As the plant contains milky latex, tribal hope that the milking capacity of cattle and goats will be stable and continues

3.13. Ornamental and shade plants

In the home gardens, tribes of Kalrayan hills are growing so many plants as vegetables, medicinal plants etc., In addition to that they are growing some ornamental and shade plants which include 11 plant species belonging to 10 genera under 8 families (Table 13). The plants such as *Bryophyllum pinnatum*, *Euphorbia tirucalli*, *Heliconia rostrata* and *Ipomoea*

quamoclit are grown as ornamentals plants whereas the inflorescence of *Caryota urens* and tender fruits of *Borassus flabellifer* collected from wild are used for ornamental purposes in marriage ceremonies and local festivals. The plants such as *Cassia fistula*, *Cassia siamea*, *Delonix elata*, *Spathodea campanulata* and *Thespesia populnea* are grown near the homes as ornamental and shade plants.

Table 13: Plants used as shade and ornamental plants by Malayali Tribes of Kalrayanhills.

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Bryophyllum pinnatum</i> (Lam.) Kurz	Ranakalli	Crassulaceae	Grown in home gardens for ornamental purposes
2.	<i>Borassus flabellifer</i> L.	Panai maram	Arecaceae	Bunch of tender fruits are used as ornamental in festivals
3.	<i>Caryota urens</i> L.	Kunthal Panai	Arecaceae	Inflorescence is used for ornamental in ceremonies
4.	<i>Cassia fistula</i> L.	Sarakondrai	Caesalpiniaceae	Shade and ornamental tree
5.	<i>Cassia siamea</i> Lam.	Pon Aavaarai	Caesalpiniaceae	Shade and ornamental tree
6.	<i>Delonix elata</i> Gamble	Vaadhanarayanan	Cesalpinaceae	Shade and ornamental tree
7.	<i>Euphorbia tirucalli</i> L.	Paachaam Paluppu	Euphorbiaceae	Grown as ornamental plant in home gardens
8.	<i>Heliconia rostrata</i> Ruiz & Pav.	Chinna Vazhai	Zingiberaceae	Grown as ornamental plant in home gardens for its beautiful inflorescence
9.	<i>Ipomoea quamoclit</i> L.	Mayil Manikkam	Convolvulaceae	Grown as ornamental plant in home gardens
10.	<i>Spathodea campanulata</i> P.Beauv.	Patadi	Bignoniaceae	Shade and ornamental tree
11.	<i>Thespesia populnea</i> (L.) Correa	Poovarasu	Malvaceae	Shade and ornamental tree

3.14. Soil conservation

Soil erosion is one of the important problems in all ecosystems including forest ecosystem. Soil conservation is necessary in order to protect the forest environment. Naturally so many plants are involved in the soil conservation process. The tribes of Kalrayan hills are using 5 plant species of different families such as *Agave americana*, *Bambusa arundinacea*, *Ipomoea carnea*, *Opuntia dillenii* and *Pennisetum purpureum* for soil

conservation purposes (Table 14). Among them *Pennisetum purpureum* is one of the important fodder crops in the plains. As it is able to grow with little water and nutrients, it is a valuable soil conservator plant and it has been grown in the bunds of crop fields. In addition, it can also serve as a fire break, wind break and improves the soil fertility of the local landscape and also serves as the source of fuel.

Table 14: Plants used for soil conservation by Malayali Tribes of Kalrayan hills

S. No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Agave americana</i> L.	Periya Kathalai	Agavaceae	Grown on bund of fields to prevent the soil erosion
2.	<i>Bambusa arundinacea</i> Retz.	Mungil	Poaceae	Grown in the field borders in slopes as soil binder
3.	<i>Ipomoea carnea</i> Jacq.	Neyveli chedi	Convolvulaceae	Grown on bund of fields to prevent the soil erosion
4.	<i>Opuntia dillenii</i> Haw.	Sappathikalli	Cactaceae	Grown in field borders to prevent soil erosion
5.	<i>Pennisetum purpureum</i> Schumach.	Neppier pul	Poaceae	Prevents soil erosion. It is mainly cultivated on bunds of agricultural fields in slopes

3.15. Indicator plants

Plants and animals are well bounded and associated with ecological factors. The growth and development of the flora and fauna are well synchronized with the ecosystem of their habitat. The tribes of the Kalrayan hills also knew this phenomenon and indentified 5 plants as the ecological indicators. The plant species such as *Azadirachta indica*,

Bambusa arundinacea, *Cassia fistula*, *Ficus benghalensis*, *Mangifera indica* and *Tamarindus indica* are considered as the ecological indicator plants by them (Table 15). There is one proverb among them known as "Maa mangum and Puli pongum". That means, if the flowers are plenty in *Mangifera indica* the rain will be less and if the flowers are plenty in *Tamarindus indica* rain will be more in the forthcoming year.

Table 15. Plants considered as ecological indicator by Malayali Tribes of Kalrayan hills

S.No	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	<i>Azadirachta indica</i> A.Juss.	Vembu	Meliaceae	Drying of tender branches and leaves on plants indicates the draught for the coming year
				Development of fruits in numerous and fleshy indicates the monsoon will be good
2.	<i>Bambusa arundinacea</i> Retz.	Mungil	Poaceae	Development of flowers and grains indicates the commencement of starvation for the following few years
3.	<i>Cassia fistula</i> L.	Konnai	Caesalpiniaceae	Occurrence of much flowers indicates the commencement of heavy rain within in a month
4.	<i>Ficus benghalensis</i> L.	Aalamaram	Moraceae	Development of fresh aerial root tips indicates the commencement of rain within 10 days
5.	<i>Mangifera indica</i> L.	Maa	Anacardiaceae	Excess flowering indicates less rain in the approaching year
6.	<i>Tamarindus indica</i> L.	Puli	Caesalpiniaceae	Excess flowering indicates heavy rain for the approaching year

3.16. Miscellaneous purposes

In addition to the wild edibles and medicinal plants, tribes of Kalrayan hills are using 22 plant species from 18 families for miscellaneous purposes such as making brooms, brushes, hand

crafts, panthal, brushes, as fruit ripening agent, milk coagulant, striking stick for musical instruments, poisonous plants etc., (Table 16).

Table 16: Plants used for miscellaneous purposes by the Malayali Tribes of Kalrayan hills

S.No	Use	Botanical Name	Vernacular Name	Family	Mode of Usage
1.	Brooms	<i>Cocos nucifera</i> L.	Thennai	Arecaceae	Mid rib of the leaflet is used as brooms
2.		<i>Phoenix loureiroi</i> Kunth	Eacha maram	Arecaceae	Entire compound leaf is used as brooms
3.	Brushes	<i>Cocos nucifera</i> L.	Thennai	Arecaceae	The base of the inflorescence rachis is crushed in to brush like structure and used as brush for white washing purposes
4.		<i>Cordia myxa</i> L.	Naruvili maram	Boraginaceae	Stem bark is carefully separated from the wood for about one feet length and required width. One side is crushed in to brush like structure used for white wash purposes
5.	Fruit ripening agent	<i>Cassia fistula</i> L.	Konnai	Caesalpiniaceae	Leaf is used
7.		<i>Chloroxylon swietenia</i> DC.	Porusa maram	Rutaceae	Leaf is used
6.		<i>Wrightia tinctoria</i> R.Br.	Paala maram	Apocynaceae	Leaf is used
8.	Hand crafts	<i>Alangium salviifolium</i> (L.f.) Wangerin	Alingi	Alangiaceae	Young stems are used for spinning Kothani
9.		<i>Bambusa arundinacea</i> Retz.	Peruvarai Moongil	Poaceae	Spinning of baskets and Kothani. Also for the preparation of Kottam
10.		<i>Borassus flabellifer</i> L.	Panai maram	Arecaceae	Compound leaf is used for spinning hand fans, mats, hats and baskets
11.		<i>Canthium dicoccum</i> (Gaertn.) Teijsm. & Binn.	Nekkini	Rubiaceae	Wood is used for the preparation of combs
12.		<i>Ceiba pentandra</i> Gaertn.	Ilavu maram	Bombacaceae	Light weight wood useful for carvings
13.		<i>Crateva religiosa</i> G.Forst.	Mavalli maram	Capparidaceae	For making wooden statue
14.		<i>Dendrocalamus strictus</i> Nees	Mungil	Poaceae	Stem is made in to long slices and used for spinning hand fans, baskets and Kothani
15.		<i>Dodonaea viscosa</i> Jacq.	Virali	Sapindaceae	Young stems are used for spinning Kothani
16.		<i>Putranjiva roxburghii</i> Wall.	Karipalai	Euphorbiaceae	Used for making toys and utensils
17.		<i>Wattakaka volubilis</i> Stapf	Peria Kurinjan	Apocynaceae	Spinning baskets and Vai Putti
18.	Milk coagulation	<i>Cordia myxa</i> L.	Neruvili	Boraginaceae	Stem bark for milk Coagulation
19.		<i>Premna tomentosa</i> Willd.	Poda Nari	Lamiaceae	Stem bark for milk Coagulation
20.	Panthal	<i>Dodonaea viscosa</i> Jacq.	Veleri Maram	Sapindaceae	Roofing material for Panthal
21.	Poisonous plants	<i>Cleistanthus collinus</i> (Roxb.) Hook.f.	Oduvanthalai	Euphorbiaceae	Leaf paste and leaf juice are poisonous
22.		<i>Strychnos nux-vomica</i> L.	Yetti Maram	Loganiaceae	Seed paste is poisonous
23.		<i>Thevetia neriiifolia</i> Juss. ex Steud.	Manjal Arali	Apocynaceae	
24.	Striking stick	<i>Asclepias curassavica</i> L.	Kuruthi poo	Asclepiadaceae	Stem is used as striking stick for a local music instrument called Parai or Thappattai
25.		<i>Clausena anisata</i> (Willd.) Hook.f.	Thapata chedi	Rutaceae	Stem is used as striking stick for a local music instrument called Parai or Thappattai and hence called as thapata chedi

Brooms are prepared from *Cocos nucifera* and *Phoenix loureiroi*. The brushes for white washing purposes are prepared from the inflorescence rachis of *Cocos nucifera* and stem bark of *Cordia myxa*. The leaves of *Cassia fistula*, *Chloroxylon swietenia* and *Wrightia tinctoria* are used as fruit ripening agents.

Stem of *Alangium salviifolium*, *Bambusa arundinacea*, *Canthium dicoccum*, *Ceiba pentandra*, *Crateva religiosa*, *Dendrocalamus strictus*, *Dodonaea viscosa*, *Putranjiva roxburghii* and *Wattakaka volubilis* are used for the preparation of various hand crafts. The internodal region of *Bambusa arundinacea* with a node in one side is used for the administration of medicines to the cattles. This cylinder like structure is locally known as Kottam. This plant is also used for spinning 'Kothani', a basket like structure used for transport of material by carts and for keeping the fodder to the cattles to avoid wastage while taking fodder.

The leaf of *Borassus flabellifer* is woven into hand fans, baskets, mats and hats. Stem of *Wattakaka volubilis* is used for spinning a interwoven net like structure called 'Vai Putti' which is wore on the mouth of the cattle while in work to prevent them from browsing in the field and also for young calves to prevent them from eating mud or soil in the young ages up to 3 to 4 months.

The stem barks of *Cordia myxa* and leaves of *Premna tomentosa* are used as milk coagulants. Small branches with leaves of *Dodonaea viscosa* is used as roofing material for making panthal (A type of flattened roof made in front of houses or open space for shade). Stem of *Asclepias curassavica* and *Clausena anisata* are used as striking stick for a local musical instrument called *Parai* or *Thappattai*. Hence, the stem of *Clausena anisata* is called as 'Thappatta kuchi'. Leaf paste of *Cleistanthus collinus* and seed paste of *Strychnos nux-vomica* and *Thevetia neriifolia* are considered as the poisonous substances by the tribes of Kalrayan hills.

4. Conclusion

Plants are the integral part of the tribal life and are the major source of socio-economic status of their life style. During the study period, we came across that the Malayalis of Kalarayan hills are having rich knowledge and well experienced in the utilization of plants and use ranges from tooth brush to house construction. They traditionally depend upon and utilize the forest resources for so many NMPs of their daily life requirements which lead to the over exploitation and rapid depletion of plants from wild. Hence, preservation of these economically important plants of this area is necessary to ensure these plants will be available for future generations. There is a great pressure on the population of tree species than any other forms and there is a necessity for the cultivation of cattle fodder because the natural grazing areas are rapidly declining.

Conservation, enhancement and use of these wild plants will contribute to the economic development and social status of the Malayali communities, thereby securing their livelihood. Ethnobotanical knowledge is confined mostly to the elderly people and due to the changes in the life styles, this valuable knowledge is declining day-by-day. Hence, the documentation and preservation of traditional knowledge and conservation of ethnobotanical plants are necessary.

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