Ethnomedicinal assessment of Irula tribes of Walayar valley of Southern Western Ghats, India

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Abstract The present study was aimed to explore the traditional knowledge of Irula tribal people who are practicing herbal medicine in Walayar valley, the Southern Western Ghats, India. A total number of 146 species of plants distributed in 122 genera belonging to 58 families were identified as commonly used ethnomedicinal plants by them. Interestingly, 26 new claims were also made in the present study. Through the data obtained from Irula tribal healers, the herbs were mostly used for medicine (40.4%) followed by trees (26.7%) and climbers (18.5%). In addition leaves were highly used for medicinal purposes, collected from 55 species (38%) followed by multiple parts from 18 species (12%). Acorus calamus is the species of higher use value (1.80) assessed to be prescribed most commonly for the treatment of cough. High informant consensus factor (1.0) obtained for insecticidal uses and cooling agent indicates that the usage of Canarium strictum and Melia dubia, and Mimosa pudica and Sesamum indicum respectively for that purposes had obtained high degree of agreement among the healers in using these species for the respective purposes. The most commonly used method of preparation was decoction (63%) followed by raw form (23%), paste (12%) and powder (2%). Therefore, it is suggested to take-up pharmacological and phytochemical studies to evaluate the species to confirm the traditional knowledge of Irulas on medicinal plants.

1. Introduction

Since few centuries, it is reported that about one fourth of the common drugs used worldwide are derived from plants (Ernst, 2005). Among the top 252 common formulations of the drugs, 219 are obtained from plants alone (Dobson, 1995). As the indigenous people are the more reliable source of information on medicinal plants (Iwu et al., 1999), for the past few decades, use of ethnomedicinal information in medicinal plant research
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2. Materials and methods

2.1. Study area and the tribal community

The study area, Walayar Valley, located in lower Western Ghats of Coimbatore district, Tamil Nadu State and Palghat district, Kerala State and the Palghat gap of both States covers an area of ca. 12500 ha (ca. 4200 ha in Tamil Nadu and 8300 ha in Kerala) between the altitude 370 and 450 m above msl. The geographical location of Walayar valley is 10° 77’ 0-3’ N and 76° 51’ 06-10’ E (Fig. 1). In this landscape, ca. 55% of the geographical area occupied by moist tropical semi-evergreen forest dominated by the tree species, Chloroxylon swietenia (Champion and Seth, 1968) is a protected forest for biodiversity conservation. The only inhabitant, Irula tribal community is permitted to do agriculture and collection of minor forest produce for their own use without posing any problem to species diversity. The Walayar river runs across the valley and its environ occupies ca. 2% of geographical area of this region. The agricultural land around the forests in this valley spreads over an area of ca. 40% of total geographical area. Annual rainfall ranges between 1500 and 2200 mm for the past 15 years.

The population of Irula tribes in Walayar valley is ca. 470, distributed in six hamlets each consists of 6–15 families. According to anthropological literature, Irula, one of the oldest tribal communities of India belongs to the Negrito race (migrated from Africa) which is one among the six ethnic groups that add to the racial mosaic of India (Von, 1982). Few elders in this community have the knowledge on medicinal uses of plants which are used mainly for first aid remedies like stomach problems, fever, headache, skin problems, etc.

2.2. Data collection

Six field visits were made in Walayar valley for getting ethnobotanical information during the period between October, 2013 and May, 2015 in all the six Irula habitations. Totally five age-old healers of in-depth knowledge on medicinal plants were identified for collecting information by interrogations. To determine the difference in knowledge among the Irula people, we cross checked the information collected with the other informants. The number of times, the healers repeated the same use of the plants was noted. For documenting the ethnobotanical information, field data sheet has been prepared and used. Local name of the plant, parts used for treatment, preparation methods, other plants used as ingredients, mode of administration etc., were collected for all medicinal plants used by Irulas. The plant species were identified with the help of keys provided in ‘The Flora of Presidency of Madras’ (Gamble and Fischer, 1935) and ‘The Flora of Tamil Nadu Carnatic’ (Matthew, 1983). Identified species were confirmed with Dr. V. Balasubramaniam, Plant Taxonomist in the Botany Department of Kongunadu Arts and Science College, Coimbatore. Herbarium specimens are maintained in the Botany Department of the College.

2.3. Ailment categories

Sixteen ailment categories were grouped (Cook, 1995) as presented elsewhere (Venkatachalapathi et al., 2016) on basis of the information provided by the Irula healers of Walayar valley.

2.4. Analysis of data

Informant consensus factor \( (F_a) \) was used to know the level of consensus among the informants or healers on the use of a plant for a particular ailment category. The Use Value \( (UV) \) is importance of a species in terms of its use in herbal remedy in relation to other species. Fidelity level \( (FL) \) is a tool to determine the most frequently used plant species as per the informants for the treatment of a disease in a particular ailment category. The \( UV, F_a \) and \( FL \) were calculated as per the formula of Trotter and Logan (1986), Phillips et al. (1994) and Friedmen et al. (1986) respectively.
3. Results

The Irula tribes of Walayar valley utilized a large number of 146 species of 122 genera belonging to 58 families for the treatment of various medicaments (Table 1). One of the interesting observations made in the study is that among the 146 ethnomedicinal plants, 26 claims from the species like Acacia leucophloea, Alstonia venenata, Artocarpus heterophyllus, Carissa spinarum, Curculigo orchioides, Hybanthus enneaspermus, Melia dubia and Solena amplexicaulis etc. are new and are reported for the first time (Table 1). Among the medicinal plant families represented, Fabaceae registered more number of 16 species followed by Euphorbiaceae (9 species), Lamiaceae (7 species) and Asclepiadaceae (6 species). Through the data obtained from life-form analysis, incidence of herbs (40.4%) were the primary source of medicine followed by trees (26.7%) and climbers (18.5%) (Fig. 2). In addition, among the utilization of various plant parts investigated, leaves of greater number of 55 species followed by whole plant (16 species), fruits (13 species) and rhizomes (12 species) were used by the tribal community for the treatment of common ailments such as cold, cough, jaundice, rheumatism etc. (Fig. 3). However, 18 species were exploited for their multiple usage in herbal remedy. They were administered either alone or in combination with parts of other species (Table 2). Generally, they were prescribed as decoction (63%), raw form (23%), paste (12%) and powders (2%) (Fig. 4).

Evidently, the current study documents, Acorus calamus as the most commonly used species prescribed for the treatment of cough by the Irula tribes with highest use value of 1.80 (Table 1). Other important species with high use value more than 1.20 were Abrus precatorius, Acacia leucophloea, Aerva lanata, Albizia amara, Cardiospermum canescens, Cassia auriculata, Dioscorea oppositifolia, Enicostemma littorale, Justicia adhatoda, Mimosa pudica, Mukia maderaspatana, Ocimum sanctum, Phyllanthus amarus, Piper betle, Plectranthus amboinicus, Plumbago zeylanica, Solanum surattense, Solena amplexicaulis, Syzygium cumini and Vitex negundo (Table 1). For employing informant consensus factor ($F_{ic}$), more than 50 use-reports were obtained for certain ailment categories viz., dermatological infections (82 use-reports, 45 species), skeleto-muscular system disorders (54 use-reports, 29 species) and gastro-intestinal ailments (50 use-reports, 30 species) (Table 3) and their $F_{ic}$ values ranged between 0.10 and 1.0 (Table 3). In this study, high $F_{ic}$ value was obtained for insecticidal uses (1.0) and cooling agent (0.85), whereas lower $F_{ic}$ was obtained for endocrinal disorders, especially diabetes (0.10). It was found that the Irula tribes commonly apply bark powders of Canarium strictum and Melia dubia for mosquito repellency and Mimosa pudica and Sesamum indicum as body coolant in Walayar valley. Appreciably, it has been determined that a high number of 100 species have obtained 100% fidelity and were highly preferred for treating particular ailments (Table 1).

4. Discussion

The information on therapeutic uses of 146 species (Table 1) collected from the Irula tribal community of Walayar valley was compared with that of the early publications (Rajendran and Henry, 1994; Vashistha, 2015). In this content, 26 new claims were documented and are reported for the first time in this study (Table 1). Remaining species were already reported for their various medicinal uses (Jain and Goel, 1995; Yesodharana and Sujana, 2007; Sanjeev et al., 2015). Among the 58 families represented, Fabaceae manifested the first dominant family in terms of species richness followed by Euphorbiaceae, Lamiaceae and Asclepiadaceae (Table 1). It has been reported already that the members of these families, owing to rich variety of secondary metabolites and Lamiaceae...
Table 1  List of medicinal plants used by the Irula tribal community in Walayar valley of Coimbatore district, Southern Western Ghats, India.

| S. No. | Botanical name and family | Local name | Use value | Parts used | Ailment category: number of use reports (ailments treated) | Preparation | Application |
|--------|--------------------------|------------|-----------|------------|------------------------------------------------------------|-------------|-------------|
| 1      | *Acacia catechu* Willd. (Mimosaceae) | Karungali | 0.60 Stem | GIA-1 (ulcer) | RSD-1 (chest pain) | Decoction | Oral |
| 2      | *A. leucoxphloea* (Roxb.) Willd. (Mimosaceae) | Vellvale maram | 1.40 Bark | DID-1 (wound healing) | GIA-3 (stomach problem) | Raw | Oral |
| 3      | *A. nilotica* (L.) Willd. (Mimosaceae) | Karuvale maram | 0.20 Stem and bark | DC-1 (toothache) | | Past | Oral |
| 4      | *Aegle marmelos* (L.) Corr. (Rutaceae) | Vilvam | 0.60 Leaf and fruit | ED-1 (diabetes) | | Raw | Oral |
| 5      | *Ailanthus excelsa* Roxb. (Simaroubaceae) | Perumaram | 0.20 Leaf | | | Decoction | Oral |
| 6      | *A. lebbeck* (L.) Benth. (Fabaceae) | Vagai | 0.20 Leaf | | | Raw | Oral |
| 7      | *Albizia amara* R. Br. (Apocynaceae) | Sinnappalai | 0.20 Latex | DID-1 (wound) | | Raw | Oral |
| 8      | *A. lebbeck* (L.) Benth. (Fabaceae) | Vagai | 0.20 Leaf | | | Raw | Oral |
| 9      | *Aristolochia venenata* R. Br. (Apocynaceae) | Pala | 0.60 Leaf and stem | SMSD-1 (arthritis) | DID-2 (antioxidant and skin diseases) | Decoction | Oral |
| 10     | *Artocarpus heterophyllus* Lam. (Rutaceae) | Vembu | 0.60 Whole plant | PB-1 (snake bite) | | Raw | Oral |
| 11     | *Azadirachta indica* A. Juss. (Meliaceae) | Sambirani chedi | 0.20 Bark | IC-1 (mosquito repellent) | | Powder | Topical |
| 12     | *Canarium strictum* Roxb. (Burseraceae) | Payira maram | 0.40 Leaf | | | Decoction | Oral |
| 13     | *Cantia dioecocum* Gaertn. Merr. (Rubiacae) | Chrukila | 0.40 Fruit and latex | Fvr-2 (fever) | | Decoction | Oral |
| 14     | *Carissa spinarum* Linn. (Apocynaceae) | Kakke maram | 1.00 Stem and flower | SMSD-1 (arthritis) | DID-2 (antioxidant and skin diseases) | Decoction | Oral |
| 15     | *Cassia fistula* Linn. (Caesalpinia) | Vembu | 0.60 Whole plant | PB-1 (snake bite) | | Raw | Oral |
| 16     | *Cinnamomum camphora* (L.) Nees & Eberm. (Lauraceae) | Pachkarpoomar | 0.20 Stem | | | Decoction | Oral |
| 17     | *Cinnamomum camphora caulata* Wight & Arn. (Burseraceae) | Kiluvai | 0.80 Leaf | Fvr-4 (fever) | | Decoction | Oral |
| 18     | *Dalbergia sissoo* Roxb. ex DC. (Fabaceae) | Eitte | 0.20 Stem | DID-1 (skin diseases) | | Past | Topical |
| 19     | *Dodonaea angustifolia* (L.f.) Benth. (Sapindaceae) | Baraley | 0.40 Leaf and bark | SMSD-2 (Bone fracture and head ache) | | Past | Topical |
| 20     | *Erythrina variegata* (L.) Merr. (Fabaceae) | Mullumurungai | 0.40 Leaf | RSD-2 (cold and cough) | | Decoction | Oral |
| 21     | *Ficus racemosa* Roxb. (Fabaceae) | Athi | 0.60 leaf, bark and fruit | CSCD-1 (blood purification) | GIA-1 (leucorrhoea) | Raw | Oral |
| 22     | *Limonia acidissima* L. (Rutaceae) | Vilampilam | 0.60 Fruit | | | Raw | Oral |
| 23     | *Mangifera indica* L. (Anacardiaceae) | Mavin mara | 0.80 Leaf, bark and fruit | DID-2 (Wound healing and antioxidant) | | Raw | Oral |
| 24     | *M. azedarach* L. (Meliaceae) | Malaivembu | 0.60 Bark | | | Decoction | Oral |
| 25     | *M. dubia* L. (Meliaceae) | Malaivembu | 0.60 Bark | | | IC-1 (mosquito repellent) | Decoction | Oral |
| S. No. | Local name | Use value | Parts used | Preparation | Application |
|-------|------------|-----------|------------|-------------|-------------|
| 26    | Churuli    | 0.20      | Flower     | GIA-1 (stomach ache) | Decoction | Oral |
| 27    | Murungai   | 0.40      | Leaf, flower and fruit | GUA-2 (male fertility) | Decoction | Oral |
| 28    | Nelli      | 0.60      | Fruit      | CSCD-1 (blood purification) | Raw | Oral |
|       |            |           |            | DID-1 (antioxidant) | Decoction | Oral |
|       |            |           |            | HC-1 (hair tonic) | Decoction | Oral |
| 29    | Pungam     | 0.40      | Seed       | SMSD-2 (rheumatism) | Decoction | Oral |
| 30    | Pucha      | 0.60      | Stem and fruit | SMSD-1 (head ache) | Decoction | Oral |
| 31    | Kiraampu   | 0.60      | Fruit      | GH-2 (piles and bathing) | Decoction | Oral |
|       |            |           |            | DC-3 (toothache) | Past | Topical |
| 32    | Naval      | 1.40      | Leaf, bark, fruit and seed | ED-4 (diabetes) | Raw | Oral |
| 33    | Puli       | 0.40      | Seed       | DID-2 (antioxidant) | Decoction | Oral |
| 34    | Marutu     | 0.20      | Bark       | GIA-1 (dysentery) | Decoction | Oral |
| 35    | Thanikai   | 0.20      | Bark       | RSD-1 (chest pain) | Decoction | Oral |
| 36    | Kadukkai   | 0.20      | Fruit      | GIA-1 (stomach pain) | Decoction | Oral |
| 37    | Palai      | 0.20      | Leaf       | DC-1 (toothache) | Past | Topical |
| 38    | Elanthai   | 0.60      | Leaf       | DID-3 (wound) | Past | Topical |
| 39    | Malai elanthai | 0.60  | Leaf | DID-3 (wound) | Past | Topical |
| 40    | Kutiyotti  | 0.60      | Latex      | GIA-1 (ulcer) | Decoction | Oral |
| 41    | Kattuelumichai | 1.00 | Fruit | SMSD-4 (body pain) | Decoction | Oral |
| 42    | Rattha choori | 0.80 | Whole plant | SMSD-4 (arthritis and joint pain) | Decoction | Oral |
| 43    | Vella Erukku | 0.20 | Latex | DID-1 (wound) | Raw | Oral |
| 44    | Elumichi   | 0.20      | Flower     | ED-6 (diabetes) | Raw and | Oral |
| 45    | Elanthi    | 0.60      | Leaf       | GIA-1 (dysentery) | Decoction | Oral |
| 46    | Sangam     | 0.20      | Leaf       | DID-1 (skin diseases) | Decoction | Oral |
| 47    | Valampuri edampuri | 0.20 | Fruit | ENT-1 (ear ache) | Decoction | Oral |
| 48    | Adalai     | 0.60      | Latex      | ENT-3 (mouth ulcer) | Decoction | Oral |
| 49    | Adatodai   | 1.20      | Leaf       | Fvr-6 (fever) | Decoction | Oral |
| 50    | Vadaikkutti| 0.20      | Leaf       | SMSD-1 (body pain) | Decoction | Oral |
| 51    | Unnichedi  | 0.40      | Leaf       | DID-2 (wound healing and antiinflammatory) | Past | Topical |
| 52    | Unnichedi  | 0.60      | Leaf       | DID-3 (wound healing) | Past | Topical |
| 53    | Maravalli  | 0.20      | Rhizome    | DID-1 (wound healing) | Past | Topical |
| 54    | Vellaippavattai | 0.80 | Leaf | PB-4 (snake bite) | Decoction | Oral |
| 55    | Amalpori   | 0.80      | Leaf       | PB-4 (snake bite) | Decoction | Oral |
Table 1  (continued)

| S. No. | Botanical name and family | Local name | Use value | Parts used | \(^a\)Ailment category: number of use reports (ailments treated) | Preparation | Application |
|--------|---------------------------|------------|-----------|------------|-------------------------------------------------|-------------|-------------|
| 56     | \(^1\)R. tetraphylla L. (Apocynaceae) | Pampukaaalahchendi | 0.60 | Leaf | PB-3 (snake bite) | Decoction | Oral |
| 57     | \(^1\)Solanum surattense L. (Solanaceae) | Kandankathiri | 1.20 | Whole plant | RSD-6 (cold and wheezing) | Decoction | Oral |
| 58     | \(^1\)Vitex negundo L. (Verbenaceae) | Notchi | 1.40 | Leaf | SMSD-7 (headache and body pain) | Decoction | Oral |
| 59     | Herbs | Thuththi | 0.80 | Whole plant | GH-4 (piles) | Decoction | Oral |
| 60     | \(^1\)Acalypha indica L. (Euphorbiaceae) | Kuppaimeni | 0.20 | Leaf | LP-1 (jaundice) | Decoction | Oral |
| 61     | \(^1\)A. fruticosa L. (Euphorbiaceae) | Vasambu | 1.80 | Rhizome | RSD-5 (cough) | Decoction | Oral |
| 62     | \(^1\)Achyranthes aspera L. (Amaranthaceae) | Nayuruvi | 0.40 | Whole plant | PB-2 (dog bite and poisonous bite) | Decoction | Oral |
| 63     | \(^1\)Acorus calamus L. (Acoraceae) | Poolai poo | 1.20 | Leaf | ED-6 (kidney stone) | Raw | Oral |
| 64     | \(^1\)Alpinia galanga L. (Zingiberaceae) | Kattukarunai | 1.00 | Rhizome | GUA-1 (menstrual problem) | Raw | Oral |
| 65     | \(^1\)Andrographis paniculata L. (Acanthaceae) | Neelavembu | 0.80 | Whole plant | PB-4 (snake bite) | Decoction | Oral |
| 66     | \(^1\)Anisomeles malabarica (LBR) (Lamiaceae) | Mitikirai | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 67     | \(^1\)Asystasia gangetica L. (Acanthaceae) | Vallarai | 0.60 | Whole plant | SMSD-1 (tumor) | Decoction | Oral |
| 68     | \(^1\)Centella asiatica L. (Apiaceae) | Vallukkai | 0.40 | Leaf | SMSD-1 (swelling) | Decoction | Oral |
| 69     | \(^1\)C. asiatica L. (Amaranthaceae) | Nilapanai | 1.20 | Rhizome | SMSD-1 (rheumatism) | Decoction | Oral |
| 70     | \(^1\)Cynodon dactylon L. (Cyperaceae) | Karbepoovale | 0.40 | Leaf | SMSD-1 (swelling) | Decoction | Oral |
| 71     | \(^1\)Cyperus rotundus L. (Cyperaceae) | Korai kilangu | 0.20 | Rhizome | SMSD-1 (head ache) | Decoction | Oral |
| 72     | \(^1\)Curcuma aromatica Salisb. (Zingiberaceae) | Kancatam | 0.20 | Whole plant | SMSD-1 (tumor) | Raw | Oral |
| 73     | \(^1\)Cleome aspera L. (Cleomaceae) | Karumpoondu | 0.20 | Leaf | SMSD-1 (headache and antiinflammatory) | Raw | Oral |
| 74     | \(^1\)Daucus carota L. (Apiaceae) | Ellukku sakkalathi | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 75     | \(^1\)Eclipta prostrata L. (Amaranthaceae) | Naikadugu | 0.80 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 76     | \(^1\)Eclipta prostrata L. (Amaranthaceae) | Karpooravalli | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 77     | \(^1\)Eugenia jambolana L. (Myrtaceae) | Kamyunist Alai | 0.20 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 78     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Karumpoondu | 0.20 | Leaf | SMSD-1 (headache and antiinflammatory) | Raw | Oral |
| 79     | \(^1\)Eucalyptus globulus L. (Myrtaceae) | Ellukku sakkalathi | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 80     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Naikadugu | 0.80 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 81     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Karpooravalli | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 82     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Kamyunist Alai | 0.20 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 83     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Karpooravalli | 0.40 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |
| 84     | \(^1\)Eupatorium cannabinum L. (Asteraceae) | Kamyunist Alai | 0.20 | Leaf | SMSD-1 (rheumatism) | Decoction | Oral |

(continued on next page)
Table 1  (continued)

| S. No. | Botanical name and family | Local name | Use value | Parts used | #Ailment category: number of use reports (ailments treated) | Preparation | Application |
|--------|---------------------------|------------|-----------|------------|-------------------------------------------------------------|-------------|-------------|
| 85     | *Eclipta prostrata L.* (Asteraceae) | Karisalankanni | 1.00      | Leaf       | HC-5 (hair tonic)                                           | Decoction   | Oral        |
| 86     | *Eletusine coracana* (L.) Gaertn. (Poaceae) | Kaelvaragu | 0.20      | Seed       | Fvr-1 (fever)                                              | Decoction   | Oral        |
| 87     | *Enicostemma axillare* L. (Gentianaceae) | Vellarugu | 0.20      | Leaf       | PB-1 (snake bite)                                          | Decoction   | Oral        |
| 88     | *E. littorale* Blume. (Gentianaceae) | Vishnukiranthi | 1.20      | Whole plant | Fvr-1 (fever)                                              | Decoction   | Oral        |
| 89     | *Evolvulus alsinoides* L. (Convolvulaceae) | Vellarugu | 0.20      | Leaf       | PB-6 (snake bite)                                          | Decoction   | Oral        |
| 90     | *Hemidesmus indicus* L. (Ascipladaceae) | Nannari | 0.80      | Root       | Fvr-1 (fever) GIA-3 (stomach problem)                      | Decoction   | Oral        |
| 91     | *Hybanthus enneaspermus* L. (Violaceae) | Orithalthamarai | 1.00      | Whole plant | GUA-5 (male fertility)                                    | Raw and     | Oral        |
| 92     | *Hygrophylla auriculata* Schum. (Acanthaceae) | Voyal chullai | 0.20      | Leaf       | DID-1 (menstrual problem)                                  | Decoction   | Oral        |
| 93     | *Hyptis sauveolens* (L.) Poit. (Lamiaceae) | Karunchsatachi | 0.20      | Leaf       | DID-1 (eczema)                                             | Past        | Topical     |
| 94     | *Leonotis nepetaefolia* (L.) W. T. Ait. (Fabaceae) | Theanthumpai | 0.20      | Leaf       | DID-1 (eczema)                                             | Past        | Topical     |
| 95     | *Mimosa pudica* L. (Fabaceae) | Thootal singi | 1.20      | Whole plant | CA-4 (body coolant)                                       | Decoction   | Oral        |
| 96     | *Notonia grandiflora* DC. (Astraceae) | Muyalkathu | 0.20      | Leaf       | ENT-1 (ear ache)                                           | Decoction   | Oral        |
| 97     | *Ocimum sanctum* L. (Lamiaceae) | Nallathulasi | 1.20      | Leaf       | RSD-6 (cold and cough)                                     | Decoction   | Oral        |
| 98     | *O. tenuiflorum* L. (Lamiaceae) | Karut tulasi | 0.40      | Leaf       | RSD-2 (cold and cough)                                     | Decoction   | Oral        |
| 99     | *Oxalis corniculata* L. (Oxalidaceae) | Paliakirai | 0.40      | Whole plant | Fvr-1 (fever) ED-1 (kidney stone)                         | Decoction   | Oral        |
| 100    | *Phyllanthus amarus* Schum. & Thonn. (Euphorbiaceae) | Kizhaanelli | 1.20      | Whole plant | GUA-5 (sterility in women)                                 | Raw         | Oral        |
| 101    | *P. maderaspatensis* L. (Euphorbiaceae) | Civappu kilanelli | 0.60      | Fruit      | GIA-3 (indigestion)                                       | Raw and     | Oral        |
| 102    | *P. reticulatus* Poir. (Euphorbiaceae) | Karunelli | 0.40      | Leaf       | GH-1 (piles)                                               | Decoction   | Oral        |
| 103    | *Physalis minima* L. (Solaniaceae) | Kupanti | 0.40      | Leaf       | GIA-1 (gas trouble)                                        | Decoction   | Oral        |
| 104    | *Pluchtranthus anthoines* (Lour.) Spreng. (Lamiaceae) | Karpooravalli | 1.20      | Leaf       | RSD-6 (cold and cough)                                     | Decoction   | Oral        |
| 105    | *Plumbago zeylanica* L. (Plumbaginaceae) | Chittiramoolam | 1.20      | Flower     | GUA-5 (sterility in women)                                 | Decoction   | Oral        |
| 106    | *Polygala arvensis* Willd. (Polygalaceae) | Vecinankai | 0.20      | Root       | SMSD-1 (inflammation)                                      | Decoction   | Oral        |
| 107    | *Pseudaarthria viscida* (L.) Wight & Arn. (Fabaceae) | Moovilai | 0.60      | Stem and root | CSSD-1 (heart problem) Fvr-1 (fever) GIA-1 (gas trouble) | Decoction   | Oral        |
| 108    | *Sansevieria roxburghiana* Schult. (Agavaceae) | Sanam | 0.80      | Leaf       | ENT-4 (ear ache)                                           | Decoction   | Oral        |
| 109    | *Sesamum indicum* L. (Pedaliaceae) | Elifu | 0.80      | Seed       | CA-4 (body coolant)                                       | Decoction   | Oral        |
| 110    | *Sida rhombifolia* L. (Malvaceae) | Kurunthotti | 0.40      | Leaf and root | GIA-1 (gas trouble)                                       | Decoction   | Oral        |
| 111    | *Spermacoce latifolia* Aubl. (Rubiaceae) | -            | 0.20      | Leaf       | DID-1 (wound healing)                                      | Past        | Topical     |
| 112    | *Tephrosia purpurea* (Linn.) Pers. (Fabaceae) | Kozhunji | 0.20      | Root       | GIA-1 (stomach problem)                                    | Decoction   | Oral        |
| 113    | *Tragia involucrata* L. (Euphorbiaceae) | Kanchori | 0.20      | Fruit      | SMSD-1 (one side headache)                                 | Raw and     | Oral        |
| 114    | *Tridax procumbens* L. (Astraceae) | Vettukkaya puntu | 0.80      | Leaf       | DID-4 (wound healing)                                      | Past        | Topical     |
## Table 1 (continued)

| S. No. | Botanical name and family | Local name | Use value | Parts used | ²Ailment category: number of use reports (ailments treated) | Preparation | Application |
|--------|---------------------------|------------|-----------|------------|----------------------------------------------------------|-------------|-------------|
| 115    | ¹Fernonia cinerea (L.) Less. (Asteraceae) | Mukuttipoondu | 0.20 | Leaf | SMSD-1 (paralysis) | Decoction | Oral |
| 116    | ¹Vigna radiata (L.) R. Wilczek. (Fabaceae) | Pasipayaru | 0.20 | Seed and latex | DID-1 (skin disease) | Past | Topical |
| 117    | ¹Withania somnifera L. (Solanaceae) | Amukkarakmizangu | 0.60 | Rhizome | SMSD-3 (nervous disorders) | Decoction | Oral |
| 118    | Climbers ¹Abrus precatorius L. (Fabaceae) | Kundu mani | 1.20 | Seed, latex and root | ENT-4 (eye pain) | Decoction | Oral |
| 119    | ¹Acacia nilotica (Lour.) Merr. (Fabaceae) | Seeyakkai | 0.40 | Fruit | DC-1 (toothache) | Powder | Oral |
| 120    | ¹Amelocissus tomentosa (Roth) Planch. (Vitaceae) | Kattukodi mundiri | 0.80 | Fruit | DID-4 (antioxidant and skin diseases) | Powder | Oral |
| 121    | ¹Asparagus racemosus Willd. (Asparagusaceae) | Thanneervittan | 1.20 | Rhizome | ED-6 (urinary problem) | Decoction | Oral |
| 122    | ¹Antigonon leptopus Hook. & Arn. (Polygonaceae) | Kodi roja | 0.20 | Root | DID-1 (anti-inflammatory) | Decoction | Oral |
| 123    | ¹Aristolochia bracteata L. (Aristolochiaceae) | Aaduthannapalai | 0.80 | Leaf | DID-3 (eczema, scabies and ringworm infection) | Decoction | Oral |
| 124    | ¹A. indica L. (Aristolochiaceae) | Aaduthannapalai | 0.80 | Leaf | DID-3 (eczema, scabies and ringworm infection) | Decoction | Oral |
| 125    | ¹Basella rubra L. (Basellaceae) | Kodippasali | 0.40 | Leaf | CSCD-2 (anaemia and increase WBC) | Raw and Decoction | Oral |
| 126    | ¹Cardiospermum halicacabum Wall. (Sapindaceae) | Mudakathan | 1.40 | Leaf | SMSD-6 (joint pain) | Raw | Oral |
| 127    | ¹C. halei 'Caracalla' (L.) Baker (Sapindaceae) | Mudakathan | 1.00 | Leaf | GIA-1 (stomach ache) | Powder | Oral |
| 128    | ¹Cissus quadrangularis L. (Vitaceae) | Pirandai | 1.00 | Stem | GIA-5 (indigestion and inducing appetite) | Powder | Oral |
| 129    | ¹Coccinia grandis L. (Cucurbitaceae) | Kovai | 0.20 | Leaf | LP-1 (jaundice) | Decoction | Oral |
| 130    | ¹Cucurbita moschata Duch. ex Lam. (Cucurbitaceae) | Poosanai | 0.20 | Fruit | GH-1 (increase weight) | Raw and Decoction | Oral |
| 131    | ¹Cuscuta chinensis L. (Cucurbitaceae) | Manjavulluwa | 0.20 | Stem | SMSD-1 (bone fracture) | Past | Oral |
| 132    | ¹Cyclea pelata L. (Menispermaceae) | Padaikilangu | 0.40 | Whole plant | GIA-1 (stomach ache) | Decoction | Oral |
| 133    | ¹Dioscorea oppositifolia L. (Dioscoreaceae) | Kavvala kodi | 1.60 | Rhizome | GIA-4 (piles) | Powder | Oral |
| 134    | ¹D. pentaphylla L. (Dioscoreaceae) | Kaattuvalli | 0.20 | Rhizome | DID-4 (wound) | Powder | Oral |
| 135    | ¹Gloriosa superba L. (Lilaceae) | Kanuvalikodi | 0.20 | Root | GUA-1 (abortion) | Decoction | Oral |
| 136    | ¹Gynnemsa sylvestre R. Br. (Asclepiadaceae) | Chirukurunjan | 1.00 | Leaf | ED-5 (diabetes) | Decoction | Oral |
| 137    | ¹Impea starphyllina Roemer & Schultes. (Convulvulaceae) | Onan kodi | 0.20 | Latex | GH-1 (cracked feet) | Raw | Oral |
| 138    | ¹'Mukia maderaspatana (Linn.) M. Roemer. (Cucurbitaceae) | Mosumuosukkai | 1.40 | Leaf | GH-7 (piles) | Decoction | Oral |
| 139    | ¹Pergularia daemia Forsk. (Asclepiadaceae) | Vaeliparruthi | 0.40 | Leaf and fruit | RSD-1 (asthma) | Decoction | Oral |
| 140    | ¹Piper betle L. (Piperaceae) | Vetarli | 1.20 | Leaf | GIA-1 (gas trouble) | Decoction | Oral |
| 141    | ¹P. nigrum L. (Piperaceae) | Kurumilag | 0.40 | Seed | GIA-4 (indigestion) | Decoction | Oral |
| 142    | ¹Sarcostemma acuminatum Roxb. (Asclepiadaceae) | Sommanum | 0.40 | Latex | RSD-2 (cold and cough) | Past | Topical |
| 143    | ¹'Solinga amplexicaulis L. (Cucurbitaceae) | Pulivanchi | 1.40 | Rhizome | DID-1 (antiinflammatory) | Decoction | Oral |

(continued on next page)
members due to more types of volatile oils are getting importance in healing the illness (Sanjeev et al., 2015). From the life-form analysis, herbs were found to be the most common functional group of plants followed by trees and climbers (Fig. 2). In general, richness of herbaceous species than any other life-forms is higher in any natural community which may lead to more use of herbs for medicinal purposes than the species of other habits (Giday et al., 2010; Pushpakarani and Natarajan, 2014; Swapna, 2015). In support of this fact, Venkatachalapathi et al. (2014), also enumerated a higher number of herbaceous species than the other life-forms in various vegetations of Attukal area of Western Ghats, an adjoining part of Walayar valley.

Among the assortment of plant parts utilized, leaves were most frequently used by the Irula tribal community for healing purpose (Fig. 3). These results were in accordance with previous literatures that several traditional healers prescribe mainly the leaves for the preparation of medicines (Gonzalez et al., 2010; Amjad et al., 2015). Umapriya et al. (2011) found that the Irula tribals of Palamalai hills of Coimbatore, India also utilize leaves mainly for their therapeutic applications. Perhaps a more likely explanation for the high utility of leaves is that they can be collected very easily than the other parts (Ayyanar and Ignacimuthu, 2011). Furthermore, leaves are the active sites of photosynthesis and hence the production of a variety of bioactive entities (Bahmani et al., 2014). Obviously, for remedies preparations decoction form was prescribed by Irulas in Walayar valley (Fig. 4). Decoction is the major form of medicine preparation in some tribal communities worldwide (Ahirwar, 2010; Bahmani et al., 2014; Amjad et al., 2015). Raw consumption, paste and powder forms were also prepared and prescribed by the Irulas of Walayar. Further, Irula healers informed that preparation of medicine was made by using single plant part or in combination with parts of more than one species (Table 2). The study revealed that a single mode of medicine preparation was more predominant (52.7%) in comparison to multiple modes (26.01%). Umapriya et al. (2011) also reported that the single mode of medicine preparation by the Irula tribe in Palamalai hills of Western Ghats, is the most common type. Similar observations for other tribal communities were documented elsewhere (Erinoso and Aworinde, 2012; Savithramma et al., 2012; Senthilkumar et al., 2013; Shosan et al., 2014). The single mode of medicine preparation by the Irula tribe may be attributed to the presence of phytochemical constituents such as saponins, tannins, alkaloids, alkenyl phenols, flavonoids, terpenoids, phorbol esters and sesquiterpene lactones in the individual herals which lead to the desired healing effect (Lixin et al., 2014). A single herb may even contain more than one

| S. No. | Botanical name and family | Local name | Use value | Parts used | #Ailment category: number of use reports (ailments treated) | Preparation | Application |
|--------|--------------------------|------------|-----------|------------|------------------------------------------------------------|-------------|-------------|
| 144    | Tylophora indica R. Br. (Asclepiadaceae) | Mekachettu | 0.20 | Leaf | RSD-1 (asthma) | Decoction | Oral |
| 145    | Loranthus flacata Linn. f. (Loranthaceae) | Pulluruvi | 0.20 | Bark | GUA-1 (menstrual problem) | Decoction | Oral |
| 146    | Viscum album Mistletoe. (Loranthaceae) | Pulluruvi | 0.80 | Fruit | CSCD-3 (heart problem) SMSD-1 (tumour) | Decoction | Oral |

Species of new claim; #Ailment categories: Circulatory system/cardiovascular diseases (CSCD), Cooling agent (CA), Dental care (DC), Dermatological infections/diseases (DID), Ear, nose, throat problems (ENT), Endocrinal disorders (ED), Fever (Fvr), Gastro-intestinal ailments (GIA), General health (GH), Genito-urinary ailments (GUA), Hair care (HC), Liver problem (LP), Poisonous bite (PB), Respiratory system diseases (RSD), Skeleto-muscular system disorders (SMSD) and Insecticidal (IC); species with 100% fidelity level.
Table 2  Ingredients added for the preparation of herbal medicines by the Irula healers.

| S. No. | Botanical name | Other plants added | Other ingredients added |
|-------|----------------|---------------------|------------------------|
| 1     | A. catechu     | Alpinia galanga, Cleome monophylla and Cyanotis axillaris (chest pain) | Milk                   |
| 2     | A. leucophloea | Angium salvifolium, Cyclea peltata, Dioscorea pentaphylla and Tephrosia purpurea (wound healing and stomach ache) | Coconut oil and honey   |
| 3     | A. nilotica    | Curcuma aromatica (toothache) | Coconut oil             |
| 4     | A. marmelos    | Curcuma aromatica, Piper nigrum and P. betle (diabetes) | Coconut oil and honey   |
| 5     | A. excelsea    | Curcuma aromatica, Piper nigrum and P. betle (menstrual problem) | Coconut oil             |
| 6     | A. salvifolium | Acacia catechu, Terminalia arjuna, T. bellerica and Curculio orchids (chest pain) | Milk and honey          |
| 7     | A. lebbek      | Anisomeles malabarica, Cleome aspera and Curcuma aromatica (eczema) | Coconut oil             |
| 8     | A. venenata    | Curcuma aromatica (wound healing) | Coconut oil             |
| 9     | A. heterophyllus | Ficus racemosa, Begonia malabaraha, Pedalium murex and Cardiospermum halicacabum (arthritis and skin diseases) | Coconut oil             |
| 10    | A. indic      | Ficus racemosa, Alpinia galanga, Phyllanthus emblica and Aloysia gangetica (blood purification) | Milk and honey          |
| 11    | A. strictum   | Allium sativum and Curcuma aromatica (mosquito repellent) | –                      |
| 12    | A. dioecicum  | Curcuma aromatica, Piper nigrum and P. betle (dog bite and stomach ache) | Salt                   |
| 13    | C. fistula    | Justicia adhatoda, Oxalis corniculata and Hemidesmus indicus (fever) | Milk                   |
| 14    | C. camphora   | Helicteres isora, Cleome viscosa and Costus specious (ear ache) | Coconut oil             |
| 15    | C. canadens   | Ocimum sanctum, Cleome monophylla and Piper nigrum (fever) | Milk/honey             |
| 16    | D. sisoo      | Curcuma aromatica (skin diseases) | Coconut oil             |
| 17    | D. angustifolia | Cardiospermum halicacabum, C. canasense, Curculio orchids and Cissus quadrangularis (joint pain) | Egg white yoke and coconut oil |
| 18    | E. variegata  | Ocimum tenuiflorum, Piper nigrum and P. betle (cough and cold) | Honey                  |
| 19    | F. racemosa   | Hemidesmus indicus, Pavetta indica, Vettiera zizanioides, Curcuma aromatica and Alainthus excelsa (leucorrhoea) | Milk and honey          |
| 20    | L. indica     | Hemidesmus indicus, Pavetta indica, Vettiera zizanioides, Curcuma aromatica, and Cardiospermum canasense and Alainthus excelsa (leucorrhoea and arthritis) | Milk and honey          |
| 21    | M. indica     | Curcuma aromatica (wound healing) | Coconut oil             |
| 22    | M. azedarach  | Hemidesmus indicus, Terminalia arjuna, T. bellerica, Centella asiatica and Cynodon dactylon (stomach ache) | Milk                   |
| 23    | M. dubia      | Allium sativum, Canarium strictum and Curcuma aromatica (mosquito repellent) | –                      |
| 24    | M. ferrae     | Curcuma aromatica, Piper nigrum and P. betle (dog bite and stomach ache) | Sugar                  |
| 25    | P. emblica    | – | Sugar, milk and honey |
| 26    | P. pinnata    | Cardiospermum halicacabum and Cardiospermum canasense (rheumatism) | Neem oil               |
| 27    | S. cumini     | – | Milk and honey          |
| 28    | T. indica     | Curcuma aromatica, Piper nigrum and P. betle (scorpion bite) | Coconut oil             |
| 29    | T. arjuna     | Alpinia galanga, Curculio orchids, Cleome monophylla, Terminalia bellerica and Cyanotis axillaris (chest pain) | Coconut oil, sugar and honey |
| 30    | T. bellerica  | Alpinia galanga, Curculio orchids, Cleome monophylla, Terminalia bellerica and Cyanotis axillaris (chest pain) | Coconut oil, sugar and honey |
| 31    | T. chebula    | Curcuma aromatica, Piper nigrum and P. betle (dog bite and stomach ache) | Salt                   |
| 32    | W. tinctoria  | Curcuma aromatica (toothache) | –                      |
| 33    | Z. mauritiana | Curcuma aromatica (wound healing) | Coconut oil             |
| 34    | Z. enophylla  | Curcuma aromatica (wound healing) | Coconut oil             |
| 35    | Shrubs         | Curcuma aromatica, Piper nigrum and P. betle (ulcer and pimples) | Milk and coconut oil    |

(continued on next page)
| S. No. | Botanical name               | Other plants added                                      | Other ingredients added               |
|-------|-----------------------------|--------------------------------------------------------|---------------------------------------|
| 36    | *Atalantia monophylla*      | *Adhatoda vasica, Eucalyptus globules* and *Ocimum basilicum* (body pain) | Honey                                 |
| 37    | *Begonia malabarica*        | *Cardiospermum halicacabum, C. canasense* and *Cissus quadrangularis* (arthritis and joint pain) | Egg white yoke                        |
| 38    | *Cassia auriculata*         | —                                                      | Milk                                  |
| 39    | *Citrus limon*              | —                                                      | Salt and sugar                        |
| 40    | *Clerodendrum inerme*       | *Carrum aromatica* (skin diseases)                     | Coconut oil                           |
| 41    | *Helicteres isora*          | *Cleome viscosa and Costus specious* (ear ache)        | Coconut oil                           |
| 42    | *Jatropha gossypifolia*     | —                                                      | Coconut oil                           |
| 43    | *Justicia adhatoda*         | *Syzigium cumini, Ocimum sanctum, Begonia malabarica, Piper nigrum and P. betle* (fever) | —                                     |
| 44    | *J. gendarussa*             | —                                                      | Coconut oil                           |
| 45    | *Lantana camara*            | *Carrum aromatica* (wound healing)                    | Coconut oil                           |
| 46    | *L. wightii*                | *Carrum aromatica* (wound healing)                    | Coconut oil                           |
| 47    | *Manihot esculenta*         | —                                                      | Coconut oil                           |
| 48    | *Pavetta indica*            | *Achyranthes aspera, Enicostemma littorale, Rauvolfia serpentina, R. trityphilla, Ocimum sanctum, Piper nigrum and P. betle* (snake bite) | —                                     |
| 49    | *Rauvolfia serpentina*      | *Achyranthes aspera, Enicostemma littorale, Ocimum sanctum, Rauvolfia trityphilla, Piper nigrum and P. betle* (snake bite) | —                                     |
| 50    | *R. trityphilla*            | *Achyranthes aspera, Enicostemma littorale, Rauvolfia serpentina, Ocimum sanctum, Piper nigrum and P. betle* (snake bite) | —                                     |
| 51    | *Solamun surattense*        | *Piper nigrum, Zingiber officinale and Asystasia gangetica* (wheezing) | Food                                  |
| 52    | *Vitex negundo*             | *Cleome viscosa, Cynodon daetylon, Euphorbia hirta, Ocimum sanctum and Piper nigrum* (snake bite) | Coconut oil                           |
| 53    | Herbs                       | *Cassia auriculata and Cynodon daetylon* (piles)       | Castor oil                            |
| 54    | *Acalypha indica*           | *Piper nigrum and P. betle* (jaundice)                 | Milk                                  |
| 55    | *Achyranthes aspera*        | *Citrus limon, Vitex negundo, Piper nigrum and P. betle* (dog bite and poisonous bite) | —                                     |
| 56    | *Acorus calamus*            | *Ocimum sanctum, Piper nigrum and P. betle* (cough)    | Honey                                 |
| 57    | *Curculio orchids*          | *Citrus limon, Pseudarthria viscid, Terminalia arjuna and T. bellerica* (heart problem) | Egg white yoke                        |
| 58    | *Cleome monophylla*         | *Cardiospermum halicacabum and C. canasense* (joint pain) | Milk/honey                            |
| 59    | *C. viscosa*                | *Commiphora ctcuate, Ocimum sanctum and Piper nigrum* (fever) | —                                     |
| 60    | *Coles aromaticus*          | *Piper nigrum and P. betle* (cough and cold)           | Coconut oil                           |
| 61    | *Cymbopogon citratus*       | *Allium sativum and Piper nigrum* (diarrhoea)          | Sugar/salt                            |
| 62    | *Cynodon daetylon*          | —                                                      | Sugar                                  |
| 63    | *Desmodium gangeticum*      | *Carrum aromatica, Piper nigrum, Hemidesmus indicus and Ocimum sanctum* (fever) | Gingelly oil and Neem oil             |
| 64    | *Eclipta prostrata*         | *Phyllanthus emblica, Hibiscus rosa-siensis, Cleome viscose and Cynodon daetylon* (hair tonic) | Coconut oil                           |
| 65    | *Eleusine coracana*         | —                                                      | Salt                                   |
| 66    | *Enicostemma axilliare*     | *Achyranthes aspera, Enicostemma littorale, Rauvolfia trityphilla, Hibiscus rosa-siensis, Ocimum sanctum, Piper nigrum and P. betle* (snake bite) | Salt                                  |
| 67    | *E. littorale*              | *Achyranthes aspera, Enicostemma axilliare, Rauvolfia trityphilla, Hibiscus rosa-siensis, Ocimum sanctum, Piper nigrum and P. betle* (snake bite) | Salt                                  |
| 68    | *Evolvulus alsinodes*       | —                                                      | Sugar                                  |
| 69    | *Hemidesmus indicus*        | *Ocimum sanctum and Piper nigrum* (fever)               | Milk and honey                         |
| 70    | *Hybanthus enneaspermus*    | —                                                      | —                                     |
| S. No. | Botanical name | Other plants added | Other ingredients added |
|-------|---------------|--------------------|------------------------|
| 71    | Hygrophylla auriculata | –                  | Honey                  |
| 72    | Mimosha pudica | Alpinia galanga, Piper nigrum and Zingiber officinale (asthma) | Honey                  |
| 73    | Notonia grandiflora | Heliceres isora, Cleome viscosa and Costus specios (ear ache) | Coconut oil            |
| 74    | Ocinum sanctum | Piper nigrum and P. betle (cough and cold) | Honey                  |
| 75    | O. tenuiflorum | Piper nigrum and P. betle (cough and cold) | Honey                  |
| 76    | Oxalis corniculata | Hemidesmus indicus, Piper nigrum and P. betle (fever) | Honey                  |
| 77    | Phyllanthus amarus | Andrographis paniculata, Piper nigrum and Piper betle (jaundice) | Milk                   |
| 78    | P. reticulatus | Abutilon indicum, Cassia auriculata and Cynodon dactylon (piles) | –                      |
| 79    | Physalis minima | Piper nigrum and P. betle (gas trouble) | Milk                   |
| 80    | Plectranthus amboinicus | Piper nigrum and P. betle (cough and cold) | Honey                  |
| 81    | Plumbago zeylanica | Hemidesmus indicus, Pavetta indica, Vetiveria zizanioides, Hybanthus enneaspermus, Begonia malabarica and Piper nigrum (sterility in women) | Milk/honey             |
| 82    | Pseudarthria viscosa | Terminalia arjuna, T. bellerica, T. chebula, Curculio orchids, Phyllanthus emblica and Desmodium gangeticum (heart problem and fever) | Coconut oil, Milk/honey |
| 83    | Sansevieria roxburghiana | Heliceres isora, Cleome viscosa and Costus specios (ear ache) | Coconut oil            |
| 84    | Sida rhombifolia | Curcuma aromatica, C. neilgherrensis, Piper nigrum, Zingiber officinale, Wrightia tinctoria and Asparagus racemosus (tumor) | Coconut oil, salt, milk/honey |
| 85    | Spermacoce latifolia | Commelina benghalensis and Curcuma aromatica (wound healing) | Coconut oil            |
| 86    | Tephrosia purpurea | Hemidesmus indicus, Cymbopogon citratus and Zingiber officinale (stomach problem) | Milk/honey             |
| 87    | Tridax procumbens | Curcuma aromatica (wound healing) | Coconut oil            |
| 88    | Vernonia cinerea | Curcuma aromatica, Cardiopermum halicacabum and C. canasense (paralysis) | Egg white yoke         |
| 89    | Vigna radiata | Curcuma aromatica (skin disease) | Coconut oil            |
| 90    | Withania somnifera | Szyzygium cumini, Begonia malabarica, Piper nigrum and P. betle (fever) | Milk/honey             |
| 91    | Climbers Abrus precatorius | Asparagus racemosus, Acalypha indica, Citrus limon, Curcuma aromatica, Piper nigrum, Allium sativum, Cleome viscosa and Costus specios (delivery pain and eye pain) | Milk/honey             |
| 92    | Ampelocissus tonentosa | Curcuma aromatica and Citrus limon (antioxidant and skin diseases) | Honey and coconut oil  |
| 93    | Antigonus lepota | Curcuma aromatica, Solena amplexicaulis and Citrus limon (anti-inflammatory) | Coconut oil            |
| 94    | Asparagus racemosus | Allium sativum, Citrus limon, Cyperus rotundus and Phyllanthus amarus (urinary problem) | Butter milk/cow milk   |
| 95    | Aristolochia bracteolata | Achyranthes aspera, Aristolochia indica, Curcuma aromatica, Zingiber officinale, Wrightia tinctoria, Citrus limon, Vitex negundo, Piper nigrum and P. betle (snake bite, eczema, scabies and ringworm infection) | Coconut oil            |
| 96    | Basella rubra | Basella alba, Phyllanthus emblica, Centella asiatica and Ficus racemosa (anaemia and increase WBC) | Honey                  |
| 97    | Cardiospermum canasense | Cardiospermum halicacabum, C. canasense, Curculio orchids, Cissus quadrangularis and Dodonea angustifolia (joint pain) | Pungam oil, egg white yoke and coconut oil |
| 98    | Cissus quadrangularis | Allium cepa, A. sativum and Murraya koenigii (indigestion and inducing appetite) | Aasafoetida            |
| 99    | Coccinia grandis | Azadirachta indica, Phyllanthus amarus, Ocimum sanctum, Piper nigrum and P. betle (jaundice) | Milk and honey         |
| 100   | Cucurbita moschata | Allium cepa, A. sativum and Murraya koenigii (increase weight) | Gingelly oil           |
| 101   | Cuscuta chinensis | Cardiospermum halicacabum, Cissus quadrangularis and Curculio orchids (joint pain) | Egg white yoke and coconut oil |
| 102   | Cychea pelata | Hemidesmus indicus, Pavetta indica and Vetiveria zizanioides (stomach ache and tonic) | Milk                   |
| 103   | Dioscorea oppositifolia | Abutilon indicum, Cassia auriculata and Cynodon dactylon (piles) | Castor oil             |

(continued on next page)
Decoction of cough. Similar to our study, Arunachalam and used species well recognized by all informants for the treatment (Table 1). Among them, clearly demonstrated that some plants have high use value dosage according to the age of the patients. The present study the preparation of medicines and they were administrated in additional knowledge, certain specific plant parts were used for and neem for the preparation of paste. According to their tra-

Walayar valley utilize oils of coconut, castor, gingelly, pongam (Ayyanar and Ignacimuthu, 2011), Irula tribal healers of used alone (Parasuraman et al., 2014). Similar to Kani tribe only when potentiated with other plants, but not evident when actions of active constituents of certain herbals are significant sent study may be explained that certain pharmacological used for multiple modes of preparation of medicine in the pre-

ergistically with each other in producing pharmacological aforementioned phytochemical constituents which works synergistically with each other in producing pharmacological effect (Bahmani et al., 2015). A sizeable number of 38 species used for multiple modes of preparation of medicine in the present study may be explained that certain pharmacological actions of active constituents of certain herbs are significant only when potentiated with other plants, but not evident when used alone (Parasuraman et al., 2014). Similar to Kani tribe (Ayyanar and Ignacimuthu, 2011), Irula tribal healers of Walayar valley utilize oils of coconut, castor, gingelly, pongam and neem for the preparation of paste. According to their traditional knowledge, certain specific plant parts were used for the preparation of medicines and they were administrated in dosage according to the age of the patients. The present study clearly demonstrated that some plants have high use value (Table 1). Among them, Acorus calamus is the most specifically used species well recognized by all informants for the treatment of cough. Similar to our study, Arunachalam and Parimelazhagan (2011) also reported that this species is generally prescribed by the Hooralis tribes of Kadambur hills of Eastern Ghats, India for treating cough and other throat problems. Saikia et al. (2013) in Assam and Venkatachalapathi et al. (2015) in nearby Walayar valley also found that A. cala-

mus is mainly prescribed for the treatment of cough. In con-

trast, certain plant species were reported to have very low use values (0.20) in the present study as they were used for very little number of specific uses (Table 1).

4.1. Informant consensus factor ($F_{ic}$)

$F_{ic}$ arrived for any species depends upon its availability and the knowledge of informants on medicinal plants (Venkatachalapathi et al., 2015). In the present study, the illnesses were grouped into 16 major ailment categories and their $F_{ic}$ values ranged between 0.10 and 1.0 per illness category (Table 3). The average $F_{ic}$ value for all ailment categories was 0.55, indicating a moderate level of informant consensus. However, it was not comparable to that of other studies in Tamilnadu by Ragupathy et al. (2008) among the “Malasars” of Velliangiri holy hills and Ayyanar and Ignacimuthu (2011) among the Kani tribes in Tirunelveli hills, the only two investiga-
tions with quantitative assessment in Tamil Nadu that showed the average $F_{ic}$ values, more than 0.70. Remarkably, high $F_{ic}$ obtained in the present study for the two ailment categories viz., insecticidal uses (1.0) and cooling agent (0.85), indicating a higher level of consensus among the Irula healers for the usage of species for these categories. They commonly apply bark powder of the species, Canarium strictum and Melia dubia particularly in avoiding mosquito bites through topical application. The insecticidal property category was not included in standardized illness groupings by Cook
(1995). However, it was included in the present study, as the Irula tribes were commonly using these two species for their mosquito repellency very regularly. It may be explained that as the Walayar valley is situated in Palakkad gap of Western Ghats, rainfall through south-west monsoon is highly effective (ca. 1100 mm between June and September alone). This moist condition results in thick vegetation of various types and the wetted soil with dense plant formation becomes the favourable site for insects including mosquitoes. Higher informant consensus was recorded by other workers also for certain ailment category as per the informants (Table 1). This fact indicates that all most of them were used for the treatment of single ailment category are suggested for further studies in the line of phytochemistry and pharmacology and hence to identify them adequately. However, consensus for certain illness categories viz., insecticidal property and cooling agent shows the effectiveness and reliability of the species viz., *Canarium strictum* and *Melia dubia*, and *Mimosa pudica* and *Sesamum indicum* on healing the respective ailment. Several new claims made in the study showed the unique knowledge of Irulas of this region on medicinal plants. Recognizing more species with high fidelity level and greater use value indicates the presence of rich varieties of phytoconstituents in these species. The species of high use value, new claims and greater fidelity level and the taxa on which higher consensus were obtained among the informants for using them in particular ailment category are suggested for further studies in the line of phytochemistry and pharmacology and hence to identify them for pharma industries.

### 4.2. Fidelity level

Among the 146 plants used for medicinal purposes by the Irula tribal community, interestingly it has been determined that a high number of 100 species have obtained 100% fidelity and most of them were used for the treatment of single ailment category as per the informants (Table 1). This fact indicates that all these 100 species were the highly preferred plants for treating the illness of particular ailment category due to their high healing potential. In agreement with the present findings, the species viz., *Acacia nilotica*, *Acorus calamus*, *Cassia auriculata*, *Cissus quadrangularis*, *Tridax procumbens* and *Vitex negundo* available in Walayar landscape were already reported to have 100% fidelity in Tirunelveli hills (Ayyanan and Ignacimuthu, 2011).

### 5. Conclusion

This wide spectrum of usage of 146 plant species indicates their strong traditional knowledge on medicinal plants. The moderate, average $F_i$ value (0.55) reveals that the consensus on traditional knowledge on medicinal plants among the Irula healers of this landscape has not been shared adequately. However, consensus for certain illness categories viz., insecticidal property and cooling agent shows the effectiveness and reliability of the species viz., *Canarium strictum* and *Melia dubia*, and *Mimosa pudica* and *Sesamum indicum* on healing the respective ailment. Several new claims made in the study showed the unique knowledge of Irulas of this region on medicinal plants. Recognizing more species with high fidelity level and greater use value indicates the presence of rich varieties of phytoconstituents in these species. The species of high use value, new claims and greater fidelity level and the taxa on which higher consensus were obtained among the informants for using them in particular ailment category are suggested for further studies in the line of phytochemistry and pharmacology and hence to identify them for pharma industries.

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### Table 3  Ethnobotanical consensus index for traditional medicinal plant use categories.

| S. No. | Ailment category | Number of use-reports ($N_u$) | Number of taxa ($N_t$) | Informants' consensus factor ($F_{ic}$) |
|--------|------------------|-----------------------------|------------------------|---------------------------------------|
| 1.     | Circulatory system/cardiovascular diseases (CSCD) | 14                          | 8                      | 0.46                                  |
| 2.     | Cooling agent (CA) | 8                           | 2                      | 0.85                                  |
| 3.     | Dental care (DC) | 6                           | 4                      | 0.40                                  |
| 4.     | Dermatological infections/diseases (DID) | 82                          | 45                     | 0.45                                  |
| 5.     | Ear, nose, throat problems (ENT) | 19                          | 8                      | 0.61                                  |
| 6.     | Endocrinial disorders (ED) | 31                          | 28                     | 0.10                                  |
| 7.     | Fever (Fvr) | 20                          | 11                     | 0.47                                  |
| 8.     | Gastro-intestinal ailments (GIA) | 50                          | 30                     | 0.40                                  |
| 9.     | General health (GH) | 23                          | 9                      | 0.63                                  |
| 10.    | Genito-urinary ailments (GUA) | 25                          | 12                     | 0.54                                  |
| 11.    | Hair care (HC) | 8                           | 4                      | 0.57                                  |
| 12.    | Liver problem (LP) | 8                           | 3                      | 0.71                                  |
| 13.    | Poisonous bite (PB) | 29                          | 12                     | 0.60                                  |
| 14.    | Respiratory system diseases (RSD) | 35                          | 16                     | 0.55                                  |
| 15.    | Skeleto-muscular system disorders (SMSD) | 54                          | 29                     | 0.47                                  |
| 16.    | Insecticidal (IC) | 2                           | 2                      | 1.00                                  |
| Total  |                 | 414                         | 223                    |                                       |

Average $F_{ic} = 0.55$
plants. We also wish to express our gratitude to the Irula tribal healers of Walayar landscape for providing information on medicinal plants.

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