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Assessment of Availability of Traditionally used Flora in Curing Jaundice in Central Himalayan Region

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Summary

Plants are used extensively for treatment of different ailments. However, the introduction of allopathic drugs decreased human dependency on medicinal plants. In the present world where industrialization accompanied with urbanization has greatly modified the values and life standards of the majority of population. The folk knowledge of people pertinent to medicinal plants uses are in danger of being lost forever. It was thus considered worthwhile to document the folk uses of medicinal plants for curing important human diseases. The manuscript provides traditional uses of plant species in curing jaundice by the local community residing in Almora district of Central Himalaya. The study examined the community structure of documented species. Vegetation analysis of species was analysed and identifying three forest area along an altitude of 500-1200m, 1200-2000m and 2000-2800m. 12 species were documented in this study of which herb (7), shrub (3), and climber (2). In majority of cases, extract from the whole plant were used for curing jaundice, followed by root, fruit. After statistical analysis, community was identified as heterogeneous. It is said that interest in medicinal plants is increasing as an alternative to modern medicine, so there is an urgent need for conservation of this valuable treasure. It is urgent to spreading awareness of conservation among common people and young generation must be made obligatory. It is necessary that sustainable harvesting techniques should be adopted so as to protect the species in the wild. It forms an important criterion that these medicinal plants should be used in a sustainable way in order to preserve for future generation.

Key Words: Almora, Central Himalaya, Ethno-medicinal Plants, Jaundice, Population assessment

Introduction

Primitive human societies have been depending on plants and plants product for various remedies through traditional knowledge system[1]. In certain areas, folk medicinal prescriptions are endemic and have survived through ages from one generation to next through the word of mouth they do not exist as written knowledge. Generally, these systems of medicines depend on old people's experiences. The person prescribing these medicines has no so-called scientific knowledge about the disease. It is very often, that the younger generations today look at local health traditions with suspicion and often belies them to be superstitions and deride the use of these traditions.

The Himalaya have been the supreme benefactor and protector in many ways from million of years. Though youngest of the mountain chains in the world, the Himalaya have attracted tourists, philosophers, scientists and saints alike. The Himalayas present a storehouse of bio-diversity, where flora and fauna vary extensively with climate diversity from one region to the other [2, 3] Almora district of central himalaya besides general people is habited by some ethnic tribes such as Botia, Raji etc. [4]. They have rich knowledge about folk therapy for different diseases like eczema, bone fracture, boils, sores, jaundice, gingivitis etc. Jaundice is one of the common diseases found in this region. The area that is largely hilly suffers from various natural and artificial life difficulties. The life of the people is much harder than the life of the people living in plains. There is lack of awareness among its people to manage a balance diet, pure drinking water and proper facilities of treatment of diseases. They lead their life on unbalanced diet, drink contaminated water and whenever attacked by the diseases feel helpless to secure proper medicinal help. Due to lack of modern medical facilities, expansive drugs and poor transportation, patients of these localities normally suffer for long[5]. In these, unfavourable situations traditional herbal healers of remote locality play vital role in providing them an alternative source of therapeutic facilities for their primary healthcare. That is why; they largely depend on ethno-medicine easily found in local surroundings. Economically and environmentally, the natural resources are the main sources for people in this region [6]. It can't be denied that in ancient day when medical facilities were not so developed used to depend on traditional knowledge system. It can't be denied that dormant knowledge during the ancient time definitely was solid and was helpful in curing different diseases but that is now not in vogue in. It now needs revival research and further development to make herbal medicine knowledge savvy.

Various studies on ethno-medicinal practices have been documented for the treatment of several diseases [5,7-9]. But very less attention has been paid to document the ethno-medicinal practices on the problem of jaundice in Almora, Central Himalaya.

Jaundice can indicate liver or gallbladder disorders. When the excretion of bilirubin is hindered, excess bilirubin passes into the blood, resulting in jaundice. Jaundice can also result from the excessive breakdown of red blood cells (a process called Haemolysis) and too much bilirubin is released into the bloodstream. This occurs typically in the haemolytic anemias (as opposed to the aplastic anaemia in which not enough red cells are produced). Jaundice is common in newborns because there is some hemolysis during labour and delivery and the newborn's liver is immature and may not be fully up to the task of handling the bilirubin for a few days. Jaundice typically brings yellow staining of the skin and sclera (the whites of the eyes), loss of appetite and feelings of nausea. Jaundice is a yellowish discoloration of the skin and mucous membranes caused by hyperbilirubinemia. Jaundice becomes visible when the bilirubin level is about 2 to 3 mg/dL (34 to 51 µmol/L) [10].

This communication has a special reference to jaundice and its remedial measures through traditional medicines. It was proposed that the traditional knowledge of this region was to study for the treatment of jaundice for betterment of the common people. It is not being done in its real health and spirits it needs further study, propagation and its extension. It also needs conservation of traditional knowledge system so that a fund of disciplined knowledge savvy system be created and a continuum of furtherance of preservation and strengthen this knowledge system. The structure of community can be studied by taking into consideration a number of characters which are usually grouped. Certain analytical characters like frequency, density, abundance, concentration of dominance, species richness and species diversity can be expressed quantitatively.

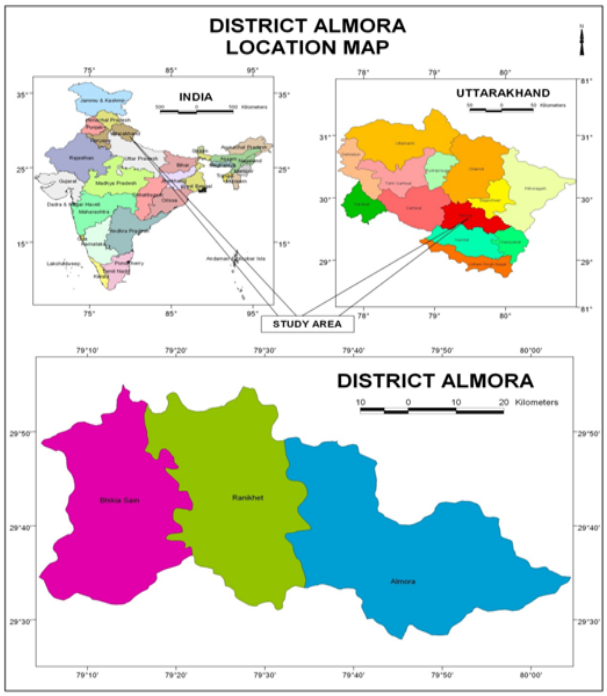

Figure 1: Location of study area in the Almora district of central himalaya

Materials and Methods

Study area

The district Almora lies between 29°30'N to 30°20'N latitudes and 79°20' E to 80°20'E longitudes. It is located in the central part of Kumaun region of Himalaya[11]. Almora district (Figure 1: Location of study area) covers area of 46 km in north-south in length and 86 km east-west width. The area of study covers the whole 3629.66 sq.km. Thus the total area covered ranges from 510 m to 2830 m of altitudes exhibiting great variety of regions extending from tropical moist deciduous forest to moist mixed coniferous forest[12]. The rivers that flow in this region are Ramganga, Kosi, Gagas and Sarju [11].

Methodology

The main purpose of this survey was to document the traditional knowledge. Information about the medicinal use of plants that is use in jaundice was collected through surveys conducted in several regions of Almora district. During the field surveys, attempts were made to cover all major habitat types available in the study area. These people are apparently very friendly but maintained a deep secrecy about their traditional knowledge. However, after visiting them for several times, they finally shared their knowledge about the medicinal uses of plants growing around them for this disease. During field trips, information on traditional medicinal plants used for jaundice was

obtained from experienced local residents and elderly medicinal pharmacists. After that the plants were identified at Regional Research Institute of Himalayan Flora, Tarikhet (Almora) Uttarakahnd. To know the population of these plants field investigation has been done. During field survey, study area was divided into three zones on the basis of altitudinal range i.e. Area-1(500-1200m), Area-2(1200-2000m) and Area-3(2000-2800m). Vegetation analysis of the selected areas along an altitudinal gradient was carried out by using 1×1 m quadrates. The quadrates were laid out randomly for all the 10 species (10 out of 12 because, rest two are cultivated species) that identified during interviews with local peoples for jaundice. The size and the number of quadrates were determined [13]. At different aspects 30 random quadrates each of 1×1 m for herbs were laid out for phyto-sociological study. The vegetational data were quantitatively analysed for abundance(A), density(D), frequency(F) [13], species richness Index (R), concentration of dominance (cd)[14], ratio of abundance to frequency (A/F)[15] and species diversity index (H) [16] for different species was calculated for eliciting the distribution patterns.

Results and Discussion

The plants are in the human use since the beginning of human civilization. All humans are dependent on medicinal plants in order to meet various requirements for survival [17]. In Uttarakhand, ethno-medicine has an enduring and indispensable part in the social life. The dominance of western knowledge system that has led to a prevailing situation in which, indigenous knowledge is grossly ignored and neglected. The present generation is ignoring the traditional healthcare system and leaning towards market oriented resources for healthcare. It is, therefore, easy to forget that over many centuries, human beings have been producing knowledge and strategies and enabling them to survive in a balance relatives with their surrounding natural and social environment. It was never documented properly and systematically. Information on the plant species reported for the treatment of different disease has also been reported earlier from other regions [4, 18-19]. In the province of Almora district, both the general population and the traditional healers are still continuing to rely on plant based folk remedies. Several studies have been carried out by several workers on existing natural resources and it has been reported that many useful plant species which are at present endangered, rare and threatened are being exploited legally or illegally by the local people or outside for commercial purposes[20-22].

During the course of the study, a total of 12 ethno-medicinal plant species of 12 families were documented in which herb (7), shrub (3), and climber (2). In majority of cases, extract from the whole plant (9) were used for curing jaundice, followed by root (3), fruit (2). The information about the plants botanical name, local name, family, life forms, parts used and distributions has been given in Table 1.

Table 1: Description of ethno-medicinal plants used in jaundice

S.N	Botanical Name	Local Name	Family	Life form	Parts used	Distribution
1	*Achyranthes bidentata* Bl.	Apamarga	Amaranthaceae	Herb	Whole plant	1600-2500 m
2	*Berberis aristata* Dc.	Kilmora	Berberidaceae	Shrub	Root	1700-2600 m
3	*Boerhavia diffusa* Linn.	Punryaru	Nyctaginaceae	Shrub	Whole plant	Up to 1800 m
4	*Centella asiatica* (L.)	Brahmi	Apiaceae	Herb	Whole plant	Up to 1500 m
5	*Citrus medica* Linn.	Nimmu	Rutaceae	Shrub	Fruits, root	Cultivated
6	*Cuscuta reflexa* Roxb.	Amerbel	Boraginaceae	Climber	Whole plant	900-2000 m
7	*Eclipta alba* Linn.	Bhangra	Asteraceae	Herb	Whole plant	300-1600 m
8	*Leucas cephalotes* Koenig.	Guma	Lamiaceae	Herb	Whole plant	Up to 1000 m
9	*Phyllanthus fraternus* Webster.	Bhoomi awala	Euphorbiaceae	Herb	Whole plant	Up to 500 m
10	*Raphanus sativus* Linn.	Muli	Brassicaceae	Herb	Root & fruit	Cultivated
11	*Thalictrum foliolosum* DC.	Mamiri, pilijar	Ranunculaceae	Herb	Whole Plant	1000-2500 m
12	*Tinospora cordifolia* (Willd.)	Guduci	Menispermaceae	Climber	Whole Plant	Up to 1500 m

Out of 12 species, population study have been carried out, only 10 species under consideration because the rest two species were cultivated in this region. Several studies have been carried out on the population studies [23, 24], by making several attempts and requests and sharing of knowledge, gradually they were motivated to share their knowledge. Performance details, at different altitudes, of identified taxa (i.e. *Achyranthes bidentata* Bl, *Berberis*

aristata Dc., *Boerhavia diffusa* Linn., *Cuscuta reflexa* Roxb., *Eclipta alba* Linn. *Leucas cephalotes* Koening, *Phyllanthus fraternus* Webster., *Thalictrum foliolosum* DC. *Tinospora cordifolia* (Willd.) and *Centella asiatica (*L.) are presented in table 2.

The quantitative analyses of identified flora used in Jaundice in area -1 are given in table 2. In this area (altitudinal range 500-1200 m), *Shorea robusta* Gaerth.f. is the dominant associated species and other associated floras are as follows: *Terminalia alata* Heyne ex Roth, *T. bellirica* (Gaertn.) Roxb, *Anogeissus latifolia* (Roxb. Ex DC) Wall. ex. Guill & Perr, *Ehretia Laevis* Roxb., *Premna mucronata* Roxb., *Adina cordifolia* (Willd. ex Roxb) Benth. & Hook. F. ex. Brandis, *Emblica officinalis* Gaerth, *Catunaregam spinosa* (Thunb.), *Syzygium cumini*(L.), *Mallotus philippensis* (Lam.) Muell-Arg., *Lannea coromandelica* (Houtt.). *Eclipta alba* Linn. and *Leucas cephalotes* Koening. having highest frequency (60%) with frequency class (C) and density 2.9 m^{-2}.

Table 2: Comparative account of frequency, frequency class, density and abundance

S.N	Species Used in Jaundice	Frequency (%)						Density (plants m^{-2})			Abundance		
		Area-1	Frequency Class	Area-2	Frequency Class	Area-3	Frequency Class	Area-1	Area-2	Area-3	Area-1	Area-2	Area-3
1	*Achyranthes bidentata* Bl	56.66	C	80	D	90	E	2.26	2.2	2.2	4	2.75	2.44
2	*Berberis aristata* Dc.	0	A	50	C	70	D	0	0.7	1.6	0	1.4	2.28
3	*Boerhavia diffusa* Linn.	53.33	C	20	A	0	A	2.23	0.3	0	4.18	1.5	0
4	*Cuscuta reflexa* Roxb.	56.66	C	0	A	0	A	2.5	0	0	4.41	0	0
5	*Eclipta alba* Linn.	60	C	70	D	30	B	2.9	2.6	0.4	4.83	3.71	1.33
6	*Leucas cephalotes* Koening	60	C	0	A	0	A	2.93	0	0	4.88	0	0
7	*Phyllanthus fraternus* Webster.	50	C	26.66	B	0	A	1.93	0.5	0	3.86	1.87	0
8	*Thalictrum foliolosum* DC.	40	B	53.33	C	66.66	D	1.4	2.3	1.7	3.5	4.31	2.55
9	*Tinospora cordifolia* (Willd.)	33.33	B	20	A	10	A	0.93	0.4	0.1	2.8	2	1
10	*Centella asiatica (L.)*	50	C	60	C	30	B	3.03	3.96	1.2	6.06	6.61	4
	Total	459.98		380		296.66		20.11	12.96	7.2	38.5	24.15	13.6

The quantitative analyses of identified flora used in area -2 are given in table 2. In this area (altitudinal range 1200-2000 m), the most dominent associated species are *Rhododendron arboreum* Sm., *Quercus leucotrichophora* A.Camus and their associated flora are as follows : *Aesculus indica* (Wall. ex camb.) Hook. F., *Cornus macrophylla* Wall., *Acer oblongum* Wall. ex. DC., *Viburnum cylindricum Buch.-Ham. ex D. Don, Populus ciliate* Wall. ex. Royle, *Pistacia chinensis. Euphorbia royleana.* The associated flora are very often abundant on rocky southern of this region. The most common shrubs in this region are as follows: *Indigofera dosua* Buch.-Ham. ex D. Don, *Indigofera cassioides*, *Flemingia fruticosa*, *Lespedeza stenocarpa*, *Rubus ellipticus*, *R. niveus*, *Myrsine Africana, Inula cappa* etc. *Achyranthes bidentata* Bl.. having highest frequency (80%) with frequency class(D) and density 2.2 m^{-2}.

The quantitative analyses of identified flora used in area -3 are given in table 2. In area-3 (Altitudinal range 2000-2800 m), the most dominant associated species are *Cedrus deodara*(Royle ex D. Don) G. Don., *Pinus roxburghii* Sargent. and other associates are *Lepisorus nudus* (Hook.) ching, *Aesculus indica* (Wall. ex comb.)Hook, *Betula alnoides* Buch.-Ham. ex D. Don, *Populus ciliate* Wall. ex Royle, *Celtis australis* Linn., *Juglans regia* L., *Alnus nitida* (spach)Endl., *Corylus colurna* Linn.,*Lyonia ovalifolia* (Wall.)Drude, *Quercus dilatata* Lindl. ex. Royle, *Buxus wallichiana* Baill., *Symplocos paniculata*(Thunb.)Miq., *Hypericum oblongifolium* choisy, *Buddleja crispa* Benth., *Rhamnus procumbens* Edgew, *Salix denticulate* Anders. and *Elaeagnus parvifolia* Wall. ex Royle. *Achyranthes bidentata* Bl. having highest frequency (90%) with frequency class (E) and density (2.2 m^{-2}) .

On the basis of frequency (%) values given in table 2, identified species are then distributed into five frequency classes [25] are reported in table 3.

Table 3: Distribution of frequency class

Frequency class	Area-1	Area-2	Area-3
A	10%	40%	50%
B	20%	10%	20%
C	70%	30%	0%
D	0%	20%	20%
E	0%	0%	10%

The total number of species(10), of which 1 belong to frequency class A, 2 to B, 6 to C, 1 to D and 0 to E in area -1 and similarly different frequency classes for area-2 and area-3 are reported in table 3 and their data's are represented diagrammatically in figure 2.

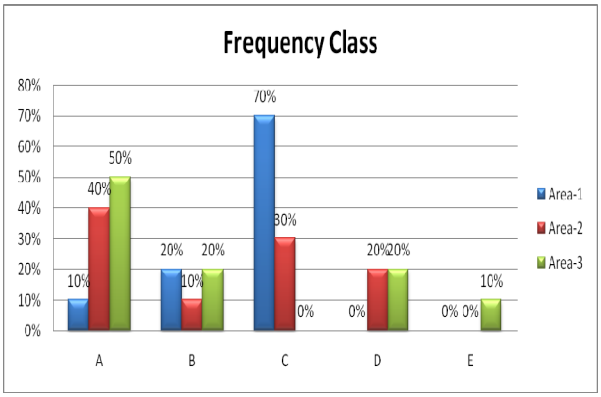

Figure 2: Distribution of frequency class

If we compare the distribution of frequency diagram (Figure 2) with the normal frequency diagram, it is clear that the community studied is heterogeneous. The highest frequency in area-1 *Eclipta alba* Linn.(60%) and *Leucas cephalotes* Koening(60%), area-2 *Achyranthes bidentata* Bl(80%) and in area-3 *Achyranthes bidentata* Bl(90%) have been reported. The highest density in area-1, *Centella asiatica (L.)(3.03)* ,area-2 *Centella asiatica (L.)(3.96)* and in area-3 of *Achyranthes bidentata* Bl(2.2) have been reported. The *Centella asiatica (L.) having* highest abundance *6.06 in area- 1, 6.61 area-2* and *4.0* in area-3 have been reported. Comparative data frequency, abundance, density of all three areas is represented in Fig- 3, 4 & 5.

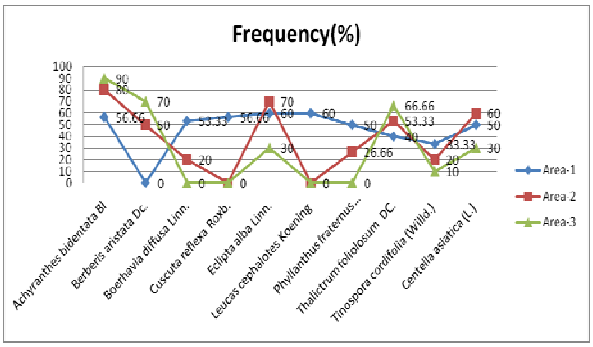

Figure 3: Plant wise comparative account of frequency

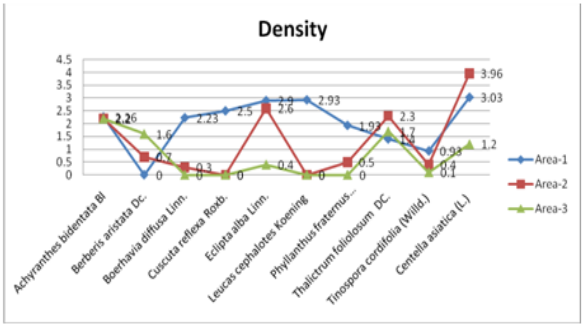

Figure 4 : Plant wise comparative account of Density

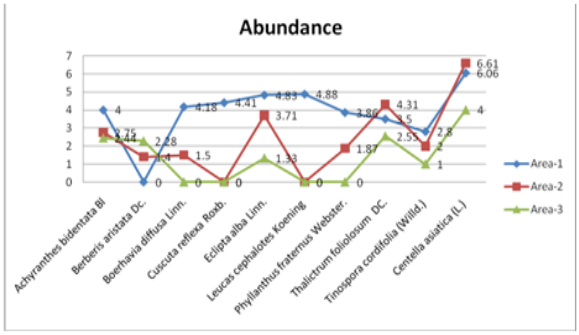

Figure 5: Plant wise comparative account of Abundance

The ratio of abundance to frequency (A/F) for different species was calculated for eliciting the distribution patterns are reported in table 4.

Table 4: Comparative account of A/F ratio

S.N	Species Used in Jaundice	A/F Area-1	Distribution Pattern	A/F Area-2	Distribution Pattern	A/F Area-2	Distribution Pattern
1	*Achyranthes bidentata* Bl	0.07	Contagious	0.03	Random	0.02	Random
2	*Berberis aristata* Dc.	0	0	0.02	Random	0.03	Random
3	*Boerhavia diffusa* Linn.	0.07	Contagious	0.07	Random	0	0
4	*Cuscuta reflexa* Roxb.	0.06	Contagious	0	0	0	0
5	*Eclipta alba* Linn.	0.08	Contagious	0.05	Random	0.04	Random
6	*Leucas cephalotes* Koening	0.08	Contagious	0	0	0	0
7	*Phyllanthus fraternus* Webster.	0.07	Contagious	0.07	Contagious	0	0
8	*Thalictrum foliolosum* DC.	0.08	Contagious	0.08	Contagious	0.03	Random
9	*Tinospora cordifolia* (Willd.)	0.08	Contagious	0.1	Contagious	0.1	Contagious
10	*Centella asiatica (L.)*	0.12	Contagious	0.11	Contagious	0.13	Contagious

The ratio of abundance to frequency is a relative measure to present the distribution of vegetation in different areas. It has been suggested that the A/F values for regular (less than 0.025), contagious (0.025-.05) and random (more than 0.05) distribution of the population [15]. A/F ratio showed that there is no species with regular distribution, area-1 having contagious distribution, the area -2 and 3 having contagious and random distribution.

On the basis of above studies, the values of species richness (R), species diversity (H') and concentration of dominance (Cd) are reported in table 5.

Table 5: Comparative values of Species richness (R), Concentration of dominance (Cd) and Species diversity (H')

Area	Species richness (R)	Concentration of dominance (Cd)	Species diversity (H')
Area-1(500-1200m)	9	0.12	2.14536
Area-2(1200-2000m)	8	0.19	1.769854
Area-3(2000-2800m)	6	0.22	1.555929

The value obtained for species diversity (H') ranges from 1.55-2.14 whereas species richness (R) along an altitudinal gradient ranges between 6 - 9. The species diversity and concentration of dominance are generally inversely related. Maximum species diversity (2.14) reported for area-1 with the species richness 9, whereas minimum species diversity (1.55) recorded for area-3 with species richness 6. In the present study the value of concentration of dominance (Cd) ranged between 0.12-0.22.

On the basis of above studies 12 species belonging to 12 families have been recorded for the treatment of jaundice traditionally. These species can be distributed within different life forms such as 7 herbs, 3 shrubs and 2 climbers. The highest number of species (9) was reported from area-1. The present values of total frequency, density and abundance are higher in area-1. *Achyranthes bidentata* Bl. having highest frequency in area-1 & 2, *Eclipta alba* Linn. and *Leucas cephalotes* Koening having highest frequency in area-3. After the comparison of obtained frequency diagram with normal diagram it is clear that community studied is heterogeneous. The ratio of abundance to frequency of different species for eliciting the distribution patterns showed that there is no species with regular distribution, area-1 having 100% contagious distribution, the area -2 having 50% contagious and 50% random distribution and the area-3 having 66.66% contagious and 33.33% random distribution. These values are comparable with the values reported for subtropical forest of Kumaun Himalaya [26].The species richness is the number of different species in a given area that ranges 6-9. Range of species diversity (H) is 1.55 (area-1), 1.76 (area-2) and 2.14 (area-3) shows higher diversity in area-1 comparative to area-2 and area- 3.The value of concentration of dominance (cd) in area-1 (0.12) in area-2 (0.19) and in area-3 (0.22), all the data shows greater diversity. Maximum diversity 2.14 reported for (area-1) with maximum number of species richness (9) whereas minimum diversity (1.55) recorded for area-3 with minimum number of species (6). With higher diversity lower the concentration of dominance in all the area because concentration of dominance showed reverse trend as compared to species diversity. These values are generally comparable with the values reported for temperate forest [27]. These findings support the range reported [28] for temperate forests. It indicates that increasing diversity and reduced concentration of dominance is associated with increased stability [29].

The frequencies of documented plants are less in this region. So, cultivation of these plants can help in conservation as well as sustainable supply of quality plant. The different regeneration systems which have been developed need to be field tested and the field data is collected so that the complete technology packages could be ready for commercialization and transfer to the user agencies [30, 31].

Conclusion

Present study highlights 12 species belonging to 12 families have been recorded for the treatment of jaundice traditionally. After the comparison of obtained frequency diagram with normal diagram it is clear that community studied is heterogeneous. Distribution patterns showed that there is no species with regular distribution. Species diversity is higher in area-1 comparative to area-2 and area-3. Higher the diversity lowers the concentration of dominance in all the area because concentration of dominance showed reverse trend as compared to species diversity. The increasing frequency results greater density and abundance. The study revealed that frequency of documented plants was not more in nature. However, density of individuals and area occupied were low compared to other species of this region, indicating habitat loss and heavy exploitation. Cultivation of these

plants can help in conservation as well as sustainable supply of quality plant. The prime importance of *in vitro* propagation of these ethno-medicinal plants would be to generate a large number of planting materials from single explants without destroying the mother plant and subsequently their restoration in the natural habitat, thus conserving the biodiversity. The significance of an efficient *in vitro* protocol would be to obtain maximum number of plantlets in minimum period of time with proper rooting along with acclimatization in the field.

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