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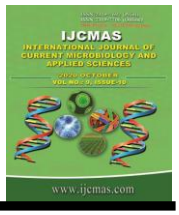

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# An Ethnobotanical Study of Medicinal Pteridophytes in Kodagu Region of Western Ghats, India

**R. H. Suraj[1], M. Jadeyegowda[1], C. G. Kushalappa[1], V. Maheshwarappa[1] and S. Y. Chandrashekar[2]**

*[1]College of Forestry, Ponnampet Kodagu, India*
*[2]College of Horticulture, Mudigere, India*

**Corresponding author*

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**A B S T R A C T**

Ethnopharmacological relevance: Interest in the medicinal pteridophytes for their traditional utility and associated pharmacological research is intensifying all over the world in the past few decades. This paper enumerated medicinal pteridophytes used by people in an unexplored and biodiversity rich Western Ghats in Southern India. Study aims to identify the pteridophytes used in medicinal therapy by the local people. This ethnobotanical survey was carried out during 2019-2020 among the people in Kodagu region in the Western Ghats, India. The information was obtained through interviews using a semi-structured questionnaire with local people. The quantitative analysis like, use value, family use value, informant's consensus factor, fidelity level, relative frequency citation, and informants agreement ratio were calculated for the quantitative study of the ethnobotanical data. A total of 33 Pteridophyte species were enumerated which were belongs to 19 families and among them Pteridaceae and Polypodiaceae were dominant. The detailed information on parts used, method of preparation, mode of application, and ailments treated were recorded. Leaves were predominantly used plant part, and a decoction is the most used herbal preparation method. *Cyathea gigantea* and *Dicranopteris linearis* are given the highest Use Value (UV) of 1.5 due to their diverse medicinal uses. The present study stresses the need to protect the indigenous knowledge of unexplored pteridophytes. As a result of the survey, *Dryanria quercifolia*, *Adiantum phillippense* and *Lygodium flexiosum* were recommended for further ethnopharmacological studies as these plants were recorded with high Use value, Informant's Agreement Ratio, Relative Frequency Citation and Fidelity level values.

## Introduction

Pteridophytes are called as reptile group of plants and are one of the earliest groups of vascular plants (Karthik *et al*., 2011). This fascinating group of plants is always attracting the botanist and naturalist all over the globe, not only because of its beautiful and unique foliage but also because of their useful aspects. Medicine in contemporary India is a fascinating blend of the traditional system with a conventional system and deeply embedded in nationalist sentiment (Khan, 2006). These medicines are not only adopted

by the people of low socio-economic classes but also by others. Although modern medicine may be available in countries like India, these traditional systems of medicine have often been used for various historical, cultural and ecological reasons (Kunwar *et al*., 2010). The rate of medicinal plant usage is increasing, but only a little is known about its use patterns (Ramawat and Goyal, 2008).

Indigenous knowledge of medicinal pteridophytes can be preserved by revealing the past and present culture about plants in the world by conducting ethnobotanical studies. To identify the plant uses as food (Pieroni, 2001), human health care medicines (Kim and Song, 2013), veterinary medicine (Upadhyay *et al.*, 2011) and economically importantance (Reyes-Garcia *et al.*, 2006) quantitative ethnobotanical swotting were used. Considering the importance of Pteridophytes, the present study was undertaken to assess the traditional medicine importance in the Western Ghats.

## Materials and Methods

### Study area

The present study was conducted in Virajpet taluq, Kodagu district. The Kodagu district located in the NE 11° 57′ N and SW 74° 55′ E covering an area of 4102 $Km^2$ (Fig. 1) with an altitude ranges from 900 MSL to 1200 MSL. The average rainfall was measured is 2552.54 mm. Most houses in Kodagu are scattered over the district, not congregated at a place. The modern medicine facilities like medicines and doctors are far away from reaching people as they are located in interior areas. So, the people are still dependent on plants in their surroundings for food and the traditional medicine use of the plant species basically transferred from generation to generation to cure diseases, etc.

### Data collection

The study was undertaken during 2019-2020 to document the ethnomedicine information in Kodagu. A semi-structured questionnaire was prepared, which included information like plant local name, part used, ailment, mode of application. To ensure the same questions were asked to all respondents, a printed questionnaire was used (Martin, 2008).

*In-situ* and *Ex-situ* methods were used to collect data. Fresh plant material was used as an *ex-situ* method of information collection, and a plant photograph chart (which was prepared) was used as an *in-situ* information collection method.

In this study totally interviewed 20 respondents (13 males and seven females) (Table 1). During the discussion, information like common ailments, fern species, methods of preparation, and application used was documented. The plant specimens were collected and were identified with "Fantastic Ferns of Dehradun and Mussoorie Hills'' (Rawat, 2014).

### Data analysis

Quantitative methods that are used to analyze the ethnobotanical data provide information on the importance and preference of fern species to the people and help in the conservation of fern species (Byg and Balslev, 2001). The following formulae were used for statistical analysis.

### Use value (UV)

Use value reflects the importance of plants to the respondents (Phillips *et al.*, 1994). It was calculated using the following formula

$UV = \sum U / n$

Where U represent number of use reports cited by each respondent for a given plant species, and n represent total number of respondents interviewed for a given plant.

The UV is co determines the plants with the highest utility in the treatment of an ailment. UV will be high when there are many use reports for a plant and low when there are few reports related to its utility (Silambarasan *et al*., 2015).

## Family use-value (FUV)

Family use value was calculated to identify the essential medicinal plant families in the study area. FUV was calculated by the following formula,

FUV = UVs/Ns

Where, UVs are the sum of the use value of the species within a given family, and Ns represent the total number of species within a given family (Cadena-Gonzalez *et al*., 2013).

The FUV is an index of cultural importance that can be applied in ethnobotany to calculate the value of plant species (Gakuubi and Wanzala, 2012).

## Fidelity level (FL)

Fidelity level was calculated to identify the most important medicinal plant species used in the treatment of various diseases. FL was calculated using the following formula (as given by Silambarasan *et al*., 2015),

FL = Ns / N * 100

Where, Ns represent the frequency of citation of a species for a particular plant ailment, and N represent the total number of citations of the species.

## Informants consensus factor (ICF)

ICF was calculated to find out the agreement of informants on the reported use reports for a different type of diseases. ICF value was calculated using the following formula (Heinrich *et al.,* 1998)

ICF = Nur – Nt / Nur – 1

Where Nur represent the number of use reports for a particular ailment category, and Nt is the number of taxa used for the particular ailment category.

## Relative frequency citation (RFC)

The local importance of each plant species was calculated using the relative frequency of citation (Tardio and Pardo-De-Santayana., 2008). The RFC value was calculated using the following formula

RFC = Fc / N

Where Fc is the number of use reports of particular plant taxa mentioned by a number of informants, and N is a total number of informants.

## Informants agreement ratio (IAR)

The importance of individual species was assessed by calculating the IAR for each species (Trotter and Logan, 1986). IAR was calculated by the following formula,

IAR = Nr – Na / Nr – 1

Where, Nr is the total number of citations recorded for individual taxa, and Na is the number of illness categories treated with this species. The IAR value zero (0) indicates the number of illness categories equals the number of citations, and one (1) indicates all the participants mentioned the plant species for a particular disease (Thomas *et al.,* 2009).

## Ailment categories

The diseases documented in the present study were classified into 12 ailment categories (Table 2). Such as dental care (DC), dermatological infection and disorder (DID), ear nose tongue (ENT), endocrinal disorder (ED), fever (FV), gastrointestinal ailments (GIA), genitor urinary problem (GUP), hair care (HC), kidney problem (KP), liver problem (LP), poisonous bite (PB), and respiratory syndrome disorder (RSD).

## Results and Discussion

## Demographic profile of the respondents

Demographic characteristic of the 20 respondents from the Kodagu region was recorded. Of these, 60% are illiterate (12). There was male domination (13) than females (7) in the practice of herbal medicines; this is because most of the women were shy to interact.

The number of respondents aged above 70 was meager, and they occupied 10% of the total respondents. The agriculturist and plantation workers share the same proportion (45%) each in total respondents (Table 1).

## Medicinal Pteridophyte diversity and their uses

In the present study, 33 species of medicinal pteridophytes belonging to 19 families for the treatment of various ailments were documented (Table 3). Of the collected ethnomedicinal pteridophytes, 26 (79%) terrestrial, 6 (18%) epiphytes, and 1 (3%) hydrophyte (Fig. 2). The Polypodiaceae and Pteridaceae (5 plants each, 15%) is dominant family (in this study followed by Adiantaceae and Oleandraceae (3 plants each, 9%), Aspleniaceae and Woodsiaceae (2 plants each, 6%), Blechnaceae, Cyatheaceae, Dennastadtiaceae, Dryopteridaceae, Gleichniaceae, Lomariopsidaceae, Lycopodiaceae, Maratticeae, Marsileaceae (1 plant each, 3%).

## Plant parts used

Among the plant part used for the preparation of medicine, leaves (59 reports, 46%) were most frequently used followed by a whole plant (31 reports, 24%), Stem (13 reports, 10%), Roots (10 reports, 8%), Rhizome (7 reports, 5%), Spores (4 reports, 3%) and Fiddle (3 reports, 2%) (Fig. 3). Likewise, most of the people around the world using leaves for herbal medicines (Macia, 2004 and Sureshkumar *et al.,* 2018).

## Preparation of herbal medicines

The respondents in the study were practicing six different types of preparation methods of medicine. Of which Decoction method was dominant practice (44 reports, 38%) followed by Paste (34 reports, 27%), Juice (22 reports, 17%), Raw (11 reports, 9%), Powder (9 reports, 7%) and Soup (3 reports, 2%) (Fig. 4). Respondents in Coorg following various application methods, in which oral method (83 reports, 65%) mostly used followed by topical (35 reports, 28%), Bath (8 reports, 6%), and Chewing (1report, 1%) (Fig. 5).

## Use value

In this study, *Cyathea gigantea* and *Dicranopteris linearis* given the highest UV of 1.5 due to its use to common diseases like dysentery, body pain, cough, and stomachache. The next highest UV 1.3 was secured by *Microsorium membranaceum*. The *Adiantum phillippense, Diplazium esculentum, Drynaria quercifolia, Ligodium flexiosum, Pitrograma calamelanos* are having moderate UV of 1.2.

**Table.1** Demographic profile of studied people during survey

| Characteristics | No. of respondents | | Total number | Percentage (%) |
|---|---|---|---|---|
| | Male | Female | | |
| **Sex** | 13 | 7 | 20 | |
| **Age** | | | | |
| **20-30** | 1 | 0 | 1 | 5 |
| **30-40** | 2 | 2 | 4 | 20 |
| **40-50** | 2 | 3 | 5 | 25 |
| **50-60** | 4 | 1 | 5 | 25 |
| **60-70** | 2 | 1 | 3 | 15 |
| **70-80** | 2 | 0 | 2 | 10 |
| **Education level** | | | | |
| **Illiterate** | 7 | 5 | 12 | 60 |
| **10$^{th}$** | 3 | 2 | 5 | 25 |
| **12$^{th}$** | 2 | 0 | 2 | 10 |
| **Graduate** | 1 | 0 | 1 | 5 |
| **Occupation** | | | | |
| **Agriculturist (Coffee planter)** | 6 | 3 | 9 | 45 |
| **Plantation workers** | 5 | 4 | 9 | 45 |
| **Grocery shop owner** | 2 | 0 | 2 | 10 |

**Table.2** Description of ailment categories and biomedical terms of illness

| Ailment category | Biomedical term |
|---|---|
| **Dental care (DC)** | Toothache |
| | Mouth blisters |
| **Dermatological infection & disorder (DID)** | Scabies |
| | Abscess |
| | Wounds |
| **Ear, Nose & Tounge (ENT)** | Earache |
| | Throat infection |
| **Endocrinal disorder (ED)** | Diabetes |
| **Fever (FV)** | Fever |
| **Gastro intestinal ailments (GIA)** | Dysentery |
| | Gastric trouble |
| | Indigestion |
| | Stomachache |
| **Genito urinary problem (GUP)** | Urinary problem |
| **Hair care (HC)** | Hairloss |
| | Dandroff |
| **Kidney problem (KP)** | Kidney stone |
| **Liver problem (LP)** | Jaundice |
| **Poisonous bite (PB)** | Scorpion sting |
| | Snake bite |
| **Respiratory syndrome disorder (RSD)** | Asthma |
| | Cough |
| **Skeleton Muscular System Disorder (SMSD)** | Body pain |
| | Bone fracture |
| | Rheumatism |

**Table.4** Family use value of pteridophytes during survey

| Family | No. of species | FUV |
|---|---|---|
| **Adiantaceae** | 3 | 1.1 |
| **Asplniaceae** | 2 | 1.0 |
| **Blechnaceae** | 1 | 1.0 |
| **Cyatheaceae** | 1 | 1.5 |
| **Dennastadtiaceae** | 1 | 1.0 |
| **Dryopteridaceae** | 1 | 1.0 |
| **Gleichniaceae** | 1 | 1.5 |
| **Lomariopsidaceae** | 1 | 1.0 |
| **Lycopodiaceae** | 1 | 1.0 |
| **Marattiaceae** | 1 | 1.0 |
| **Marsileaceae** | 1 | 1.0 |
| **Oleandraceae** | 3 | 1.0 |
| **Polypodiaceae** | 5 | 1.1 |
| **Pteridaceae** | 5 | 1.0 |
| **Selaginellaceae** | 1 | 1.0 |
| **Schizaceae** | 1 | 1.2 |
| **Tectariaceae** | 1 | 1.0 |
| **Thelypteridaceae** | 1 | 1.0 |
| **Woodsiaceae** | 2 | 1.1 |

**Table.5** Informants consensus factor (ICF) values of ailment categories

| Ailment category | Number of use reports | Number of species | ICF |
|---|---|---|---|
| **Dental care** | 9 | 5 | 0.50 |
| **Dermatological infection disorder** | 19 | 11 | 0.44 |
| **Ear, Nose &Tongue** | 9 | 4 | 0.62 |
| **Endocrinal disorder** | 5 | 2 | 0.75 |
| **Fever** | 5 | 2 | 0.75 |
| **Gastro intestinal ailments** | 19 | 7 | 0.66 |
| **Genitor urinary problem** | 3 | 2 | 0.50 |
| **Hair care** | 7 | 3 | 0.66 |
| **Kidney problem** | 3 | 2 | 0.50 |
| **Liver problem** | 5 | 1 | 1.00 |
| **Poisonous bite** | 4 | 3 | 0.33 |
| **Respiratory syndrome disorder** | 13 | 6 | 0.58 |

**Table.3** Ethnomedicinal pteridophytes used by the studied people in Virajpet taluk of Kodagu district

| Scientific name, Family, Habit | FC | RFC | UV | IAR | Parts used | Ailment category: No of use reports | FL | Preparation | Application |
|---|---|---|---|---|---|---|---|---|---|
| ***Adiantum capillusveneris*** **(Adiantaceae)-Terristrial** | 2 | 0.1 | 1.0 | 0 | Leaf, Stem | DC:(Mouth blister)<br>ED:(Diabetes)<br>RSD:(Cough) | 50<br>50<br>50 | Raw<br>Powder<br>Decoction | Oral<br>Oral<br>Oral |
| ***Adiantum incisum*** **Forrsk (Adiantaceae)-Terristrial** | 4 | 0.2 | 1.0 | 0.66 | Leaf, Whole plant | GUP:(Urinary problem)<br>GIA:(Dysentery) | 25<br>75 | Decoction<br>Decoction | Oral<br>Oral |
| ***Adiantum phillipense*** **(Adiantaceae)-Terristrial** | 9 | 0.45 | 1.0 | 0.75 | Leaf, Whole plant | ED:(Diabetes)<br>PB:(Snakebite)<br>DID:(Wounds) | 44.44<br>22.22<br>33.33 | Powder<br>Juice<br>Paste | Oral<br>Oral<br>Topical |
| ***Angiopteris helferiana*** **(Marathiaceae)-Terristrial** | 4 | 0.2 | 1.0 | 0.66 | Leaf | GIA: (Indigestion)<br>HC:(Hairloss) | 50<br>50 | Soup<br>Powder | Oral<br>Topical |
| ***Asplenium formosum*****(Aspleniaceae)-Terristrial** | 3 | 0.15 | 1.0 | 1 | Leaf | DID:(Abscess) | 66.66 | Paste | Topical |
| ***Asplenium nidus*** **(Aspleniaceae)-Epiphyte** | 4 | 0.2 | 1.0 | 1 | Leaf | HC:(Dandroff) | 100 | Paste | Bath |
| ***Athyrium honenckerium*** **(Woodsiaceae)-Terristrial** | 1 | 0.05 | 1.0 | 0 | Root | PB:(Scorpion sting) | 100 | Decoction | Oral |
| ***Blechnum orientale*** **(Blechnaceae)-Terristrial** | 3 | 0.15 | 1.0 | 1 | Stem | ENT:(Earache) | 100 | Decoction | Topical |
| ***Bolbitis subcrenata*** **(Lomariopsidaceae)-Terristrial** | 2 | 0.1 | 1.0 | 1 | Whole plant | DID:(Wounds) | 100 | Paste | Topical |
| ***Cyathea gigantean*** **(Cyatheaceae)-Terristrial** | 2 | 0.1 | 1.5 | 0 | Whole plant | GIA:(Dysentery) | 50 | Decoction | Oral |
| ***Dicranopteris linearis*** **(Gleichniaceae)-Terristrial** | 4 | 0.2 | 1.5 | 0.66 | Leaf | RSD:(Asthma)<br>ENT:(Throat infection) | 75<br>75 | Juice<br>Decoction | Oral<br>Oral |
| ***Diplazium esculentum*** **(Woodsiaceae)-Terristrial** | 6 | 0.3 | 1.2 | 0.8 | Stem | RSD:(Cough)<br>GIA:(Stomachache) | 66.66<br>50 | Decoction<br>Juice | Oral<br>Oral |
| ***Drynaria quercifolia*** **(Polypodiaceae)-Epiphyte** | 11 | 0.55 | 1.2 | 0.7 | Whole plant, Root,Stem, Leaf | GIA:(Dysentery)<br>LP:(Jaundice)<br>ENT:(Earache)<br>(Throat infection)<br>RSD:(Asthma) | 45.45<br>45.45<br>.09<br>18.18<br>9.09 | Decoction<br>Decoction<br>Decoction<br>Decoction<br>Juice | Oral<br>Oral<br>Topical<br>Oral<br>Oral |
| ***Dryopteris cochleata*** **(Dryopteridaceae)-Terristrial** | 2 | 0.1 | 1.0 | 1 | Leaf | PB:(Snakebite) | 100 | Juice | Oral |
| ***Lycopodium cernum*** **(Lycopodiaceae)** | 1 | 0.05 | 1.0 | 0.0 | Whole plant | DID:(Wounds) | 100 | Paste | Topical |
| ***Lygodium flexiosum*** **(Schizaceae)-Terristrial** | 6 | 0.3 | 1.2 | 0.6 | Leaves, Root | FV:(Fever)<br>DID:(Scabies) | 50<br>33.33 | Decoction<br>Paste | Oral<br>Topical |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Marsilea minuta* (Marsileaceae)-Hydrophyte** | 1 | 0.05 | 1.3 | 0 | Fiddles | DC:(Toothache) | 100 | Raw | Chewing |
| ***Microsorium membranaceum* (Polypodiaceae)-Epiphyte** | 3 | 0.15 | 1.0 | 0.5 | Leaf, Whole plant | DC:(Mouth blister)<br>DID:(Wounds) | 100<br>33.33 | Raw<br>Paste | Oral<br>Topical |
| ***Microsorium punctatum* (Polypodiaceae)-Epiphyte** | 1 | 0.05 | 1.0 | 0 | Whole plant | DID:(Wounds) | 100 | Paste | Topical |
| ***Nephrolepsis cordifolia (*Oleandraceae)-Terristrial** | 4 | 0.2 | 1.0 | 0.66 | Root, Whole plant | RSD:(Cough)<br>DID:(Wounds) | 75<br>25 | Decoction<br>Paste | Oral<br>Topical |
| ***Nephrolepsis exaltata* (Oleandraceae)-Terristrial** | 4 | 0.2 | 1.0 | 0.66 | Fiddle, Leaf | DC:(Toothache)<br>KP:(Kidney stone) | 50<br>25 | Raw<br>Decoction | Chewing<br>Oral |
| ***Nephrolepsis multiflora* (Oleandraceae)-Terristrial** | 3 | 0.15 | 1.0 | 1 | Rhizome | SMSD:(Knee pain) | 100 | Decoction | Oral |
| ***Parahemiotitiscordata* (Pteridaceae)-Terristrial** | 1 | 0.05 | 1.2 | 0 | Spores | HC:(Hairloss) | 100 | Powder | Topical |
| ***Pitrogrammecalamelanos*(Pteridaceae)-Terristrial** | 5 | 0.25 | 1.0 | 0.5 | Leaf, Spores | DC:(Mouth blister)<br>KP:(Kidneystone)<br>GIA:(Gastric problem) | 40<br>40<br>40 | Leaf<br>Decoction<br>Decoction | Oral<br>Oral<br>Oral |
| ***Pteridium revolutum*(Pteridaceae)-Terristrial** | 3 | 0.15 | 1.0 | 1 | Whole plant | GIA:(Dysentery) | 100 | Decoction | Oral |
| ***Pteris biaurita* (Pteridaceae)-Terristrial** | 1 | 0.05 | | 0 | Whole plant | SMSD:(Bodypain)<br>GIA:(Dysentery | 50<br>50 | Juice<br>Decoction | Oral<br>Oral |
| ***Pteris vittata* (Pteridaceae)-Terristrial** | 2 | 0.1 | 1.0 | 0 | Stem, Leaf | RSD:(Cough)<br>DID:(Wounds) | 50<br>50 | Decoction<br>Paste | Oral<br>Topical |
| ***Pyrrosia pillosoides* (Polypodiaceae)-Epiphyte** | 1 | 0.05 | 1.0 | 0 | Leaf | SMSD:(Bone fracture) | 100 | Paste | Topical |
| ***Pyrrosia porosa* (Polypodiaceae)-Epiphyte** | 1 | 0.05 | 1.0 | 0 | Whole plant | GIA:(Dysentery) | 100 | Decoction | Oral |
| ***Pteris pellucida*(Pteridaceae)-Terristrial** | 2 | 0.1 | 1.0 | 1 | Whole plant | DID:(Wounds) | 100 | Paste | Topical |
| ***Selaginella tenera*(Selaginellaceae)-Terristrial** | 5 | 0.25 | 1.0 | 0.75 | Leaf | GUP:(Urinary problem) | 40 | Decoction | Oral |
| ***Tectaria polymorpha* (Tectariaceae)-Terristrial** | 6 | 0.3 | 1.0 | 0.8 | Leaves | FV:(Fever)<br>DID:(Scabies) | 33.33<br>50 | Decoction<br>Paste | Oral<br>Topical |
| ***Thelypteris parasitica* (Tectariaceae)-Terristrial** | 2 | 0.1 | | 1 | Leaf | SMSD:(Rheumatism) | 100 | Paste | Topical |

**Fig.1** Habitat of collected ethnomedicinal pteridophytes in the study area

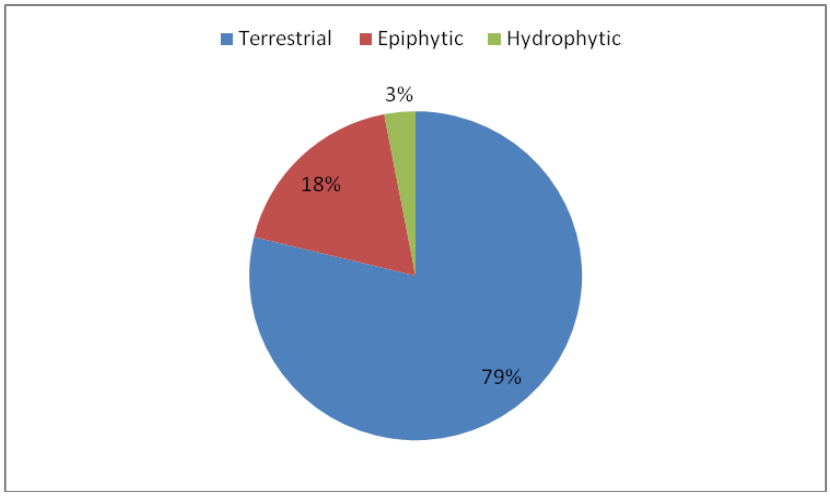



**Fig.2** Plant part used for the preparation of herbal medicines among people

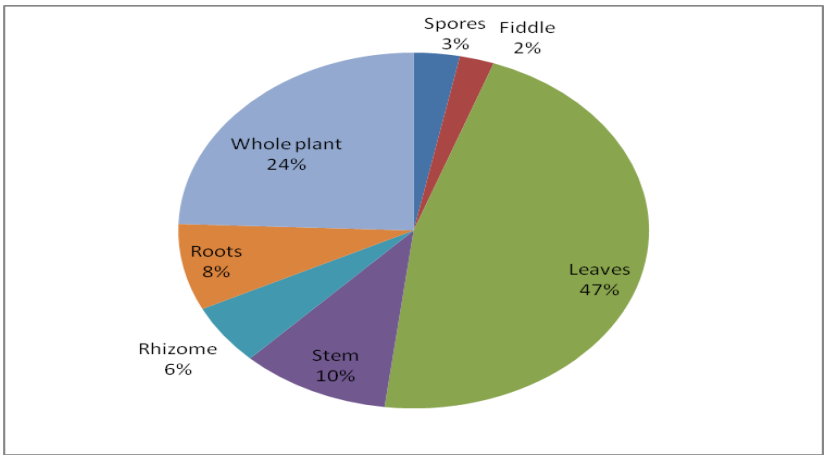



**Fig.3** Method of preparation of herbal medicine

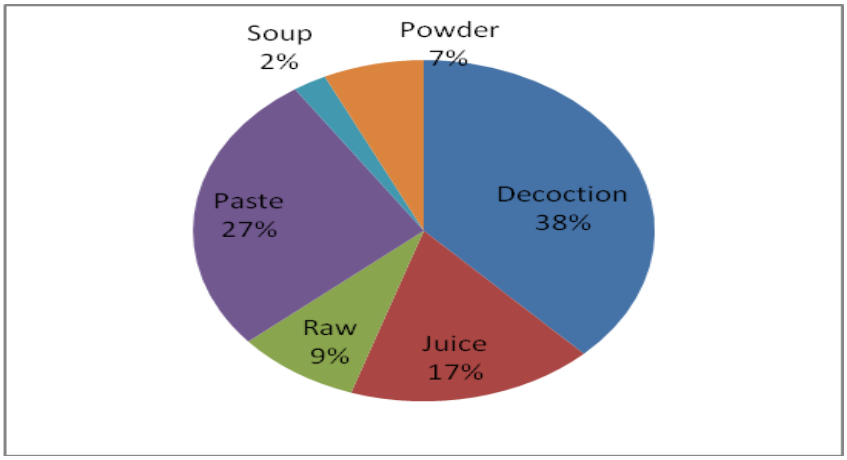
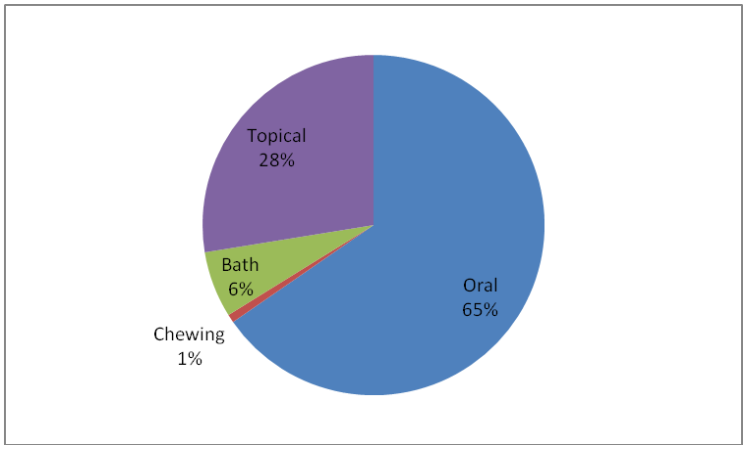


**Fig.4** Mode of application of herbal preparation by the respondents




The lowest UV were secured by *Adiantum capillus veneris, Adiantum incisumforrsk, Angiopterishelferiana, Asplenium formosum, Asplenium nidus, Athyrium honenackerium, Blechnum orientale, Bolbitissubcrenata, Dryopteris cochleata, Lycopodium cernum, Marsilea minuta, Microsorum punctatum, Nephrolepsis cordifolia, Nephrolepsis exaltata, Nephrolepsis multiflora, Parahemiotitis cordata, Pteris biaurita, Pteris vittata, Pyrrosia pillosoides, Pyrrosiaporosa, Pteris pellucid, Selaginella teneraTectaria polymorpha and Thelypteris parasitica* with UV of 1.0.

## Family use value

The most frequently used family of the present study was Cyatheaceae, and Gleichniaceae with the highest FUV of 1.5, followed by Schizaceae FUV 1.2, Adiantaceae, Polypodiaceae, Woodsiaceae with FUV of 1.1 and remaining families are reported with 1.0 FUV (Table 4).

## Fidelity level

In the present study, 15 species of pteridophytes were recorded with 100% fidelity level for a different type of illness category (Table 3). Plants with 100 FL were *Microsorium membranaceum, Pteridium revolutum, Dryopteris cochleata, Parahemiotitis cordata, Asplenium nidus, Athyrium honenckerium, Blechnum orientale, Pteris biaurita, Marsilea minuta, Nephrolepsis multiflora, Pyrrosiapollosoides, Bolbitissubcrenata, Lycopodium cernum, Microsorium punctatum.*

## Informant consensus factor

The degree of knowledge sharing among the respondents of the study area to treat specific ailment by specific plant species will have highest ICF value. Total 12 ailment categories ICF values were calculated using documented use reports by respondents in the present study area, and a number of taxa employs. The range of ICF is between 1-0.33. The highest ICF value recorded for LP (1) followed by GIA (0.66), HC (0.66),ENT (0.62), RSD (0.58), DC (0.5), GUP (0.5), KP (0.5), DID (0.4),and PB(0.3) (Table 5).

## Relative frequency citation

The local importance of each pteridophyte species of study area is obtained by using RFC value. In the present study, *Dryanaria quercifolia* was recorded with highest RFC (0.55), which tends to show that it was locally

important among all the interviewed respondents for the variety of diseases treatment like jaundice, throat infection, dysentery, asthma and earache (Table 3). It was followed by *Adiantum phillipense* (0.45), *Diplazium esculentum, Lygodium flexiosum, Tectaria polymorpha* (0.3 each). The low RFC value was reported for pteridophytes like *Athyrium honenckerium, Lycopodium cernum, Marsilea minuta, Microsorium punctatum, Parahemiotitis cordata, Pteris biaurita, Pyrrosiapillosoides* and *Pyrrosia porosa* (0.05 each). If the number of datasets is very small, it is not possible to determine the best strategy for evaluating the relative importance of species as shown by high correlation coefficient between RFC and UV and between the number of citations and respondents (Vitalini *et al.,* 2003).

## Informants agreement ratio

The highest IAR values for pteridophytes implies those pteridophytes were suggested by all the respondents for treating same disease, especially in case of single disease (Table 3). The highest IAR values reported by *Asplenium formosum, Aplenium nidus, Blechnum orientale, Bolbitissubcrenata, Dryopteris cochleata, Nephrolepsis mutiflora, Pteridium revolutum, Pteris pellucid* and *Thelypteris parasitica*. Low IAR value was recorded for *Adiantum capillus veneris, Athrium honenckerium, Cyathea gigantean, Lycopodium cernum, Marsilea minuta, Microsorium punctatum, Prahemiotitis cordata, Pteris biaurita, Pteris vittata, Pyrrosia pillosoides* and *Pyrrosia porosa.*

From this study, high incidence of ethnomedicinal pteridophytes in Kodagu region western ghats is accordance with studies of Gupta, 1960a; Gupta, 1960b; Foreau, 1961; Blasco, 1971; Parihar and Parihar, 2006; Benjamin and Manickam, 2007; Perumal, 2010; Singh and Upadhyaya 2012; Singh and Singh, 2012. The present study results contradict those studies (Kirtikar and Basu, 1935; Warrier *et al.*, 1996; Liu *et al*., 2012; Das and Choudhury, 2014) where low incidence of ethnomedicine has been reported for pteridophytes. Singh, 1999 reported 160 species of useful pteridophytes in India on the basis of phytochemical, pharmacological and ethnobotanical studies.

Dixit., 1974, Singh *et al.*, 2005, Shaikh and Chopade., 2015 also stated that Pteridaceae was the dominant family, followed by Polypodiaceae. The plant species having the highest fidelity level constitutes those are most preferred pteridophytes among the respondents in the treatment of particular illness category (Friedman *et al.*, 1986) and plants which are used in some respective manner are more likely to be biologically active (Trotter and Logan, 1986). Hence the plants with highest FL might be an indication of their good healing potential for specific ailment (Ayyanar and Igracimuthu, 2011). Scientifically it is proven that plants with highest FL values were reported to number of pharmacological effects.

In this present study, presume that pteridophytes have effective medicinal value. To my knowledge *Drynaria quercifolia* is abundantly available in the present study area, which is used for curing asthma, dysentery (accordance with Bhuyan., 1989), earache, jaundice, and throat infection.

*Dicranopteris linearis* leaves are used as a decoction to cure asthma (in accordance with Choudhary., 2014). *Dryopteris cochleata* leaves paste is used to cure snakebite (Sathiyaraj *et al.*, 2015). *Bolbitis subcrenata, Pyrrosia pillosoides* are rarely found in the study area and are used to cure wounds and bone fracture respectively.

In conclusion the present study unvieled that the study area has a vast diversity of medicinal pteridophytes, which are used for

improving the health of the people. These studied people provide medical practice among themselves. But younger generations are not interested to learn these traditional practices from their elders and are migrating to lucrative jobs in nearby urban areas. There is a need for further evaluating efficacy and safety of commonly used ethnomedicinal pteridophytes. As a result, the plants with high UV, IAR, RFC, and FL values in the present study could serve as promising plants for further biomedical studies.

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