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Quantitative Ethnomedicinal Study of Plants Used to Treat Bone Fracture in Jhargram District, West Bengal, India

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ABSTRACT

Jhargram District is rich in plant diversity. The local tribal people of remote areas of this district mainly depend on traditional knowledge of medicinal plants to treatment of bone fracture. The main aim of the study was to documentation of herbal drugs preparation for treatment of bone fracture. The present study deals with 14 plant species under 12 families that are used by different tribal people like Santal, Munda, Lodha, Bhumij, and Sabar to cure bone fractures. The extensive season wise field survey was carried out from December 2018- February 2020. A total of 39 informants were selected from different village areas of this district for collecting valuable ethnomedicinal information through a standard questionnaire, interviews, and oral communication. This paper highlights the local name of plant species, usable plant parts, various modes of administration and combination of herbal drugs and also focus on conservation of such ethnomedicinal plants around us. Surveying data were analyzed by different quantitative tools such as relative frequency of citation (RFC) and fidelity level (FL).

Keywords: *Bone-fracture, Ethnomedicinal plants, Traditional knowledge, Conservation Jhargram district*

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INTRODUCTION

India is a land rich in biodiversity and medicinal plant resources. From the dawn of civilization, human beings have been dependent primarily on plants for food, shelter, and healthcare (Dubey *et al.*, 2004). With this background; this study highlights some ethnomedicinal plants used for the treatment of bone fracture in Jhargram district, West Bengal, India.

An extensive season-wise field survey was conducted from December 2018 to February 2020 in eight blocks, namely Binpur-I, Binpur-II, Jhargram, Jamboni, Gopiballavpur-I, Gopiballavpur-II, Sankrail, and Nayagram of Jhargram district. Most of the area contains lateritic and alluvial soil. Subarnarekha, Kangshabati, Dulung, and Tarafeni rivers are all found in this district. Three types of vegetation, such as Sal coppice forests, shrub jungle, and plantation, are also found in this area. The important tribal communities in this district are Santal, Munda, Lodha, Sabar, and Bhumij. A total of 39 informants were selected from different village areas of this district for the purpose of collecting valuable information about medicinal plants through standard questionnaires, oral interviews, and finally cross-checking with the help of published literature. Two quantitative tools were used for surveying data analysis, such as the relative frequency of citation (RFC) (Tardìo & Pardo-De-Santayana, 2008) and the fidelity level (FL) (Friedman *et al.*, 1986).

The present study exhibits a total of 14 plant species belonging to 12 genera and 12 families that are used to cure bone fractures. Also documented that are local name (different languages), time of collection, usable parts, actual mode of utilization, mode of administration, and combination with other ingredients. The main aim of the present study is to address the urgent need for conservation and documentation of valuable medicinal plants and traditional ethno-medical knowledge for future generations and to create awareness among the tribal people about medicinal plants and the urgent need to initiate mass propagation and stop the overexploitation of local medicinal plants. Otherwise, many valuable plants lose their own habitat.

MATERIALS AND METHODS

Study area

The present study on ethnomedicinal practices of different tribal communities has been carried out in eight blocks of Jhargram District, West Bengal, India. The district covers an area of 3,037.64 km^2. It is situated in south west corner of the West Bengal, lying between 22.45º north and 86.98º East

longitude **(Figure 1)** and sharing borders with neighboring states of Jharkhand and Odisha. The district has 8 community development blocks, viz. Binpur-I, Binpur-II, Jhargram, Jamboni, Gopiballavpur-I, Gopiballavpur-II, Sankrail, and Nayagram (Anonymous, 2011). The total population of the district is 11, 37,163 as per 2011 census. About of 96.52% population lives in rural area and 3.48% population lives in urban areas of Jhargram district.

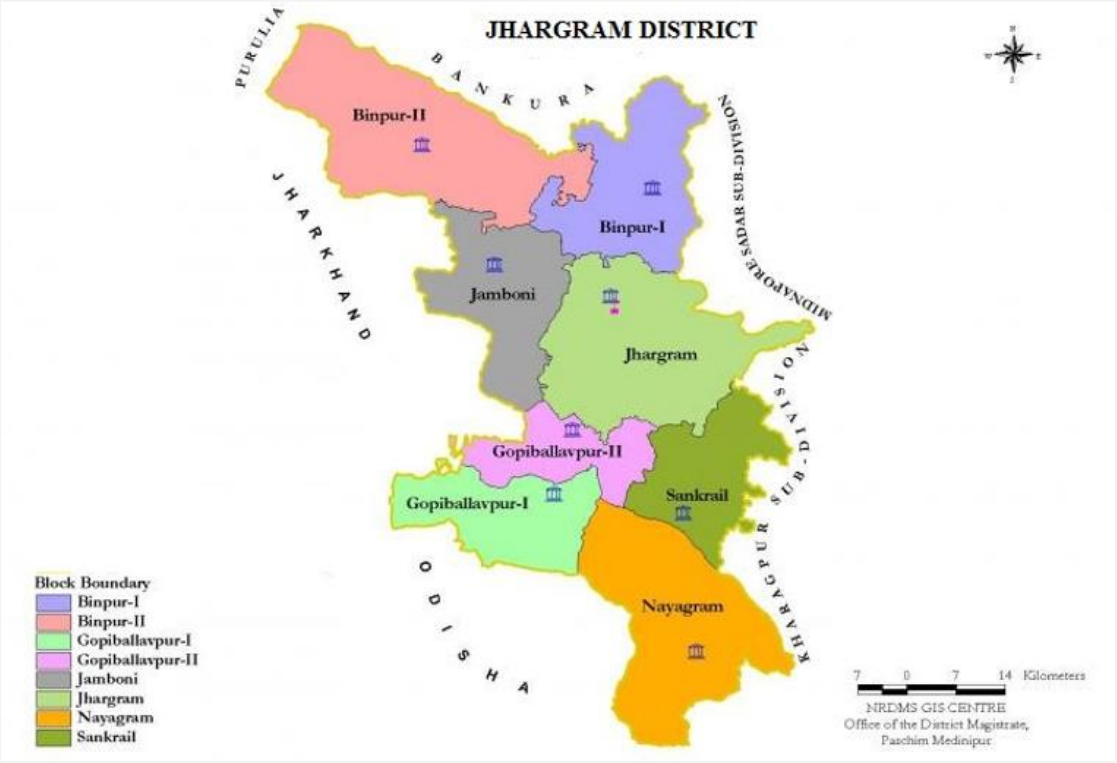


Figure 1. The map showing the different blocks of Jhargram District

Field survey, informant's selection, and data collection

An extensive season-wise field survey was conducted from December 2018 to February 2020 in different village areas of Jhargram district, following the standard methodology described by Jain (1991).

Firstly, the local people were befriended to create confidence and credibility about the survey; otherwise they would not expose their traditional knowledge about medicinal plants.

During the survey, a total of 39 informants were selected to collect valuable information about medicinal plants to cure bone fractures. Information was gathered through oral interviews with the informants using standard questionnaires **(Table 1)**. The informants are getting detailed information about medicinal plants, local names of the plants, morphology, habit, habited time of collection, usable plant parts, medicinal uses, methods of medicine preparation, and actual dosage and duration. The plant species were collected from their own habitats with the help of informants for identification, and herbarium was prepared following conventional methods and deposited in the Botany department of the Vidyasagar University, West Bengal, India. The ethnomedicinal data were verified and cross checked by different tribal communities and finally verified with the help of available published literature (Pal & Jain, 1998; Bhakat & Pandit, 2003; Pakrashi & Mukhopadhya, 2004; Bandyopadhyay & Mukherjee, 2005; Paria, 2005; Bandyopadhyay & Mukherjee, 2006; Das & Mondal, 2009; Upadhya *et al*., 2009; Mitra & Mukherjee, 2010; Chekole, 2017; Sadat-Hosseini *et al.,* 2017; Bhakat & Sen, 2018; Demie *et al*., 2018; Dutta, 2018; Faruque *et al*., 2018; Marin *et al.,* 2018; Sen, 2018; Faruque *et al*., 2019; Dutta *et al.*, 2020; Kassa *et al*., 2020; Das, 2021; George & Hautier, 2021; Raghuvanshi *et al.,* 2021; Sen & Bhakat, 2021).

The plants were identified through relevant flora and monographs and the validity of the correct scientific name, author citation, and family names were confirmed using www.theplantlist.org.

Quantitative tools for ethno medicinal data analysis

Two quantitative tools are as follows-

- *Relative frequency of citation (RFC)*
  RFC: The RFC is calculated by using the formula:
  RFC= FCs/N
  Here, FCs is the no. of informants who informs the use of a particular species.
  N is the total no. of informants.
  Theoretically, it varies from 0 (zero) to 1 (one) when few informants inform a species; the value will be close to 0 (zero); the upper limit 1 is possible when all the informants inform a particular species.

- *Fidelity level (FL): The FL is calculated using following formula:*
  FL=NP/N×100

Here, NP is the no. of informants who informs the particular use of the species.
N is the total no. of informants.

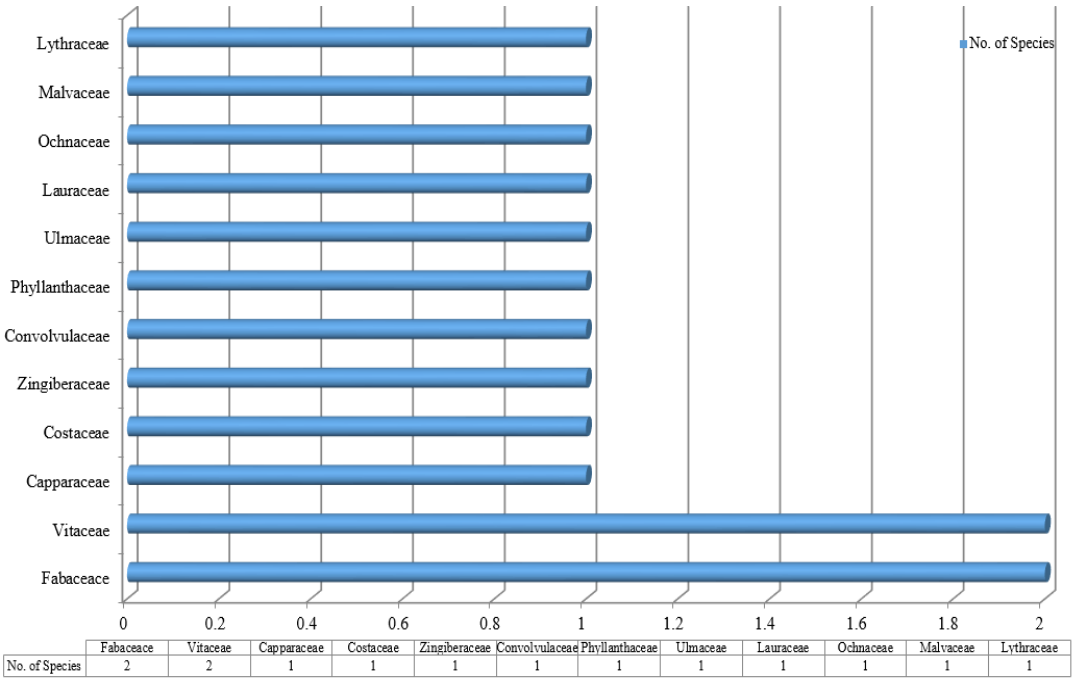
Fidelity levels indicate the significant of plant species for a particular use.

Table 1. A questionnaire used during field survey

Parameter	Information	Questions
Informants details	Name- Gender- Age- Occupation- Education- Village name-	Which plant used for treatment of different ailments?
		Which part of the plant used to treat in different ailments?
		How used the Plant material in fresh or preserved condition?
		Name of the different ingredients for preparation of medicine.
		How do you prepare in different forms of medicine?
		How is the mode of administration of medicine for each ailment?
		What the actual dose and duration of medicine for treatment each ailment?

RESULTS AND DISCUSSION

A total of 14 species belonging to 12 genera and 12 families are used by the tribal medicine man to cure bone fractures. The most dominant family is Fabaceae and Vitaceae representing the highest 2 species each. Then Capparaceae, Costaceae, Zingiberaceae, Convolvulaceae, Phyllanthaceae, Ulmaceae, Lauraceae, Ochnaceae, Malvaceae, Lythraceae contribute 1 species each **(Figure 2)**. Various uses of plants, alone or in combination with other species, were recorded, as were discussable parts of the species of the mode of administration of herbal drugs given with an RFC value given in **Table 2**.



	Fabaceace	Vitaceae	Capparaceae	Costaceae	Zingiberaceae	Convolvulaceae	Phyllanthaceae	Ulmaceae	Lauraceae	Ochnaceae	Malvaceae	Lythraceae
No. of Species	2	2	1	1	1	1	1	1	1	1	1	1

Figure 2. Plant families contributing no. of medicinal plants species

During the survey, it was revealed that treesrepresent 4 species, followed by herbs 4 species, shrubs 4 species, and climbers 2 species **(Figure 3)**. Plant parts such asthe whole plant, leaves, root and root bark, tuber root, rhizome, stembark and stem paste are used for the preparation of herbal drugs. Most of the herbal drugs are prepared insingle parts or inmixture with other ingredients such as halud (*Curcuma longa*), lime, moram stone, and soil of earthen, woven looms, rock, salt, and black pepper **(Figure 4)**. Mainly, paste forms of herbal medicine are used as plasters for the treatment of bone fractures. These traditional medicinal men used various units of measurement like finger length, numbers, pinch, and spoon to estimate the actual doses of medicine.

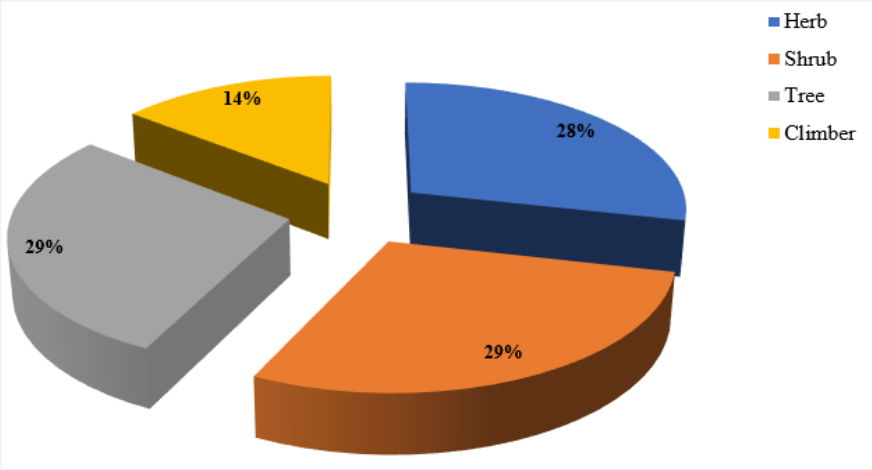


Figure 3. Habit wise distribution of the species

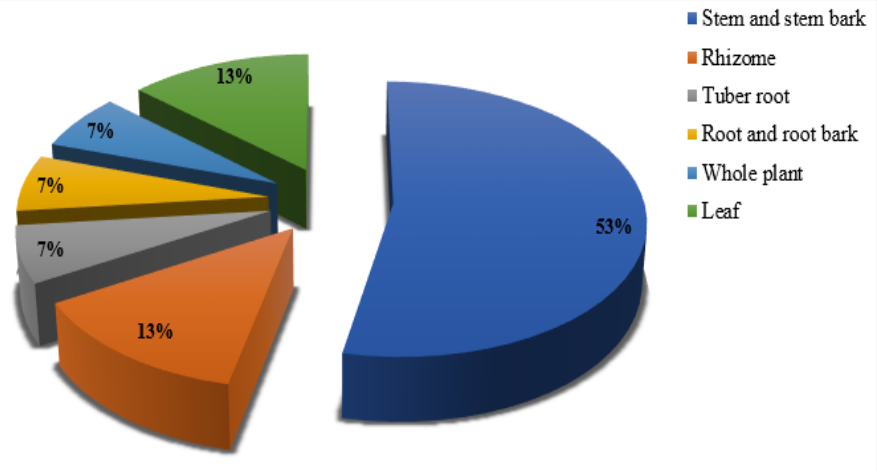


Figure 4. Frequency of Medicinal plant parts used by the ethnic people of Jhargram District

A total of 14 species **(Figure 5)** with RFC values were calculated. The RFC values range between 0.15 and 1. The highest value of RFC is 1 in *Litsea glutinosa* and is followed by *Curcuma longa* (0.94), *Cissus quadrangularis* (0.89), *and Euphorbia neriifolia* (0.84). *Litsea glutinosa is commonly called* Piplus, Kukrchita (Bengali), Garur, Poj, or Leda (Sanali). Its stem bark paste mildly heated and applied as a plaster form on bone fracture, joint twisting and swelling portion.

a)

b)

c)

d) e) f)

g) h) i)

Figure 5. Some ethnomedicinal plantsused for the treatment of bone fracture: a) *Bauhinia vahlii*; b) *Capparis zeylanica*; c) *Cheilocostus speciosus*; d) *Cuscuta reflexa*; e) *Cissus quadrangularis*; f) *Cissusa dnata*; g) *Litsea glutinosa*; h) *Ochna obtusata*; i) *Urena lobata*

Lowest RFC 0.15 in *Urena lobata*. This RFC value calculation depends on the collected ethnomedicinal data. The upper RFC values of 1 (one) indicate that all informants know about a particular species and also their abundant use. The small RFC value of 0.15 is indicates that few informants inform a particular species.

Table 2. Details of ethnomedicinal plants used for the treatment of bone fracture in Jhargram district

Sl. No.	Scientific name	Family	Local name	Habit	Uses and Mode of administration	RFC
1.	*Bauhinia purpurea* L.	Fabaceae	Rakta Kanchan (Bengali); singyara, Baper (Santali)	Medium tree	**Stem bark:** Stem bark paste applied to treat bone fracture.	0.46
2.	*Bauhinia vahlii* Wight &Arn.	Fabaceae	Chihurlata, Sihar (Beng); Sehari, Jom-lar (Lodha); Sihari-chop, Lamarklar, Bir-gungu-nari, Jom (Santal)	Climber	**Stem bark:** Stem bark paste with Halud (*Curcuma longs)* and lime then mixed together and warmed it, this mixture applied on bone fracture.	0.56
3.	*Capparis zeylanica* L.	Capparaceae	Rohini, Hingshra, Asria (Santali), Bagnai, Kalikera, Kakadoni (Lodha)	Climbing Shrub	**Stem bark:** Stem bark paste with paste of Leda (*Litsea glutinosa*) stem bark and moram stone then warmed it and applied on bone fracture.	0.71
4.	*Cheilocostus speciosus* (J. Koenig) C. Specht.	Costaceae	Kemuk, Kenw (Bengali); Orop, Kewa-kanda (Santali); Kiricha-kanda, Keo-gera, Toagora (Lodha)	Rhizomatous Herb	**Rhizome:** Rhizome paste with paste of black pepper (*Piper nigrum*), turmeric (*Curcuma longa*) and pinch of lime mixed together then warmed it applied on a plaster for bone fracture.	0.79

5.	*Cissus adnata* Roxb.	Vitaceae	Panialata (Bhumij), Bodlarnari (Santali)	Woody climber	**Root:** Root paste heated and then applied on cut, wounds and as a plasture for bone fracture.	0.41
6.	*Cissus quadrangularis* L.	Vitaceae	Harjora, Harbhanga (Bengali and Santali)	Climbing Herb	**Stem and Leaf:** Stem and leaves paste with moram stone and turmeric (*Curcuma longa*) paste mixed together and mildly heated applied as a plaster form on bone fracture. Stem and leaf paste used to cure headache.	0.89
7.	*Curcuma longa* L.	Zingiberaceae	Halud, Haldi(Bengali)	Rhizomatous Herb	**Rhizome**: Rhizome paste with lime mixed together and heated, then applied on plasture form for treatment of foot wrench, swelling and joint twisting.	0.94
8.	*Cuscuta reflexa* Roxb.	Convolvulaceae	Swarnalata, Aloklata (Bengali); Banda, Alokjarhi (Santali)	Parasitic twining herb	**Whole plant:** Whole plant paste applied to cure arthritis, muscle pain and bone fracture.	0.74
9.	*Euphorbia neriifolia* L.	Phyllanthaceae	Mansasij (Bengali), Ekte (Santali)	Small tree	**Leaf:** Leaf paste mildly heated and applied to binding form on wrench portion or fracture portion.Leaf paste used to cure pain of muscle and bones.	0.84
10.	*Holoptelea integrifolia* Planch	Ulmaceae	Challa (Begali); Saharha (Santali); Kanju (Munda)	Tree	**Stem bark:** Stem bark paste with paste of halud (*Curcuma longa*), lime andGarlic (*Allium sativum*) applied as plastered form over bone fracture.	0.17
11.	*Litsea glutinosa* (Lour.) C. B. Rob.	Lauraceae	Piplus, Kukrchita (Bengali), Garur, poj, Leda (Sanali)	Medium tree	**Stem bark:** Stem bark paste mildly heated and applied as a plaster form on bone fracture, joint twisting and swelling portion.	1.0
12.	*Ochna obtusata* var. *pumila* (Buch.-Ham. ex DC.) Kanis	Ochnacea e	Champabaha (Bengali); Simalkata, Kedar (Santali)	Under shrub	**Stem bark:** Stem bark paste with mildly heated and used as plaster on bone fracture.	0.82
13.	*Urena lobata*L.	Malvaceae	Banokra (Bengali); Bhidijanetet, Bherilet (Santali); Mindi-jata (Lodha)	Under shrub	**Leaf:** Leaf paste applied to cure boils, wounds and bone fracture.	0.15
14.	*Woodfordia fruticosa*(L.) Kurz	Lythraceae	Dhatki, Dawa, Dhai (Bengali), Dhaura, Dhowa, Dhainti, Ichak (Santali)	Large shrub	**Stem and root bark**: Stem and root bark paste applied as a plaster for treatment of bone fracture.	0.35

Table 3. Plants species with their Fidelity level (FL)

Plant Species	Therapeutic uses	NP	N	FL %
***Bauhinia purpurea* L.**	Bone fracture	18	39	46.15
***Bauhinia vahlii* Wight & Arn.**	Bone fracture	22	39	56.41
***Capparis zeylanica* L.**	Bone fracture	28	39	71.79
***Cheilocostus speciosus* (J. Koenig) C. Specht.**	Bone fracture	31	39	79.48
***Cissus adnata* Roxb.**	Bone fracture	16	39	41.02
***Cissus quadrangularis* L.**	Bone fracture	35	39	89.74
***Curcuma longa*L.**	Bone fracture	37	39	94.87
***Cuscuta reflexa* Roxb.**	Bone fracture	29	39	74.35
***Euphorbia neriifolia* L.**	Bone fracture	33	39	84.61
***Holoptelea integrifolia* Planch**	Bone fracture	07	39	17.94

***Litsea glutinosa* (Lour.) C. B. Rob.**	Bone fracture	39	39	100
***Ochna obtusata* var. *pumila* (Buch.-Ham. Ex DC.) Kanis**	Bone fracture	32	39	82.05
***Urena lobata* L.**	Bone fracture	06	39	15.38
***Woodfordia fruticosa* (L.) Kurz**	Bone fracture	14	39	38.89

A total of 14 species with a high fidelity level (FL) are given in **Table 3**. The FL value between 15.38% and 100%. The highest FL value is 100 % in *Litsea glutinosa,* followed by *Curcuma longa* (94.87%), *Cissus quadrangularis* (89.74 %), *Euphorbia neriifolia* (84.61%) and the lowest FL value is 15.38 % in *Urena lobata*. The highest FL indicates highest number. of informants inform a particular plant for a specific use. Lower values of FL indicate a small numberof informants for a particular plant for a specific use because most of the informants do not know about the medicinal uses of these plants.

CONCLUSION

The valuable traditional knowledge about medicinal plants and the procedure of herbal drugs used by the tribal medicine men to cure bone fractures was documented; otherwise, we are bound to lose our indigenous knowledge system for ever. It is essentially required for proper protection, conservation, cultivation, and utilization of these ethnomedicinal plants in this district. The quantitative ethnomedicinal tools such as RFC and FL were used for data analysis. The highest value of RFC and FL indicate that the abundant uses of a particular species for cure bone fracture and also indicate all informants inform a particular species for a specific use like bone fracture. This study recommends initiating the sustainable utilization, protection, and conservation of medicinal plants.

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