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<p>A study and survey of Medicinal plants used by local peoples in Jawadhu hills of Thiruvannamalai, Tamilnadu, India</p>		
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<p>History of Article:</p> <p>Received 22 September 2015 Received in revised from 27 September 2015 Accepted 10 October 2015 Available online 25 October 2015</p>	<p>ABSTRACT</p> <p>The study of ethnobotanical was carried out along with the ethnic groups (Thiruvannamalai district) in the South Western Ghats of India. The present study revealed the use of 20 species of plants distributed in 20 genera belonging to 16 families which were commonly used by most of the Jawadhu hills. For thousands of years, medicinal plants have played an important role throughout the world in treating and preventing a variety of diseases. Traditional healer's people in Jawadhu hills still depend on medicinal plants and most of them have a general knowledge of medicinal plants which are used for first aid remedies, to treat cough, cold, fever, headache, poisonous bites and some simple ailments.</p> <p>Keywords: Medicinal plants, Traditional healers, Jawadhu hills.</p>	

INTRODUCTION

The Rig-Veda written during 4500 BC to 1600 BC is believed to be the oldest repository of human knowledge about medicinal usages of plants in Indian subcontinent (Puspagadan, 1995). According to WHO (World Health Organization, 2001), about 80% of the world population, especially in the rural areas depends on herbal medicine for their healthcare needs. The ethnic people residing in different geographical belts of India depends on wild plants to meet their basic requirements and all the ethnic communities have their own pool of secret ethnomedicinal and ethno-pharmacological knowledge about the plants available in their surroundings (Muthukumarasamy *et al.*, 2003; Rana *et al.*, 2010; Rajendran *et al.*, 2002 and Jain, 2001), which has been serving rural people with its superiority. Due to changing life style, extreme secrecy of traditional healers and negligence of youngsters, the practice and dependence of ethnic societies in folk medicines is in rapid decline globally, therefore, ethnobotanical exploitation and documentation of indigenous knowledge about the usefulness of such a vast pool of genetic

resources is deliberately needed (Viswanadhan, 2004; Saikia *et al.*, 2003; Kumar *et al.*, 2003 and Singh, 2004). We selected rural areas of Adilabad district and adjoining areas for ethnomedicinal investigation because this area is very rich in phytodiversity and tribal population.

Biodiversity brings enormous benefits to mankind from direct harvesting of plants and animals for food, medicine, fuel construction material, and other uses to aesthetic, cultural, recreational and research values. Traditional medicinal plants use in India is about 4000 years old. Herbs had been used by all cultures throughout history. It was an integral part of the development. About 80% of the people in developing countries use traditional medicines for their health care (Ghosh, 2003).

In less developed/developing countries 80% of the people still rely only on traditional medicine obtained from local plants and 85% of traditional medicines involve the use of plant extracts (Farnsworth *et al.*, 1985). Since adequate hospital facilities and allopathic doctors are absent in much of the tropics, any destruction of tropical forests would concomitantly destroy the primary healthcare network involving local plants

and traditional ‘doctor’ (Balick *et al.*, 1996). About 90% of medicinal plants used in industries are collected from the wild. Over 70% of the plant collection involves destructive harvesting because of the use of the parts like roots, bark, wood, stem and the whole plant in case of herbs.

MATERIAL AND METHODS

Survey of ethno botanical properties of Jawadhu hills Thiruvanamalai

In order to assess the consumption of indigenous medicinal plants, survey was carried out during the year, 2015 in the forest areas of Jawadhu hills, Thiruvanamalai district in Tamilnadu, India. To get maximum information the survey was widened diagonally during the rainy season. The information on medicinal uses of the indigenous plants has been described after gathering it from local people, experienced aged rural folk, traditional herbal medicine practitioners, local herbal drug sellers and the information collected from the available literature. A total of 275 inhabitants were interviewed. Randomly people were selected of which 160 men and 115 women of age 25 and above ($x = 57.92$) were interviewed in their local language, that is, Tamil.

In addition, direct plant observation and identification was done with the help of local healers known as ‘Maruthuvar’. A structured feedback form was used to draw information from the resource persons using standard methods (Martin, 1995). Information on medicinal plants, local name, plant parts used and mode of administration for curing diseases has been recorded. Plants collected during the surveys were identified with the help of published regional flora (Gamble, 1935; Matthew, 1983). The identified plant specimens were then confirmed with the herbaria of botanical SURVEY of India (BSI), Southern circle, Coimbatore, India. The specimens were deposited in the Herbarium, Department of Botany, Presidency College, Chennai 600 005. Voucher specimen numbers along with other details are given in (Table 1) and the collected data contains the list of plants of different families with their traditional uses, plant parts used and their mode of administration which are listed in alphabetical order.

Ailment categories

Based on the information obtained from the traditional healers in the study area, all the reported ailments were categorized into 15 categories (Table 1) viz. gastro-intestinal ailments (GIA), dermatological infections/diseases (DID), respiratory systems diseases (RSD), genito-urinary ailments (GUA), fever (Fvr), skeleton-muscular system disorders (SMSD), poisonous bites (PB), circulatory system/cardiovascular diseases (CSCD), endocrinal disorders (ED), liver problems (LP), dental care (DC), hair care (HC), ear, nose, throat problems (ENT), cooling agents (CA) and general health (GH). Several diseases were placed in one ailment category based on the body systems treated.

Data analysis

Informant consensus factor (Fic)

The informant consensus factor (Fic) was used to see if there was agreement in the use of plants in the ailment categories between the plant users in the study area. The Fic was calculated using the following formula (Heinrich *et al.*, 1998):

$$F_{ic} = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

Where N_{ur} refers to the number of use-reports for a particular ailment category and N_t refers to the number of taxa used for a particular ailment category by all informants. The product of this factor ranges from 0 to 1. A high value (close to 1.0) indicates that relatively few taxa are used by a large proportion of the informants. A low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness.

Use value (UV)

The relative importance of each plant species known locally to be used as herbal remedy is reported as use value (UV) and it was calculated using the following formula (Phillips *et al.*, 1994):

$$UV = \frac{\sum U}{n}$$

Where UV is the use value of a species, U is the number of use reports cited by each informant for a given plant species and n is the total number of informants interviewed for a given plant. The UV is helpful in determining the plants with the

highest use (most frequently indicated) in the treatment of an ailment. UVs are high when there are many use-reports for a plant and low when there are few reports related to its use.

Fidelity level (FL)

To determine the most frequently used plant species for treating a particular ailment category by the informants of the study area, we calculated the fidelity level (FL). The FL was calculated using the following formula (Friedmen *et al.*, 1986):

$$FL \% = \frac{N_p}{N} \times 100$$

Where Np is the number of use-reports cited for a given species for a particular ailment category and N is the total number of use reports cited for any given species. Generally, high FLs are obtained for plants for which almost all use-reports refer to the same way of using it, whereas low FLs are obtained for plants that are used for many different purposes (Sriithi *et al.*, 2009).

Relative importance (RI)

We calculated the relative importance (RI) of each medicinal plant based on the normalized number of pharmacological properties (PH) attributed to it and the normalized number of body systems (BS) it treated. Data on medicinal uses were organized according to the PH attributed to each taxon (e.g. analgesic, anti-inflammatory etc.) and to the specific body systems treated (e.g. skin diseases, fever, asthma etc.). The RI was calculated using the following formula (Bennett and Prance, 2000)

$$RI = \frac{Re PH + Rel BS}{2} \times 100$$

Where RI is the relative importance, PH is the number of reported pharmacological properties for the given plant, ReelPH is the relative number of pharmacological properties

(PH of a given plant/maximum PH of all reported species), BS is the number of body systems treated and Rel BS is the relative number of body systems treated (BS of a given plant/maximum BS of all reported species).

RESULT AND DISCUSSION

Documentation of indigenous ethnomedicinal knowledge from the traditional healer of Jawadhu hills, Thiruvanamalai district

The present study revealed the use of 20 species of plants distributed in 20 genera belonging to 16 families which were commonly used by most of the Jawadhu hills traditional healers for the treatment of 8 types of ailments. The prominent family was Asclepidaceac with two species, followed by Acanthaceac and Sterculiaceac with two species respectively. For each reported species were provided the botanical name of the plant, family, voucher specimen number, local (Tamil) name, life form, use value, parts used, ailments treated, method of preparation, mode of administration and relative importance.

The medicinal uses of plants gathered in our study were compared with the previously published information from other parts of India. In this present study found that there were 20 claims from the plants such as *Acacia melanoxylon* R. Br., *Adhatoda vasica* Wallch, *Alangium salvifolium* (L.f) Wagerin in Engl., *Barleria lupulina* Lindl., *Basella rubra* L., *Bryophyllum pinnatum* (Lam.) Oken., *Cassia occidentalis* L., *Decalepis hamiltonii* Wight & Arn., *Guazum tomentosa* Kunth., *Helicteres isora* L., *Heliotropium indicum* L., *Hemidesmus indicus* (L.) R. Br., *Leptadenia reticulata* Retz., *Melia azadarachta* L., *Rauwolfia serpentine* (L.) Benth., *Santalum album* L., *Stachytarpheta indica* (L.) Vahl., *Strychnos nux-vomica* L., *Vitexag nuscatus* L., were reported for the first time from the study area (new claims were given with asterisk mark in Table-1.

Table-1. List of commonly herb medicinal used plants of Jawadhu Hills Traditional healer

Botanical Name	Family	Habit	Vernacular Name	Part Used	Mode of preparation	Medicinal properties
<i>Acacia melanoxylon</i>	Mimosoideae	Tree	Semaivel	Stem bark	Extract	Stem bark extract has been used for treating

R.Br.						fever, leucorrhoea, piles and erysipelas. It is also used in treatment of haemoptysis, gonorrhoea and chest infection.
<i>Adhatoda vasica</i> Wallich,	Acanthaceae	Shrub	Adhatoda	Leaf	Decoction	The leaves of Vasica are shows stimulant effect on the respiratory system. Vasica shows an antispasmodic and expectorant effect, and has been used for centuries with much success to treat asthma, chronic bronchitis, and other respiratory conditions
<i>Alangium salvifolium</i> (L.f) Wagerin in Engl.	<i>Alanginaceae</i>	Tree	Azhinthal	Leaf	Decoction	The dried leaves, has traditionally been used to treat various ailments in folk medicine for antifertility. The leaves can be used as hypoglycemic, anti-diabetic, anti- protozoal, anti-cholinesterase, antispasmodic and as an anti-arthritic.
<i>Barleria lupulina</i> Lindl.	Acanthaceae	Shrub	Chemuli	Leaf	Leaf extract	The leaf juice is given to stop bleeding when cut and leaf paste is used as poultice to relief pain. It has strong inhibitory effect against acne-inducing bacteria.
<i>Basella rubra</i> L.	<i>Basellaceae</i>	Climber	Cylonpasala	Leaf	Leaf juice	The leaf juice is a demulcent, used in cases of dysentery. Stem and leaves are used as mild laxative, diuretic and antipyretic
<i>Bixa orellana</i> L.	<i>Bixaceae</i>	Tree	Sappiravirai	Leaf and Seed	Fresh juice	The shoots and young leaves are used for feverish infections including gonorrhea dysentery and hepatitis. They are believed to protect the liver and reduce cholesterol. The leaves and seeds are also used to soothe an irritated stomach that is suffering from excessively spicy

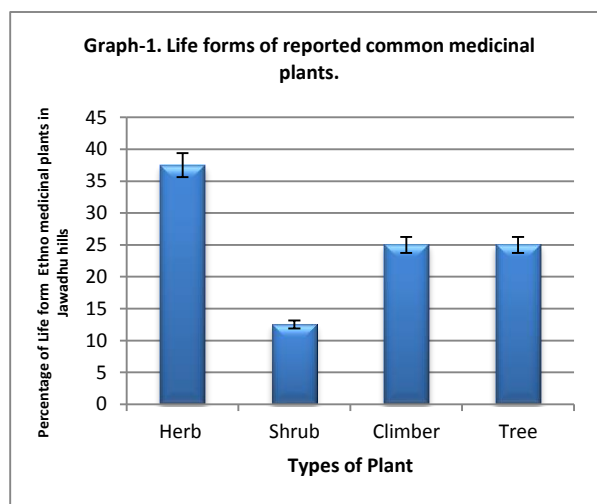
						food
<i>Bryophyllum pinnatum</i> (Lam.) Oken	Crassulaceae	Herb	Katipotalkut ipodum	Leaf	Roasted leaf	Roasted leaf externally used for rheumatoid arthritis, tummy bug, injuries from falls, numbness of limbs, bruise, bum and ulcer.
<i>Cassia occidentalis</i> L.	Caesalpiniaceae	Herb	Pei thagarai	The roots, leaves and seeds	Decoction	The leaves have been used as a folklore medicine for hepatotoxicity treatment. Also used in treatment for intestinal worms, internal parasites, skin parasites
<i>Decalepis hamiltonii</i> Wight & Arn.	Asclepiadaceae	Climber	Malainanari	Root	Powder	The root used as demulcent, diaphoretic, diuretic and tonic. It is useful in the loss of appetite, fever, skin disease, diarrhea and in nutrition disorders. This root extract is taken orally to rejuvenate the body
<i>Guazum tomentosa</i> Kunth,	Sterculiaceae	Tree	Kattuutharac ham	Whole plant	Powder	Traditionally whole plant is used for its multipurpose benefits, e.g. As astringent, in cold, in cough, in diarrhea, as diuretic, in dysentery, in venereal diseases, etc.
<i>Helicteres isora</i> L.	Sterculiaceae	Shrub	Valampurikai	Fruit	Fruit pod extracts or oil form	Fruit pod extracts are found to be anti-dysenteric, vermifuge. It is also used in flatulence, stomach ache, gout and as astringent. Fruits are fried in mustard oil and used to apply on the body of new born babies to relieve pain.
<i>Heliotropium indicum</i> L.	Boraginaceae	Herb	Thekoti	Leaf	Leaf Extract	It's most important local application is for skin lesions, wounds, abscesses, gastric and varicose ulcerations, rashes and warts.
<i>Hemidesmus indicus</i> (L.) R. Br.	Asclepiadaceae	Climber	Nanari	Root	Leaf extract or decoction	Root extract used for the treating Eczema, Erysipelas, Psoriasis, and Urticaria from heat and

						aggravated Pitta. It 'cleans' the blood, stops itching and reduces suppuration. It is also used in Auto immune disease such as Rheumatism, Rheumatoid arthritis and also used in nephritic disorders.
<i>Leptadenia reticulata</i> Retz.	Asclepiadaceae	Climber	Jeevanti	Leaf and root	Extract	The leaves and roots are used in skin infections such as ringworm, wounds, nose and also in ear disorders, asthma and in the treatment of habitual abortion in women. It is cold, sweet, aphrodisiac, rejuvenative and improves digestive process.
<i>Melia azadarachta</i> L.	Meliaceae	Tree	Malaivembu	Leaf	Decoction	Leaf extracts are used in Ayurvedic remedies for common colds, headaches, stomach disorders, inflammation, diabetes, various forms of poisoning and malaria.
<i>Rauwolfia serpentina</i> (L.) Benth.	Apocynaceae	Herb	Sarpagandha	Root	Root Powder	Indian snakeroot is used for mild high blood pressure, nervousness, trouble sleeping (insomnia), and mental disorders such as agitated psychosis and insanity. Indian snakeroot is also used for snake and reptile bites, fever, constipation, feverish intestinal diseases, liver ailments, achy joints (rheumatism), fluid retention (edema), epilepsy, and as a tonic for general debilities.
<i>Santalum album</i> L.	Santalaceae	Tree	Santhanam	Wood	Extract	Sandalwood paste is great for the skin. It can be used to improve skin texture, soothe burnt skin, and treat eczema and rashes. It can also be used to soothe prickly heat. Sandalwood has been found to be an antispasmodic agent. It

						helps to relax the nerves, blood vessels, and muscles. Regular use of sandalwood oil can stop muscle contractions and spasms
<i>Stachytarpheta indica</i> (L.) Vahl.	Verbenaceae	Herb	Semainaiyur uvi	Leaf	Leaf extract	Routinely used for dyspepsia, fever, chronic liver problems, and constipation and as diuretic
<i>Strychnos nux-vomica</i> L.	Loganiaceae	Tree	Etti	Seed	Powder	The pharmacological effects of this plant have also been known to increase spinal reflexes and stimulate respiratory and sensory centers of the cerebral cortex.
<i>Vitex agnus-castus</i> L.	Verbenaceae	Tree	Mail kaladi	Leaf	Extract	The leaves are recommended for aid in external wound healing, complaints of the spleen, and for use in child birth.

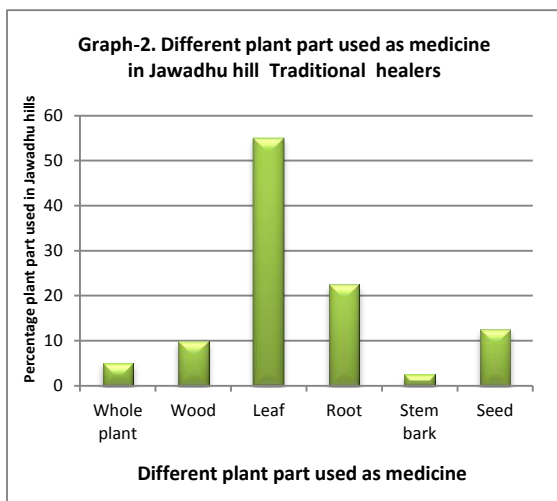
Ethno medicinal plants of Life form and parts used in Jawadhu hills traditional healers

Herbs were the primary source of medicine herb (37.5%) followed by trees (25%), shrubs (12.5%) and climbers (25%) (Graph-1). The frequent use of herbs among the indigenous communities is a result of wealth of herbaceous plants in their environs (Tabuti et al., 2003; Ragupathy et al., 2008; Giday et al., 2010) and Tirunelveli hills harbours more number of herbs as compared to trees, shrubs and climbers (Manickam et al., 2004). Among the different plant parts used, the leaves (55%) were most frequently used for the preparation of medicine solely or mixed with other plant parts. It was followed by Seed (12.5%), whole plant (5%), wood (10%), seed (12.5%, including seed oil), root (22.5%) (Graph-2). Many indigenous communities elsewhere also utilized mostly leaves for the preparation of herbal medicines (Giday et al., 2010; Gonzalez et al., 2010). The reason why leaves were used mostly is that they are collected very easily than underground parts, flowers and fruits etc. (Giday et al., 2009) and in scientific point of view leaves are active in photosynthesis and production of metabolites (Ghorbani, 2005).



Method of preparation and mode of administration of ethno medicinal plants in traditional users of Jawadhu hills

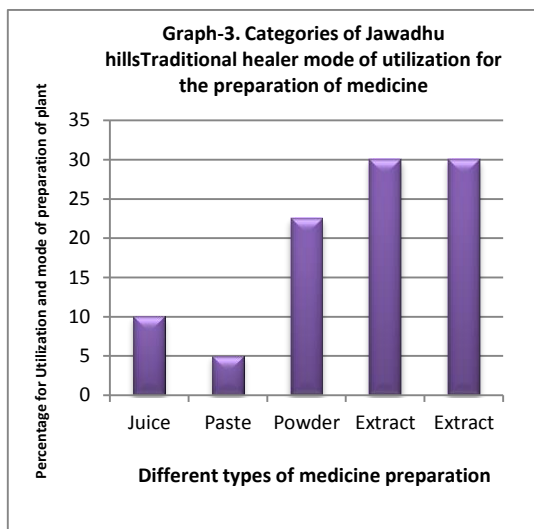
The preparation and utilization of plant parts were grouped into five categories (Graph-2). Of these, most commonly used method of preparation was paste (5%) followed by powder (22.5%), juice (5%), extract (30%, taken as raw and plant part prepared as pickles) and decoction (30%). Preparation of paste for the treatment of ailments is a common practice among the other tribal communities in India (Ignacimuthu et al., 2006; Ragupathy et al., 2008; and other parts of the World (Giday et al., 2007, 2010; Roosita et al., 2008). The paste was prepared by grinding the fresh or dried plant parts with oil or water. The powder was prepared by the grinding of shade dried plant parts. The decoction was obtained by boiling the plant parts in water until the volume of the water reduced to minimum or required amount. The inhalation was done by the burning of plant parts and inhaled the smoke through nose or mouth.



Method of administration of ethno medicinal plants recommended in Jawadhu hills traditional healers

Internal uses (72%) were predominating over external or topical uses (28%) and nasal application. For topical use, the most important methods used were direct application of paste or medicated oil (with oil) and mostly dealt with diseases like skin disorders, wounds, heel cracks, poison bites, rheumatism, body pain and headache. Most of the medicines were given orally which is in agreement with some other

studies conducted elsewhere (Lee et al., 2008; Poonam and Singh, 2009).



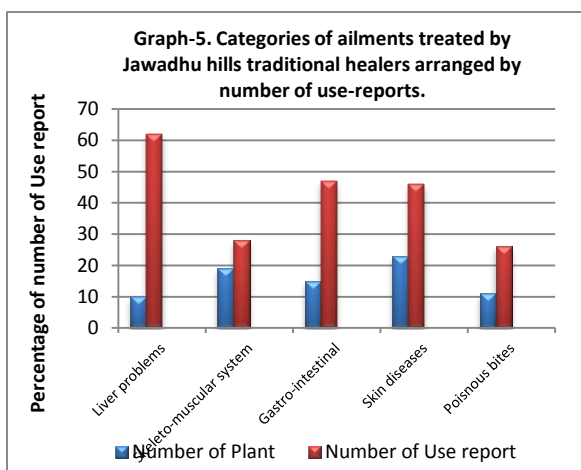
Plant use values

The most commonly used species was *Solanum trilobatum* with 11 use-reports by 6 informants, giving the highest use value of 2.5. *S. trilobatum* is attributed to its use in the treatment of various diseases and it is well recognized by all the informants as a respiratory plant. Many traditional healers' (Maruthuvar) families in Thiruvannamalai district of Tamil Nadu, India are growing *S. trilobatum* as a climbing vine in their home and it was a household custom to consume one leaf a day (Ragupathy and Newmaster, 2009). Other important plants with high use value were *Phyllanthus amarus*, *Acalypha indica*, *Sida acuta*, *Sida spinosa*, *Sida cordifolia*, *Heliotropium indicum*, *Stachytarpheta indica*, *Bryophyllum pinnatum*, *Polygonum glabrum*, *Rauwolfia serpentine*, *Ruta graveolens* (15 use reports by 8 informants with a UV of 1.96), *Adhatoda vasica*, *Solanum indicum*, *Barleria lupulina*, *Helicteres isora*, *Azima tetracantha*, *Hemidesmus indicus*, *Passiflora foetida*, *Cardiospermum halicacabum*, *Mukia maderaspatana*, *Leptadenia reticulate*, *Hemidesmus indicus* (12 use-reports by 7 informants with a UV of 1.78), *Decalepis hamiltonii*, *Basella rubra*, *Convolvulus arvensis*, *Syzygium cumini*, *Santalum album*, *Terminalia chebula*, *Melia azedarach* (nine use-reports by six informants with a UV of 1.50). Most of these plants were frequently used by the Paliyar tribals in Theni district of Tamil Nadu (Ignacimuthu et al., 2008) and tribal practitioners of Eastern

Rajasthan (Upadhyay et al., 2010), India for the treatment of various ailments.

Informant consensus factor

Generally Fic of local knowledge for disease treatment depended on the availability of the plant species in the study area (Rajakumar and Shivanna, 2009). In order to use the informant consensus factor (Fic), we classified the illnesses into broad disease categories. The Fic values in present study were ranged from 0.73 to 0.91. The use categories with more than 24 use-reports were dermatological infections/diseases (46 use-reports, 23 species), gastro-intestinal diseases (47 use-reports, 15 species) and skeleto-muscular system disorders (28 use-reports, 19 species) (Graph-5). In the present study, endocrinal disorders and liver problems had the highest Fic of 0.88 and 0.86 respectively and it is in agreement with the previous studies among the neighboring indigenous communities in Tamil Nadu, India; diabetes and jaundice had the highest Fic of 1.00 among the Irulas in Thanjavur district (Ragupathy and Newmaster, 2009), jaundice has the highest Fic of 0.92 among the Malasar tribals in Coimbatore district (Ragupathy et al., 2008) and 0.923 among the Paliyar tribals in Theni district (Pandikumar et al., 2011). *Phyllanthus amarus* and *G. sylvestre* were very commonly used for the treatment of jaundice and diabetes correspondingly in these studies.



Relative importance

The collected medicinal plants possessed number of pharmacological properties (Khare, 2007). The plant with more number of pharmacological properties (PH) was *Azima*

tetracantha, *Hemidesmus indicus*, *Cardiospermum halicacabum* (20 PH); so, it had a normalized PH value of 1.00 (20/20). *Terminalia chebula* and *Melia azedarach* was employed to treat five body systems and had a normalized BS value of 1.00 (5/5). *Phyllanthus amarus* and *Adhatoda vasica* had the highest RI of 71.0 and it was followed by *Hemidesmus indicus* (65.0), *Rauwolfia serpentine* (RI of 55.5), *Polygonum glabrum* (48.0), *Ruta graveolens* and *Helicteres isora* (43.2), *Stachytarpheta indica* and *Convolvulus arvensis* (38.5). These plants were also used to treat more body systems and were considered as most versatile taxa in the study area. According to Upadhyay et al. (2010).

CONCLUSION

The present study revealed that traditional medicines were still in common use by the Jawadhu hills traditional user communities and accurate knowledge of the plants and their medicinal properties were held by only a few individuals in this community. Hence a need for detailed investigation of ethnobotanical knowledge held by each traditional user community is required before such valuable knowledge vanishes. Thus, our work would be useful in preventing the loss of ethnomedicinal traditions of Jawadhu hills traditional user communities. The new claims which are recorded from the study area showed that still much can be learned from investigating herbals available abundantly in the forests. The plants with highest fidelity level and use values in the present study may indicate the possible occurrence of valuable phytochemical compounds and it requires a search for potential new drugs to treat various.

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