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Ethnomedicine of Santal tribe living around Susunia hill of Bankura district, West Bengal, India: The quantitative approach

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ABSTRACT

The present paper deals with the observations on ethnomedicinal uses of wild plants by the Santal tribal people of villages surrounding the Susunia hill of Bankura district, West Bengal. Data were collected by interviewing Santal medicine men and knowledgeable persons with the help of semi-structured and open-ended questionnaire. The data have been analyzed employing suitable statistical tools like Informant Consensus value for Plant Part (CPP), Consensus Factor (F_{ic}), Fidelity Level (FL%), Preference ranking exercise, Importance value (IV_s) and Pearson Correlation Coefficient (PCC). Altogether 25 plants have been recorded which are used by the Santal people in formulation of 40 ethnomedicinal preparations for curing 27 types of diseases. Leaves secured the highest CPP value (0.33). Circulatory system disorder, Nervous System disorder and Birth/Puerperium disorder secured the highest F_{ic} value (1). *Abrus precatorius* L., *Ampelocissus latifolia* (Roxb.) Planch., etc. secured the highest FL value(100%). *Curcuma longa* L. has been identified as most preferred species by preference ranking exercise. The highest score of IVs observed in *Borassus flabellifer* L., *Cajanus cajan* (L.) Millsp.,etc. The PCC between IV_s and FL was 0.679 showing moderate positive significant association. Bioassay of these ethnomedicinal remedies has to be carried out further for their scientific validation.

INTRODUCTION

Ethnomedicine has been playing very important role in human health care since time immemorial. This practice of health care is based on belief and experience of the ethnic people, which is a part of their tradition and culture. There has been an increased demand of herbal drug in international trade because herbal medicines are cheap, more effective, easily available and supposed to have no side effects. This branch of ethnobotany is now getting more importance in the field of pharmacognosy for its basic information regarding medicinal plants, their various traditional uses, way of preparations, doses, and mode of administration of crude drugs. In our national agenda, documentation, conservation, preparation of database of medicinal plants and their cultivation are now priority issues. Number of medicinal plants is steadily being increased in the traditional pharmacopoeias of our country through extensive research work in the field of ethnobotany. The information about prescription, pharmacology, attitude towards diseases, diagnosis, etc. of the age-old tribal medicine system are still lying unclaimed in different parts of the district Bankura. A perusal of literature shows that documentation of ethnobotanical works from this district has been made by different workers (Acharya and Mukherjee, 2010a, b; Banerjee et al., 2013; Basu, 2003; Choudhuri et al., 1982; Ghosh et al., 1996; Ghosh, 1999, 2002, 2003a, b, 2006, 2008; Kar, 1999; Mallick and Mallick, 2012; Mallick et al., 2012; Mondal and Biswas, 2012; Mukherjee and Namhata, 1988; Namhata and Mukherjee, 1988, 1989, 1992; Namhata and Ghosh, 1993; Pal et al.,1989; Paul, 2004; Paul and Verma, 2004; Sinhababu and Banerjee, 2013). No ethnobotanical work including its quantitative analysis has been carried out from the Susunia hill of Bankura district. In this context, present study has been designed to document and conserve the traditional herbal knowledge of Santal tribe living around Susunia hill. Bankura is one of the seven districts of Burdwan Division in the Indian state of West Bengal. It lies between N 22°46′ and N 23°38′ and between E 86°36′ and E 87°46′. The district has an area of 6881.24 sq km and total forest area of 1404 sq km.

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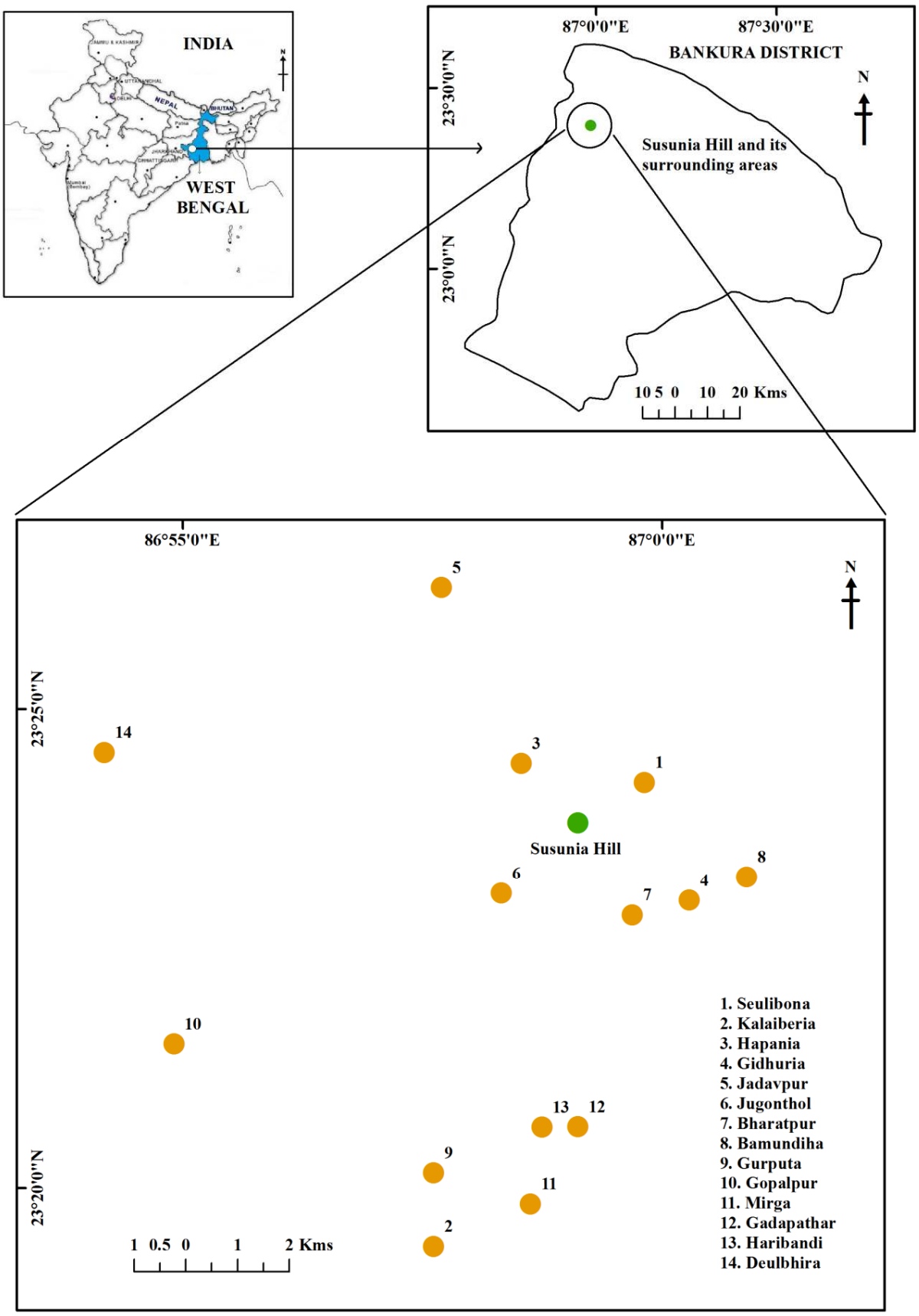

Fig. 1: map of Bankura district showing the study sites.

The Biharinath and Susunia are two remarkable hills of this district. Susunia hill (around N 23.39693° and E 86.98527°) is situated in the north-west of Bankura district, in the Chhotanagpur gneissic plateau of West Bengal and rises to 439.5 m above sea level (Figure-1).

It is a very small hill and runs for a length of about 3 km. Like other forest areas in the district, forest of the Susunia hill is also tropical dry deciduous type dominated by Sal tree (*Shorea robusta* Gaertn. f.). The hill is very rich in its plant resources including medicinal plants. The district Bankura is inhabited by many tribal communities such as Santals, Oraons, Koras, Bhumij, Mech, Mahali, Bedia and Mundas. Santals represent the largest indigenous tribal community in the district and the villages surrounding the Susunia hill are dominated by this tribe. The tribal villages selected for this study are located within 10 km radius around the hill.

MATERIALS AND METHODS

Data collection

Ethnomedicinal data were collected between March 2011–February 2013 following the standard methods (Jain, 1987; Jain and Mudgal, 1999) from 14 tribal villages that were selected with the help of aged persons in the villages on basis of the availability of traditional healers (Figure-1). The villages were visited in different seasons (summer, monsoon and winter) to avail most of the plant resources in their flowering condition. Twenty Santal key medicine men and five knowledgeable persons were selected as informants using purposive sampling method (Dolores and Tongco, 2007) (Table-1 and Figure-2). Most of the informants belong to an age between 50 and 80 years. The key informants selected from each sampled villages were the most knowledgeable ones as suggested by the tribal elders of respective villages. Before interview, Prior Informed Consent (PIC) was taken from each informant. The data have been collected by interviewing the informants through semi-structured and open-ended questionnaire. The Santal name of the plant, parts used, preparation and mode of administration of the crude drug, disease cured, etc. were recorded in detail. Interviews were conducted in the local languages i.e. Santali and Bengali. The plant specimens were collected and identified with the help of different Floras (Prain, 1903; Sanyal, 1994; Saxena and Brahmam, 1994; Varma, 1981). Correct and Valid scientific names for the recorded plant species have been used here following The International Plant Names Index (IPNI). Collected plant specimens have been preserved as herbarium specimen following conventional techniques (Jain and Rao, 1977) and kept in Visva-Bharati Herbarium, Department of Botany, Visva-Bharati, Santiniketan for future references.

Fig. 2: A. An interview with Rabindranath Hembrame (a key medicine man); B. Rasamoy Murmu showing his medicinal collection; C. Kartik Murmu giving medicine to a patient; D. Mohan Hansda performing some rituals as part of his ethnomedicinal practice and patients waiting for him.

Quantitative ethnomedicinal data analysis

Here in this study, different quantitative tools like Consensus value for Plant Part [CPP](Monteiro *et al*., 2006), Informant Consensus Factor [F_{ic}](Trotter and Logan, 1986), Fidelity Level [FL%](Friedman *et al*., 1986), Preference ranking exercise (Martin, 1995), Importance value [IV_s] (Byg and Balsev, 2001) and Pearson Correlation Coefficient (PCC) were employed to analyze the collected data.

Consensus value for Plant Part (CPP) measures the degree of agreement among informants concerning the plant part used and is calculated as CPP = P_x / P_t , where P_x = number of times a given plant part was cited; P_t = total number of citation of all parts.

F_{ic} has been determined to identify the most potential medicinal plant species used in the culture of Santal people of the study area. It is expressed by a formula: $F_{ic} = N_{ur} - N_t / N_{ur} - 1$, where N_{ur} is the number of use reports from informants for a particular disease category, N_t is the number of taxa that are used for that disease category. F_{ic} value ranges between 0-1, where a high value indicates the greater informant consensus and a lower value signifies disagreement among the informants.

The Fidelity Level (FL%) is used to quantify the percentage of informants claiming the use of a certain plant for the same major purpose and is calculated as : FL= N_p / N x 100, where N_p = number of informants who cited the species for a particular disease ; N = total number of informants that cited the species to treat any given disease.

Preference ranking exercise (Martin, 1995) was conducted by six key medicine men on five medicinal plants used to treat boil in the study area. Boil was the disease against which highest number of medicinal plants was prescribed by the informants. The informants were given the plants and asked them to arrange plants based on their personal experience regarding efficacy of the plants. Medicinal plant that believed to be the most effective was given the highest value i.e. 5 and the one with least effectiveness was given a value of 1. Finally, rank was determined based on the total score of each species.

The Importance Value (IVs) measures the proportion of informants who regard a species as most important and is calculated as follows: IVs = n_{is} / n, where n_{is}= number of informants who consider the species $_s$ most important; n= total number of informants.

Pearson product-moment correlation coefficient is a good measure to numerically quantify the nature of the linear relationship between two variables , giving a value between +1 and -1 inclusive, where 1 is total positive correlation, 0 is no correlation, and -1 is total negative correlation. The strength of the relationship is indicated by the correlation coefficient (r) but is actually measured by the coefficient of determination (r^2)**.** The significance of relationship is expressed in probability levels p (0.05). In our case, the two variables of interest are IVs and FL. Pearson product- moment correlation coefficient is done with the help of Statistics software [version 1.1.23-r7] (Wessa, 2014).

RESULTS AND DISCUSSION

The result has been presented in tabular form. The species are arranged in alphabetical order of their scientific names with family name and voucher number, followed by the Santal name, plant parts used, mode of administration, diseases cured FL% and IV_s (Table- 2).

Medicinal plants reported

Altogether 25 ethnomedicinal plants have been recorded from the district. These 25 recorded taxa spread over 22 species, 22 genera, 14 families of dicotyledons and 3 species, 3 genera, 3 families of monocotyledons. The family Fabaceae was represented by the highest number of species (4 species, 16%) followed by Asteraceae (3 species, 12%), Euphorbiaceae, Solanaceae and Vitaceae (2 species each, 8%). Remaining 12 families had single species representation (Figure- 3). Dominance of medicinal plant species from families Fabaceae and Asteraceae could be attributed to their wide distribution and abundance in the flora of this area.

Habitually the investigated taxa fall under 4 groups like Trees, Shrubs, Herbs and Climbers. The numbers of species in each group and their respective percentage have been defined as Trees- 8 (32%), Shrubs- 4 (16%), Herbs- 10 (40%) and Climbers- 3 (12%) (Figure- 4). The most dominant life form of the species used by the tribal people in the district includes herbs (40%) which indicate that they are easily accessible and commonly grown around the tribal villages in the district.

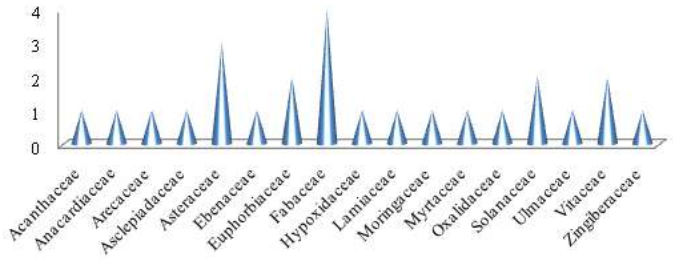

Fig. 3: Number of plant species in their respective family.

Diseases treated

The recorded 25 plant species are used in formulation of 40 types of ethnomedicinal preparations that cure 27 types of diseases. The diseases which occur most frequently in the area are boil, scorpion sting, stomachache, elephantiasis, intestinal worm, etc. These 27 types of diseases were grouped into 11 major categories like dermatological disorder, muscular-skeletal system disorder, digestive system disorder, infections, genitio-urinary system disorder, etc. It has been observed that against boil, a medicinal condition under the category of dermatological disorder, a large number of medicinal plants (6species) were prescribed. For scorpion sting, the number of prescribed species is 4, followed by 3 species in case of stomachache, 2 species in case of external cut, elephantiasis, intestinal worm, jaundice, etc.

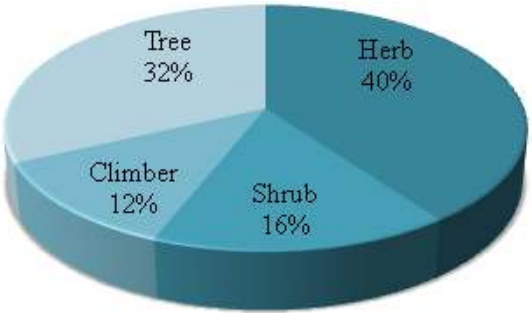

Fig. 4: Growth form of the investigated taxa.

Plant parts used

The leaf part of the plants (CPP value 0.33) was used by the tribal people very frequently in formulation of the remedies as compared to other plant parts. Flower, fruit and seed secured the CPP value of 0.29 followed by root and rhizome (0.24), stem bark (0.07), latex and gum (0.05) and whole plant (0.02) (Figure- 5). Medicine men here in the study area prefer leaves most in preparation of their remedies because this part of plant is easily accessible than other parts, more efficacious and it is known to us that leaves are the sites for synthesis of bioactive secondary metabolites . Collection of plant parts specially leaves by the tribal people would support the sustainable method of harvest because in most of the cases at least a number of leaves are left unplucked which allow the parent plant to survive normally. Harvesting root , rhizome and seed poses more threat to survival of plants than collecting other parts such as leaves ,bark and flower.

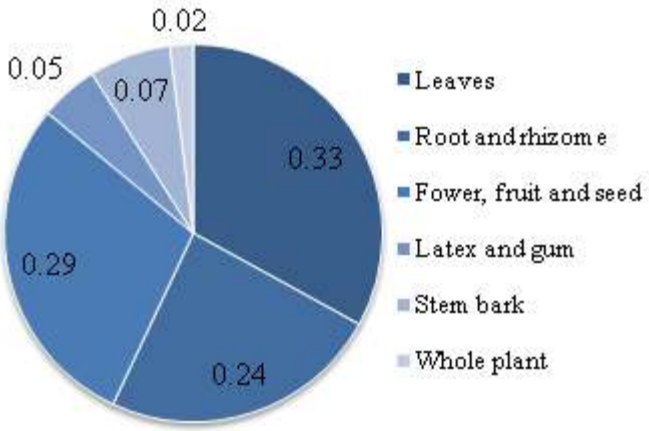

Fig. 5: CPP values of plant parts used in herbal preparations.

Use of drugs in various forms

It has been observed that Santal medicine men in the study area follow various ways of remedy preparation which depend on type of disease treated. The major modes of remedy preparations were paste (50%), ointment (12.5%), powder (7.5%), cooking, juice, pill (5%), burning ash, decoction, gum, latex, mouthwash and plaster (2.5%)(Figure-6). Along with herbal ingredients, different additives like coconut oil, molasses, black salt and termite mound's soil were often used in preparation of remedies. Plant ingredients were collected by the medicine men from wild habitat in the study area and other ingredients like coconut oil, molasses, black salt were procured from the commercial sources. The soil of termite's mound was collected from its mounds which are very common in forest floor of the district.

The majority (72.5%) of the remedies were prepared from fresh materials only. Some remedies were prepared from dried materials (15%) exclusively and few were prepared from dried or fresh materials depending upon their availability in the area (12.5%). The fact that both fresh and dried forms are used in the preparation of remedies create a better opportunity for the Santal people here to have access to the materials used in medicinal formulation across different seasons of the year. It is the opinion of the informants regarding their use of fresh ingredients in remedy preparation that in fresh form the efficacy potential of the ingredients remain intact , which they thought, could be lost on drying.

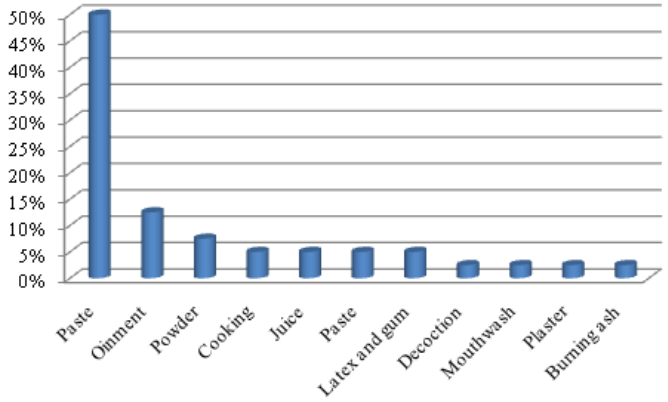

Fig. 6: Method of preparation of Santal medicine.

Routes of administration and doses

More than half (57.5%) of the remedies were applied externally on affected part of the skin directly, and 42.5% of the preparations were applied internally in the form of oral application. Results show that there was no agreement in measurement or unit used among informants. Informants generally used measuring units such as teaspoon, cup, fingers, etc. but still differed in the doses they administered.

Statistical analysis

Finally, the data were analyzed by employing the quantitative tools like F_{ic}, FL%, preference ranking exercise, IVs and Pearson product-moment correlation coefficient to get more objectivity in this study. Our study reveals that there is a high level of consensus among the informants regarding disease cure and medicinal plant use. The F_{ic} value for different disease categories ranges from 0.909 to 1.00 which indicates greater agreement among the informants regarding phyto-therapeutic uses of medicinal plants (Table- 3). Circulatory system disorder, nervous system disorder and birth/puerperium disorder secured the highest

F_{ic} value (1) which indicates the remedies against these disease categories are very efficacious and those remedies are actively practising among the Santal healers in the study area. The species used in remedies for the disease categories with high F_{ic} values are considered as high consensus species which have established as very prospective one in many natural product studies. It has been established by many workers that high consensus species are the prospective candidates for investigation of their phytochemistry and pharmacology (Heinrich, 2000; Trotter and Logan, 1986). One earlier study found that the good consensus of Kenyah healers in Borneo on antimalarial plants was indicative of high activity in laboratory antiplasmodium assays (Leaman *et al*., 1995). Like wise the plant species which have been identified as highest scorer in respect of their F_{ic} value can be considered useful in development of evidence-based phytomedicine for the tribal people of the study area.

Fidelity Level (FL%) value of the recorded 25 plant species ranges from 28% - 100% (Table- 2). Highest fidelity level value (100%) has been recorded for ten plants such as *Ampelocissus latifolia* (Roxb.) Planch. and *Lannea coromandelica* (Houtt.) Merr. against elephantiasis, *Cajanus cajan* (L.) Millsp. and *Diospyros melanoxylon* Roxb. against jaundice, *Calotropis gigantea* (L.) W.T. Aiton against scorpion sting, *Abrus precatorius* L. against sprain, *Blumea lacera* (Roxb.) DC and *Borassus flabellifer* L. against external cut, *Centratherum anthelminticum* (L.) Gamble for good digestion, *Cissus adnata* Roxb. against bone fracture, etc. The highest FL% value could be considered as an indicator for the high healing potential of those plants used against the corresponding diseases. Plants with highest fidelity level value could also be targeted for further phytochemical investigation to identify the bioactive compounds that are responsible for their high healing potential. These ten plant species are till commonly growing in natural habitats in the study area with no adverse effect of collection pressure upon them, but in future there may be a chance of declining the population of them due to their high use pressure in long term. Preference ranking exercise conducted on six medicinal plants which are used to treat boil reveals that *Curcuma longa* L. is the most preferred medicinal plant followed by *Andrographis paniculata* Nees, *Ricinus communis* L. (Table- 4). The fact that *Curcuma longa* L. is the most frequently used plant for treatment of boil in the area which highlights its highest efficacy potential among the six plant species cited by the informants. Here IV_s of the plants ranges from 0.2 -1. The highest Importance Value (IV_s) calculated here is 1 which has been recorded for the plants like *Borassus flabellifer* L. against external cut, *Cajanus cajan* (L.) Millsp. against jaundice, *Centratherum anthelminticum* (L.) Gamble for digestion, *Cissus adnata* Roxb. against bone fracture, *Moringa oleifera* Lam. against pox and high blood pressure, *Solanum surattense* Burm.f. against toothache (Table- 2). The highest score for Importance Value of these plants also highlights that these plants are therapeutically very important and tribal healers in the area rely mostly upon them for effective treatment. Here the Pearson correlation coefficient has been determined between IVs and FL% and its value is 0.679 (Table- 5) which showed a moderate positive correlation between the proportion of informants who regard a species as most important and percentage of informants claiming the use of a certain plant for the same major purpose. The IVs and FL% are moderately correlated which means that their use patterns across the species moderately match. The degree to which IVs and FL% varies across the species is measured numerically by r^2 which states that around 46 percent variation in IVs can be explained by that of FL. These findings have further supported by a scattered plot which reflects a moderate positive correlation (Figure- 7).

Table. 1: Name of the informants, their age, village and category.

Sl. No	Name	Age (Years)	Village	Category of informant
1	Rabindranath Hembrame	61	Seulibona	Key medicine man
2	Karamchand Hembrame	48	Seulibona	Knowledgeable person
3	Baidyanath Hansda	45	Seulibona	Knowledgeable person
4	Aditya Hansda	38	Kalaiberia	Key medicine man
5	Shyamapada Besra	50	Hapania (Pahar para)	Key medicine man
6	Abinash Tudu	40	Hapania (Pahar para)	Knowledgeable person
7	Bijoy Besra	40	Hapania (Pahar para)	Knowledgeable person
8	Kankaram Tudu	76	Hapania (Pahar para)	Key medicine man
9	Ramchandra Hansda	80	Hapania (Pahar para)	Key medicine man
10	Panchu Hembrame	75	Hapania (Pahar para)	Key medicine man
11	Rasamoy Murmu	67	Gidhuria	Key medicine man
12	Mohan Hansda	65	Jadavpur	Key medicine man
13	Shankar Murmu	50	Jadavpur	Key medicine man
14	Rampada Murmu	51	Jadavpur	Key medicine man
15	Mangal Hembrame	53	Jadavpur	Knowledgeable person
16	Kartik Murmu	57	Jugonthol	Key medicine man
17	Dharama Tudu	61	Bharatpur	Key medicine man
18	Dharmadas Mandi	80	Bamundiha	Key medicine man
19	Ramdas Soren	58	Bamundiha	Key medicine man
20	Jagan Murmu	66	Gurputa	Key medicine man
21	Joydeb Murmu	39	Gopalpur	Key medicine man
22	Biswanath Hembrame	56	Mirga	Key medicine man
23	Dasarath Murmu	79	Gadapathar	Key medicine man
24	Bilome Murmu	50	Haribandi	Key medicine man
25	Ramdas Soren	55	Deulbhira	Key medicine man

Table- 2: Medicinal plants used by the Santal tribal people of surrounding villages of the Susunia hill

Formulation no.	Scientific name/Family/Voucher no.	Santal name	Part used	Mode of administration	Diseases	FL%	IV_S
1	*Abrus precatorius* L. (White variety) /Fabaceae/SK10	Kawet	Leaf	Leaves are made into paste and applied on affected area topically once a day for 4 days.	Sprain	100	0.32
2	*Ampelocissus latifolia* (Roxb.) Planch. /Vitaceae/SK50	Icewar	Root	Root is made into paste, warmed and applied topically on the affected area twice a day for 30 days.	Elephantiasis	100	0.56
3	*Andrographis paniculata* Nees /Acanthaceae/SK15	Kalmegh	Leaf	Leaves are made into paste, pill is made from it and one pill is taken orally once a day for 7 days.	Boil	79	0.6
4	*Andrographis paniculata* Nees /Acanthaceae/SK15	Kalmegh	Leaf	Leaves are made into paste, pill is made from it and one pill is taken orally once a day	Diabetes	37	0.28
5	*Blumea lacera* (Roxb.) DC. /Asteraceae/SK40	Randoi	Leaf	Leaf paste is applied topically on cut area to stop bleeding	External cut	100	0.6
6	*Borassus flabellifer* L. /Arecaceae/SK43	Taledare	Tomentum of leaf	Tomentum of leaf is applied on the cut area to stop bleeding	External cut	100	1
7	*Borassus flabellifer* L. /Arecaceae/SK43	Taledare	Root	Secretion of root is collected and one cupfull of juice is taken orally once a day for 15 days	Seminal weakness	32	0.32
8	*Butea monosperma* (Lam.) Taub. /Fabaceae/SK54	Murut	Flower	Flowers (3) are made into paste and taken orally once a day for 7 days	White discharge	64	0.56
9	*Butea monosperma* (Lam.) Taub. / Fabaceae /SK54	Murut	Seed	Seeds are ground into powder and one teaspoonfull of powder is mixed with half cupfull of water and taken orally once a day in empty stomach	Intestinal worm	82	0.72
10	*Cajanus cajan* (L.) Millsp. / Fabaceae/SK59	Baredare	Leaf	Leaves are made into paste and taken orally	Jaundice	100	1
11	*Calotropis gigantea* (L.) W.T.Aiton /Asclepiadaceae/SK 65	Akana	Latex	Milky latex is directly applied on affected area	Scorpion sting	100	0.6
12	*Centratherum anthelminticum* (L.) Gamble /Asteraceae/SK22	Shaonraj	Seed	Seed powder is mixed with salt and taken orally after meal	Digestive	100	1
13	*Cissus adnata* Roxb. / Vitaceae/SK35	Bodlar	Root	Root paste together with termite mound's soil is bandaged for 7 days	Bone facture	100	1
14	*Curculigo orchioides* Gaertn. /Hypoxidaceae/SK31	Turom	Root	Root (100gm) made into paste and taken orally twice a day for 15 days	White discharge of women, urine with semen	100	0.52
15	*Curcuma longa* L. /Zingiberaceae/SK27	Shasang dare	Rhizome	Paste of rhizome is warmed and applied on abscess for 2-3 days	Boil	94	0.6
16	*Curcuma longa* L. /Zingiberaceae/SK27	Shasang dare	Rhizome	Paste of rhizome is applied on affected area	Sprain	50	0.32
17	*Datura metel* L. /Solanaceae/SK14	Dhutra	Leaf	Leaves are made into paste, warmed and applied on abscess	Boil	54	0.28
18	*Datura metel* L. /Solanaceae /SK9	Dhutra	Root	Root (25gm) is made into paste and taken orally once a day	Knee arthritis	62	0.32
19	*Diospyros melanoxylon* Roxb. /Ebenaceae /SK45	Tereldare	Gum	Gum is mixed in water and taken orally once a day for 7 days	Jaundice	100	0.28
20	*Elephantopus scaber* L. /Asteraceae /SK60	Mejurjhuti	Whole plant	Half-burnt plant is made into powder, mixed with coconut oil and applied on the boil	Boil	82	0.36
21	*Elephantopus scaber* L. /Asteraceae/SK60	Mejurjhuti	Root	Root paste is applied on affected area	Scorpion sting	45	0.2
22	*Holoptelea integrifolia* (Roxb.) Planch. /Ulmaceae/SK18	Challa	Stem bark	Stem bark is made into paste and applied on affected area	Ring worm	100	0.6
23	*Lannea coromandelica* (Houtt.) Merr. /Anacardiaceae /SK19	Dokadare	Stem bark	Stem bark is made into paste and mixed with molasses, warmed and pill is prepared from it. One pill is taken orally twice a day for 3 days.	Elephantiasis	100	0.56
24	*Leucas mollissima* Wall. /Lamiaceae/SK29	Dhandhurupara	Leaf	Leaves are made into paste and applied on forehead	Headache	50	0.28
25	*Leucas mollissima* Wall. /Lamiaceae/SK29	Dhandhurupara	Leaf	Leaves are cooked and taken orally	worm	71	0.4
26	*Millettia pinnata* (L.) Panigrahi /Fabaceae/SK 37	Karajdare	Seed	Seed oil is applied on affected area	Boil	76	0.52

27	*Millettia pinnata* (L.) Panigrahi /Fabaceae/SK37	Karajdare	Seed	Seed oil is warmed and massaged on the heel	Heel crack	35	0.24
28	*Millettia pinnata* (L.) Panigrahi /Fabaceae/SK37	Karajdare	Seed	Seed oil is applied on affected area	Itching	41	0.52
29	*Moringa oleifera* Lam. /Moringaceae/SK66	Mungdodare	Leaves, flower, fruit	Leaves, flowers and fruits are cooked and taken orally	Pox, High blood pressure	100	1
30	*Oxalis corniculata* L. /Oxalidaceae/SK51	Tandi chatam ara	Leaf	Leaves are made into paste and taken two teaspoonfull for 2-3 days(for stomachache) or 10-12 days(for gastric problem)	Gastric problem,Stomachache	100	0.36
31	*Ricinus communis* L. /Euphorbiaceae/SK39	Eradom	Leaf	Leaves are made into paste and applied on breast	Breast pain after childbirth	37	0.28
32	*Ricinus communis* L. /Euphorbiaceae/SK39	Eradom	Root	Root paste is directly applied on affected area	Scorpion sting	47	0.36
33	*Ricinus communis* L. /Euphorbiaceae/SK39	Eradom	Seed	Seed oil is applied on belly	Stomachache	37	0.28
34	*Ricinus communis* L. /Euphorbiaceae/SK39	Eradom	Leaf	Leaf paste is warmed and massaged on breast	Induce lactation	37	0.28
35	*Ricinus communis* L. /Euphorbiaceae/SK39	Eradom	Leaf	Leaf paste is applied on boil	Boil	42	0.32
36	*Solanum surattense* Burm.f. /Solanaceae/SK17	Rangoni	Seed	Seeds(3-4) are boiled in water and taken orally twice a day	Malaria	28	0.28
37	*Solanum surattense* Burm.f. /Solanaceae/SK17	Rangoni	Seed	Seeds(3-4) are boiled in water and gargled once a day for 7 days	Toothache	100	1
38	*Syzygium cumini* (L.) Skeels /Myrtaceae/SK49	Kodedare	Stembark	Juice is made from bark and taken orally one teaspoonful for 25 days	Stomachache, gastric problem	100	0.44
39	*Tragia involucrata* L. /Euphorbiaceae/SK61	Sengal sing	Seed	Seeds are made into paste and applied topically on head once a day for 3-4 days	Hair fall	88	0.56
40	*Tragia involucrata* L. /Euphorbiaceae/SK61	Sengal sing	Root	Root paste is applied on affected area	Scorpion sting	31	0.2

Table. 3: Informant Consensus Factor (F_{ic}) for each disease category

Disease category	No. of Taxa (N_t)	No. of use-reports (N_{ur})	F_{ic}
Circulatory System Disorder	1	25	1
Nervous System Disorder	1	7	1
Injuries	2	40	0.9743
Metabolic System Disorder	2	39	0.9736
Birth/Puerperium Disorder	1	14	1
Digestive System Disorder	5	97	0.9583
Genito-urinary System Disorder	3	48	0.9574
Infections	6	88	0.9425
Muscular-Skeletal System Disorder	4	49	0.9375
Dermatological Disorder	8	100	0.9292
Poisoning	4	34	0.9090

Table. 4: Preference ranking of six medicinal plants reported for treating boil

Medicinal plants	Informants*						Total score	Rank
	A	B	C	D	E	F		
Andrographis paniculata Nees	3	3	4	3	2	5	20	2nd
Curcuma longa L.	5	5	4	4	2	4	24	1st
Datura metel L.	5	3	1	1	1	5	16	5th
Elephantopus scaber L.	2	1	3	5	1	3	15	6th
Millettia pinnata (L.) Panigrahi	3	1	5	1	2	5	17	4th
Ricinus communis L.	3	2	3	3	5	3	19	3rd

*Informants cited as A to F; where, A = Kankaram Tudu; B = Syamapada Besra; C = Panchu Hembrame; D = Mohan Hansda; E = Kartik Murmu; F = Rabindranath Hembrame

Table. 5: Summary statistics for Pearson Product-Moment Correlation.

Statistics	IV_s	FL
Mean	0.498	72.525
Standard Deviation	0.249	27.247
Correlation (r)	0.679	
Determination (r^2)	0.461	
T-Test	5.706	
p-value (2 sided)	0.00000144	
p-value (1 sided)	0.00000072	
Degrees of Freedom	38	
Number of Observations	40	

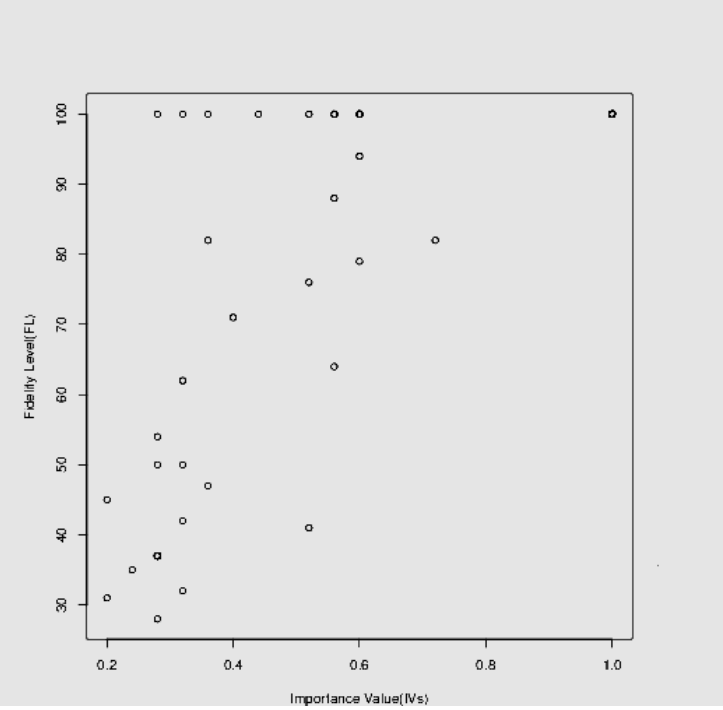

Fig. 7: Correlation between IV_s and FL.

CONCLUSION

The study will help in preparation of ethnomedicinal database. The use of quantitative tools is very new approach here in analysis of Santal medicine from West Bengal. The high consensus obtained from the healers underlines their well-defined herbal tradition and could guide in selection of medicinal plants as potent candidates for bioprospecting and natural product studies. The traditional knowledge of herbal medicine practiced among the Santal community of the villages surrounding the Susunia hill of Bankura district should be conserved through its documentation before it is lost from the respective Santal societies forever. It will also protect the IPR of the Santal community of the study area. The herbal claim of this study has to be exploited further for developing new cost effective herbal drug.

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