

Traditional uses of plants to cure stomach disorders by the Nepali community in Nagaon and Sonitpur Districts of Assam, India

Rinju Bharali¹, B. K. Dutta^{1,4}, P. Gogoi² and Bijumoni Borah³

¹Microbial & Agricultural Ecology & Biodiversity Conservation Laboratory, Department of Ecology and Environmental Sciences, Assam University, Silchar, 788011, Assam, India

²Formerly of: NEDFi, R & D Centre For MAP, Khetri, Kamrup, 782403, Assam, India

³Department of Botany, Anandaram Dhekial Phookan College, Haibargaon, Nagaon, 782002, Assam, India

⁴Corresponding author: E-mail: bimankdutta@rediffmail.com

[Received 21.05.2017; Revised 12.06.2017; Accepted 14.06.2017; Published 30.06.2017]

Abstract

The present study was conducted in the Nagaon and Sonitpur districts of Assam, India to document medicinal plants which are being used by the people of Nepali community to cure their stomach disorders. Study documented 38 species belonging to 24 families of which 18 are trees, 4 shrubs, 14 herbs and 2 climbers. The stomach disorders they treat include diarrhea, dysentery, stomachache, blood dysentery and constipation.

Key words: Medicinal plants, Stomach disorders, Nepali community, Nagaon and Sonitpur Districts, Assam

INTRODUCTION

The use of plants as source of medicines is practiced throughout the world. Plants and plant products have augmented human cultures since time immemorial but only few people realized that the plants form the most important component of our environment (Singh 1993). Treatment of diseases through herbal and other natural organic substances dominated the medical practice for centuries by different ethnic groups living in remote areas of Assam (Mahanta *et al.* 2006). Their dependence on medicinal plants for the primary healthcare may be due to effectiveness, easy availability, lack of modern healthcare alternatives, cultural preferences and to their century old association with plants (Caniago *et al.* 1998). Their association with plants helped them to acquire huge information regarding their medicinal application by continuous trial and error method (Mahanta *et al.* 2006). Such knowledge was gathered by certain group of people like village head and traditional healers, locally known as *Bej*, *Ojha*, *Baidya*, etc. who treat common people using their age-old traditional knowledge and practice. A survey of World Health Organization (WHO) indicates that about 70 to 80 % of the world populations in developing countries, even today, depend on herbal sources as their primary healthcare system (Fransworth *et al.* 1985). Around 16000 species of higher plants are found in India and out of these 7500 species have been reported to be used by different ethnic communities for medicinal and health care purposes (Arora 1987). According to another report (Pushpagandan 1995) over 2000 species of ethnomedicine and folk medicine are newly identified as drug yielding plants and also about 7500 plants are used in traditional health practices in mostly rural and tribal dominating villages of India.

A good number of workers in India are engaged in recording traditional knowledge. Workers like Shah and Joshi (1971), Pangtey *et al.* (1982), Rawat and Pangtey (1987), Pande *et al.* (1989) and Kala (2005) recorded the ethnobotanical knowledge of Kumaon region. However, there are only few studies on the utility of medicinal plants in the treatment of a specific disease (Sharma & Joshi 2010; Kumari *et al.* 2011).

In recent years, herbal medicines are gaining popularity among the western population because these have minor or no side effects if administered properly (Jordan *et al.* 2010). Beside medicinal use, plants are increasingly used also in cosmetics (Aburjai & Natsheh 2003) and nutraceuticals (Espín *et al.* 2007; Bernal *et al.* 2011).

Herbal medicines have been proved to be highly effective to treat a wide range of diseases (Blumenthal 2002; Mukherjee & Wahile 2006; Sarkar & Das 2010), including gastrointestinal disorders (Heinrich *et al.* 1992; Manandhar 2002; Madikizela *et al.* 2012; Street & Prinsloo 2013). Gastrointestinal disorders are ailments affecting the functions of the digestive tract i.e. food and liquid absorption, digestion or excretion (Neamsuvan *et al.* 2012). Such disorders are caused due to infections by different bacteria, viruses, and other parasitic organisms (Mathabe *et al.* 2006; Karki & Tiwari 2007). Common gastrointestinal disorders are stomach / abdominal pain, diarrhea, dysentery, gastroenteritis, constipation, vomiting etc. (WHO 2008). These disorders cause morbidity and can lead to mortality, especially in the developing world where sanitation is deficient (Heinrich *et al.* 1992; Pawlowski *et al.* 2009; Tuite *et al.* 2011). Outbreaks of diarrhea, dysentery or cholera caused by contaminated drinking water have claimed millions of lives worldwide mainly infants and children (Sarkar *et al.* 2007; Ryan 2011). For example, serious diarrhea/ dysentery/cholera out-breaks were reported in Ethiopia (Bartels *et al.* 2010), Haiti (Tuite *et al.* 2011), Vietnam (Anh *et al.* 2011), Zimbabwe (Fisher 2009), and Nepal (Bhandari *et al.* 2009), all with a high death toll. In Nepal, 80 – 85 % of the population depends on traditional medicine for primary health care (Manandhar 2002). The use of medicinal plants is widespread, not only because those are easily accessible and affordable, but also due to persistent cultural beliefs and practices, as well as the lack of access to modern health care systems in rural areas (Coburn 1984; Pohle 1990; Baral & Kurmi 2006). Medicinal plants are used to treat various gastrointestinal disorders ranging from simple ones like vomiting to more complex problems like peptic ulcer (Lama *et al.* 2001; Rajbhandari 2001). There are many studies related to traditional uses of plant species in Nepal (Manandhar 2002; Shrestha *et al.* 2004; Joshi & Joshi 2005; Kunwar & Bussmann 2008). Beside ethnobotanical studies, *in-vitro* and *in-vivo* trials were realized to identify the mechanisms explaining the effectiveness of some of the medicinal plants used in traditional medicines (Griggs *et al.* 2001; Panthi & Chaudhary 2006; Rajbhandari *et al.* 2009; Mitra *et al.* 2010). This practice of establishing phyto-chemical or pharmacological explanations for traditional uses is not only helpful to institutionalize traditional medicine, but can also lead to the development of new drugs (Newman & Cragg; 2007; Mazumdar & Dutta Choudhury 2015) or indicate future directions for bio-prospecting (Soejarto *et al.* 2005; Douwes *et al.* 2008; Pushpangadan *et al.* 2015). However, till date, only a few studies have so far linked with traditional medicinal uses to pharmacological or phytochemical properties (Kunwar *et al.* 2009; Uprety *et al.* 2010; Gaire & Subedi 2011; Luitel *et al.* 2014).

The stomach is a very vital organ in the digestive system and the human body on the whole. Every day, the stomach has to cope with different types of food for storing, primary processing and partial digestion. Stomach disorders generally occur due to the nature of food that we consume and it's incompatibility with our constitution and microbial infections. Some of the most common stomach problems we face in our day to day life are stomach-aches, cramps, vomiting and indigestion (Jalal *et al.* 2013). Medicinal plants have been used as

source of curing various stomach disorders since ancient times and more so in the state of Assam including the districts of Nagaon and Sonitpur. The Nepali community of this region uses various plants for stomach disorders till date. Keeping the centuries-old trend alive, the Nepali community still relies hugely on the wild plants for their daily needs such as food, fodder and medicines.

Some studies on ethno-medicinal practices from different regions of India have been reported but there are few investigations available for Nagaon and Sonitpur district of Assam except a few studies in the last decade (Bora 1999; Saikia 2006; Saikia *et al.* 2008; Saikia *et al.* 2010; Bharali *et al.* 2012). In view of this, the present study was conducted to identify, collect and document the ethno-medicinal plants used by the Nepali community of Nagaon and Sonitpur districts of Assam. The present paper, therefore, deals with some plants being used regularly by the people of Nepali community against different types of stomach disorders.

Nepali community, amongst different other traditional communities in Assam, has rich cultural heritage. Nepalese are scattered all over Assam and other North Eastern states as well. However, in Assam Nepalese are mostly concentrated in the Sonitpur district and in some parts of Nagaon district.

Sonitpur district is situated on the North bank of Brahmaputra River. Its geographical location is 26°30' to 27° 01' N latitudes and 92° 16' to 93° 43' E longitudes. Arunachal Pradesh bound Sonitpur district on the North, River Brahmaputra on the South, Lakhimpur district on the East and Darrang district on the West. The average daily temperature varies from 17 - 37° C. The vegetation is mostly tropical semi-evergreen and mixed deciduous forests.

Nagaon is situated in central part of Assam. The boundary of the district is with Sonitpur district and the River Brahmaputra in north, West Karbi Anglong and N.C. Hills districts are in south, and East Karbi Anglong and Golaghat districts are bordering on the East. The district lies between 25°- 45' to 26°- 45' N latitude and 92° - 33' to 92° - 41' E longitude with an area of about 4435.3 sq km and the average altitude of about 60.6 m. The climate of this district is in general monsoon type. The temperature of Nagaon is about 24.8° C (maximum) and 11.2° C (minimum) during winter and in summer it is 32.9° C (maximum) and Min. 25.5° C (minimum). Forests in Nagaon district are mostly deciduous type.

MATERIALS AND METHODS

The study has been conducted among the Nepali community during March 2011 – October 2014 in *Missa*, *Jakhalabandha* and *Sulung* villages of Nagaon district and *Tezpur*, *Biswanath Chariali*, *Gohpur* and *Dhekiajuli* villages of Sonitpur district of Assam.

The primary information regarding the use and values of plants were collected during the field work using standard survey techniques (Deshmukh *et al.* 2010) that included individual and in-depth interviews and group discussion among the local plant users, community members and healers (*ojah/ dhami*), persons having indigenous knowledge, etc. Ethnomedicinal information was collected through questionnaire. The set questions contained the local names of the plants used to cure stomach disorders; the plant part used for this purpose and the mode of administration of the plant materials. The interviews were performed in Nepali language for which interpreters were used. Some of them were well versed with Assamese language. After the interview, the informants were asked to supply the plant specimens and often they accompanied to the field to collect plant materials. Particularly visits to Bura Chapori Wildlife Sanctuary in Sonitpur district, Assam were very fruitful. A few elderly ladies were particularly helpful in some cases. Details of use including the approximate

amounts and number of doses were recorded for specific diseases for authentication and validation of method (Jain 1987).

The collected plant specimens were processed into mounted herbarium sheets (Jain & Rao 1977) and were identified with the help of various literature including Hooker (1872 - 1897), Kanjilal *et al.* (1934 – 1940), Bor (1940), Deb (1961a,b), Sinha (1987), Kirtikar and Basu, (1935) and by consulting experts. Identification of specimens was confirmed by matching at the Herbarium of Assam University and at ASSAM. Secondary information was collected by reviewing numerous published works related to the present study and are referred appropriately.

For this work necessary Permission was taken from the Community leaders for publishing the knowledge imparted by them.

Almost all possible information regarding the medicinal plants used to cure stomach disorders by the Nepali community have been recorded and discussed.

RESULT AND DISCUSSION

Data collected through the survey in Sonitpur and Nagaon districts of Assam led to the record of 38 species of plants representing 29 genera from 24 families which are used to treat different types of stomach disorders. These include plants of different habit groups including herbs (14 spp. or 37 %), trees (18 spp. or 47 %), shrubs (4 spp. or 11 %), and climbers (2 spp. or 5 %). For each species, scientific and local names, family, parts used and uses are presented in Table 1 and Figure 1. The most commonly represented families were Rutaceae (4 spp.), Malvaceae, Poaceae, Amaranthaceae, Anacardiaceae, Leguminosae, Apiaceae, Clusiaceae, Lamiaceae, Euphorbiaceae, Polygonaceae and Combretaceae with 2 spp. from each. Different plant parts were used for the treatment of different stomach disorders. In general, fruits (11 spp.) were highly used and is followed by whole plant (8 spp.), bark (6 spp.), leaves (5 spp.), roots (4 spp.), flowers and seeds (1 sp. each) (Figure-2). These plants used for the treatment of different stomach troubles such as indigestion, diarrhea, constipation and dysentery.

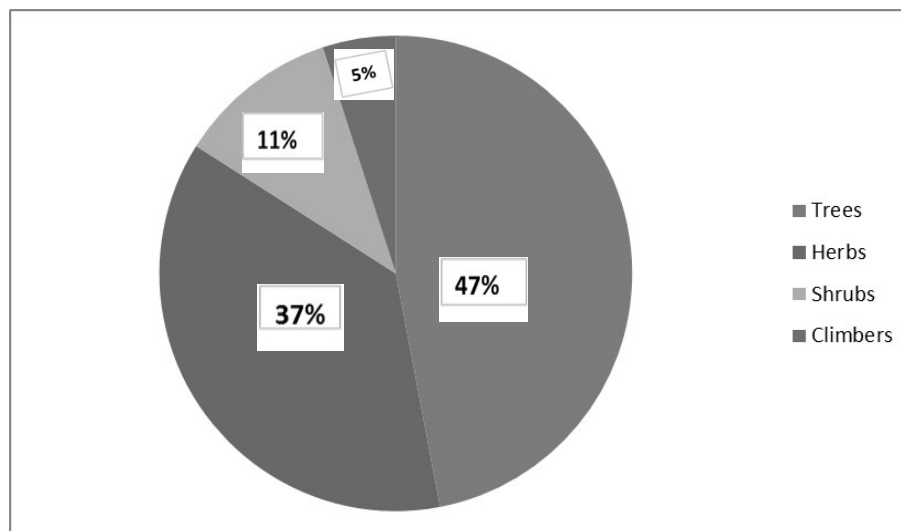


Fig. 1. Different habit-group of plants used by the Nepali community in Nagaon and Sonitpur Districts of Assam to treat gastric problems

Table 1. Medicinal plants used for curing different types of stomach disorders by the Nepali community in Nagaon and Sonitpur districts of Assam

Plant species	Local name	Parts used	Use
<i>Abelmoschus esculentus</i> (L.) Moench [Malvaceae]; Rinju 0234	Ramtoria	Whole plant	whole plant extract taken to cure abdominal disorder, constipation and diarrhea
<i>Agrostis filipes</i> Hook.f. [Poaceae]; Rinju 0162	Bobocha	Root	Root juice used to treat chronic dysentery
<i>Amaranthus spinosus</i> L. [Amaranthaceae]; Rinju 0166	Khutura	Whole plant	Whole plant extract is given in diarrhea
<i>Amaranthus tricolor</i> L. [Amaranthaceae]; Rinju 0134	Morisa	Root	Root juice is used for acute abdominal pain and stomach ache.
<i>Anacardium occidentale</i> L. [Anacardiaceae]; Rinju 0169	Kaju	Bark	Bark decoction is used for curing diarrhea and dysentery
<i>Bauhinia vahlii</i> Wight & Arn. [Leguminosae: Caesalpinioideae]; Rinju 0172	Bhorla	Bark	Bark juice is given in dysentery and stomach ache
<i>Bauhinia variegata</i> L. [Leguminosae: Caesalpinioideae]; Rinju 0173	Byagan	Bark	Bark juice is used to treat dysentery
<i>Cardiospermum halicacabum</i> L. [Sapindaceae]; Rinju 0107	Kopalphuta	Stem, leaf	Infusion of stem and leaf is used in diarrhea and dysentery
<i>Centella asiatica</i> (L.) Urb. [Apiaceae]; Rinju 0031	Taaprejhar	Whole plant	Extract is good for dysentery and diarrhea
<i>Cinnamomum verum</i> J.Presl [Lauraceae]; Rinju 0177	Dalchini	Bark	Used as a remedy for diarrhea
<i>Citrus aurantiifolia</i> (Christm.) Swingle [Rutaceae]; Rinju 0118	Kagati	Fruit	Preserved green fruit in salt is good in treating mucous in fsces
<i>Citrus limon</i> (L.) Osbeck [Rutaceae]; Rinju 0120	Thulla nimbu	Fruit	Juice of green fruit is good in diarrhea
<i>Citrus paradisi</i> Macfad. [Rutaceae]; Rinju 0056	Gol nimbu	Fruit	Juice of both green and ripe fruits are given in dysentery, diarrhea and indigestion
<i>Citrus x aurantium</i> L. [Rutaceae]; Rinju 0119	Suntala	Ripe fruit	Ripe fruit is good against dysentery and diarrhea
<i>Cocos nucifera</i> L. [Arecaceae]; Rinju 0103	Nariol	Coconut water	Green coconut water is given in diarrhea and dysentery
<i>Dillenia indica</i> L. [Dilleniaceae]; Rinju 0148	Chalta	Fruit	Extract of green fruit is given in diarrhea and dysentery
<i>Dioscorea bulbifera</i> L. [Dioscoreaceae]; Rinju 0015	Bantarul	Root-stock	Extract is used to treat dysentery
<i>Ficus benghalensis</i> L. [Moraceae]; Rinju 0222	Bar	Leaf	Juice of tender leaves are given in dysentery.
<i>Garcinia cowa</i> Roxb. ex Choisy [Clusiaceae]; Rinju 0027	Thekera	Fruit	Sliced green fruit is sun dried, soaked overnight in water and extract is given in dysentery and diarrhea
<i>Garcinia pedunculata</i> Roxb. ex. Buch. – Ham. [Clusiaceae]; Rinju 0028	Thekera	Fruit	Sliced green fruit is sun dried, soaked overnight in water and extract is given in dysentery and diarrhea

Plant species	Local name	Parts used	Use
<i>Gossypium herbaceum</i> L. [Malvaceae]; Rinju 0187	Rui	Root	Decoction is given in diarrhea and dysentery.
<i>Hydrocotyle sibthorpioides</i> Lam. [Araliaceae]; Rinju 0032	Taaprejhar	Whole plant	Eaten in diarrhea, dysentery and as tonic in general weakness.
<i>Imperata cylindrica</i> (L.) Raeusch. [Poaceae]; Rinju 0188	Siuri	Sobol	Extract of sobol is used to treat gastritis and dysentery
<i>Jasminum simplicifolium</i> subsp. <i>australiense</i> P.S.Green [Oleaceae] Rinju 0189	Chamelip hool	Flower	Extract of flower is used to cure indigestion
<i>Lawsonia inermis</i> L. [Lythraceae]; Rinju 0192	Mehendi	Seeds	Powdered seeds mixed with ghee and used to treat dysentery
<i>Mentha arvensis</i> L. [Lamiaceae]; Rinju 0197	Pudina	Leaf	Extract is given to cure diarrhea and blood dysentery
<i>Ocimum basilicum</i> L. [Lamiaceae]; Rinju 0011	Ban tulsii	Whole plant	Juice of whole plant is given in gastritis
<i>Paederia foetida</i> L. [Rubiaceae]; Rinju 0039	Paadelata	Leaf	Leaf and tender shoot decoction is given in diarrhea, dysentery and acidity
<i>Peperomia pellucida</i> (L.) Kunth [Piperaceae] Rinju 0140	Purnonua	Whole plant	Extract is used to cure any kind of stomach trouble
<i>Phyllanthus amarus</i> Schumach. & Thonn. [Phyllanthaceae]; Rinju 0111	Aamla	Whole plant	Extract is given in empty stomach to treat indigestion
<i>Phyllanthus emblica</i> L. [Phyllanthaceae]; Rinju 0072	Aamla	Fruit	Used in diarrhea and dysentery
<i>Polygonum microcephalum</i> D.Don [Polygonaceae]; Rinju 0202	Modhusul ong	Leaf, stem	Cooked leaves and tender shoots are eaten to cure various stomach troubles
<i>Polygonum pubescens</i> Blume [Polygonaceae]; Rinju 0077	Bih logini	Leaf	Leaf juice is given for diarrhea and dysentery
<i>Punica granatum</i> L. [Lythraceae]; Rinju 0121	Dalim	Fruit	Juice of ripe fruit is given in diarrhea and dysentery
<i>Shorea robusta</i> Gaertn. [Dipterocarpaceae]; Rinju 0205	Phosing	Bark	Powdered resin extracted from bark is taken with curd in dysentery
<i>Spondias pinnata</i> (L.f.) Kurz [Anacardiaceae]; Rinju 0002	Amora	Bark, fruit	Bark decoction given in dysentery; curry of unripe fruit is given in diarrhea and dysentery
<i>Terminalia bellirica</i> (Gaertn.) Roxb. [Combretaceae]; Rinju 0073	Barro	Fruit	Dry-fruit powder mixed with dry-fruit powder of <i>Terminalia chebula</i> and <i>Phyllanthus Emblica</i> , called churan of 'trifola' good for any kind of stomach trouble
<i>Terminalia chebula</i> Retz. [Combretaceae]; Rinju 0074	Hooro	Fruit	Used as in <i>Terminalia bellirica</i> .

In majority of cases, the herbal medicines were prepared in the form of decoction, juice and powder. Maximum numbers of plants were used for dysentery (23 spp.) followed by diarrhea (21 spp.), stomachache (2 spp.), indigestion (2 spp.) and least number were reported against constipation and blood dysentery (1 sp.) (Figure-3).

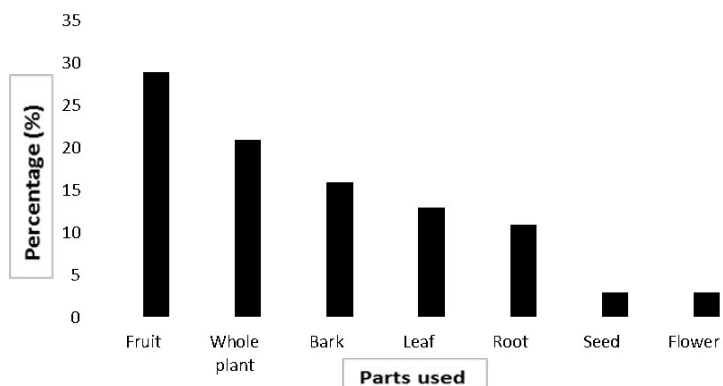


Fig. 2. Percentage of plant parts used as medicine by the Nepali community in Nagaon and Sonitpur Districts of Assam

Most of the reported plants in the present study are also used by other tribal people in India for the treatment of stomach disorders. *Centella asiatica*, *Citrus limon*, *Garcinia cowa*, *Hydrocotyle sibthorpioides*, *Mentha arvensis*, *Paederia foetida*, *Phyllanthus emblica*, *Punica granatum* have similar types of information related to stomach disorders were reported from Assam (Mahanta *et al.* 2005; Basumatary *et al.* 2014, Gogoi *et al.* 2015; Bora *et al.* 2016) and Kumaon Himalaya (Jalal & Garkoti, 2013).

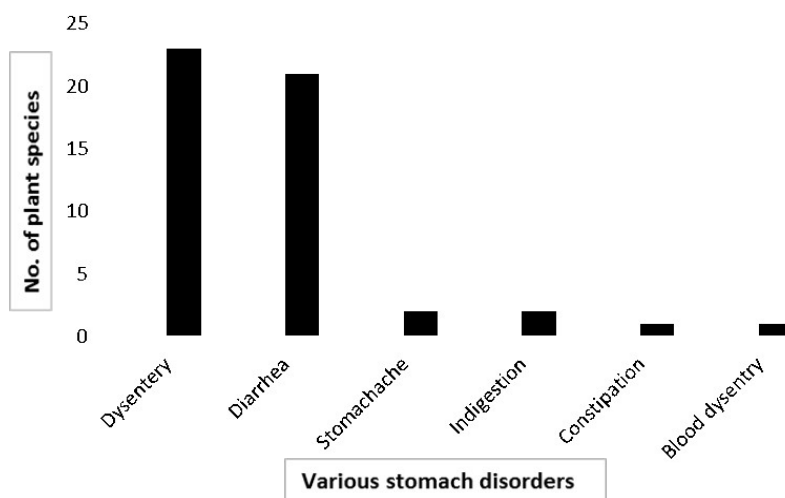


Fig. 3. Number of plants used for curing various stomach disorders by the Nepali community of Nagaon and Sonitpur Districts of Assam

The present investigation revealed that out of the total of 38 species, 6 species (*Abelmoschus esculentus*, *Amaranthus tricolor*, *Anacardium occidentale*, *Bauhinia variegata*, *Cardiospermum halicacabum*, *Gossypium herbaceum*, have new uses as ethnomedicine used for curing stomach trouble according to Nepali community of Nagaon and Sonitpur districts of Assam. Moreover 1 plant species (*Agrostis filipes*) is reported to be a new claim in the field as compared to the established reports on their utilization as ethnomedicine (Jain 1991).

The main focus of this study was to gather the different medicinal plants used by the Nepalese of Nagaon and Sonitpur districts of Assam. The community is heavily dependent

on plant products and believe in their various remedial properties since long. The traditional healers of this area grow many of their required plants in their home gardens and the remaining plants are collected from the nearby vegetation.

All their knowledge on ethno-medicine has been transmitted orally through the generations and most of these are closely guarded treasures. Therefore, there is no written document.

It has also been noticed that the younger generation have least interest to learn the uses of these plants. Therefore, it is important to survey and document their indigenous knowledge immediately. At the same time the wisdom of the community on the process of preparation by the medicine-men and their utilization should be given due importance.

These ethno-medicinal plants are also a source of income for the Nepali community. In these regions, the traditional communities collect medicinal plants from the wild and sell those in local markets. Over-exploitation and unscientific tapping by the ignorant local people have resulted in the loss of many important plants. Many of these plants are on the brink of extinction at least in local vegetation and there is an urgent need to conserve such plants with high medicinal value to ensure their existence and sustainable utilization against massive, indiscriminate deforestation and uncontrolled exploitation.

CONCLUSION

The present study revealed that the Sonitpur and Nagaon region is rich in wild plants having important ethno-medicinal values. The Nepali community is partly dependent on medicinal plants to fulfill their day-to-day health care needs and some such species could be exploited for the healthcare of human community at large. The conservation of ethnomedicinal resources and wild relatives of crop plants is vital for future scientific evaluation and improvement programs. This aspect of the study should also be given its due importance and, therefore, the research work on the economically important plants used by the Nepali community must continue so that these plants and their knowledge about those can be conserved before they are lost forever.

Acknowledgements

Authors are grateful to the local resource persons for sharing their valuable knowledge on plants and plant resource and for their kind co-operation during the survey period.

LITERATURE CITED

- Aburjai, T. & Natsheh, F.M. 2003. Plants used in cosmetics. *Phytoth. Res.* 17: 987 – 1000.
- Anh, D.D.; Lopez, A.L.; Thiem, V.D.; Grahek, S.L.; Duong, T.N.; Park, J.K.; Kwon, H.J.; Favorov, M.; Hien, N.T. & Clemens, J.D. 2011. Use of oral cholera vaccines in an outbreak in Vietnam: a case control study. *PLoS Neglected Tropical Diseases* 5: e1006.
- Arora, R.K. 1987. Ethnobotany and its role in the conservation and use of the genetic resources in India. *Ethnobotany* 9: 6 – 15.
- Baral, S.R. & Kurmi, P.P. 2006. *A Compendium of Medicinal Plants in Nepal*. Rachana Sharma, Kathmandu, Nepal.
- Bartels, S.A.; Greenough, P.G.; Tamar, M. & VanRooyen, M.J. 2010. Investigation of a cholera outbreak in Ethiopia's Oromiya Region. *Disast. Med. Public Health Preparedness* 4: 312.

- Basumatary, N.; Terron, R. & Saikia, M. 2014. Ethnobotanical practices of the Bodo-Kachari Tribe of Karbi Anlong District of Assam. *Int. J. Life Sc. Bt. Pharm. Res.* 3(1): 161 – 167.
- Bernal, J.; Mendiola, J.A.; Ibáñez, E. & Cifuentes, A. 2011. Advanced analysis of nutraceuticals. *J. Pharmac. Biomed. Anal.* 55: 758 – 774.
- Bhandari, G.P.; Dixit, S.M.; Ghimire, U. & Maskey, M.K. 2009. Outbreak investigation of diarrheal diseases in Jajarkot. *J. Nepal Health Res. Council* 7: 66 – 68.
- Bharali, R.; Dutta, B.K. & Gogoi, P. 2012. Ethnobotanical studies on the Lalung Tribe of Nagaon District (Assam). In: Dutta, B.K.; Choudhury, P. & Nath, A.J. (eds.), *Biodiversity Research in North- East India*. Assam University, Silchar. Pp. 198 – 215.
- Blumenthal, M. 2002. Herb sales down in mainstream market, up in natural food stores. *Herbal Gram* 55: 60.
- Bor, N.L. 1940. *Flora of Assam*, Vol. V. Govt. of Assam Press, Shillong.
- Bora, A.; Bora, C. & Dutta, C. 2016. Ethnomedicinal plants used for the treatment of common diseases by the Lakhimpur district, Assam. *J. Nat. Prod. Plant Resour.* 6(1): 6 – 11.
- Bora, P.J. 1999. A study of ethnomedicinal uses of plants among the Bodo tribe of Sonitpur district, Assam, India. *J. Econ. Tax. Bot.* 23 (2): 604 – 608.
- Caniago I & Siebert, S. 1998. Medicinal plants ecology, knowledge and conservation in Kalimantan, Indonesia. *Econ. Bot.* 52: 229.
- Coburn, B. 1984. Some native medicinal plants of the western Gurung. *Kailash* 11: 55 – 88.
- Deb, D.B. 1961a. Monocotyledonous plants of Manipur Territory. *Bull. Bot. Surv. India.* 3(2): 115 – 138.
- Deb, D.B. 1961b. Dicotyledonous plants of Manipur Territory. *Bull. Bot. Surv. India* 3(3): 253 – 350.
- Douwes, E.; Crouch, N.R.; Edwards, T.J. & Mulholland, D.A. 2008. Regression analyses of southern African ethnomedicinal plants: informing the targeted selection of bioprospecting and pharmacological screening subjects. *J. Ethnopharm.* 119: 356 – 364.
- Espín, J.C.; García-Conesa, M.T. & Tomás-Barberán, F.A. 2007. Nutraceuticals: facts and ùction. *Phytochemistry* 68: 2986 – 3008.
- Fisher, D. 2009. Cholera in Zimbabwe. *Annl. Acad. Med., Singapore* 38: 82.
- Fransworth, N.R.; Akerele, O. & Bingel, A.S. 1985. Medicinal plants in therapy. *Bull. World Health Organ.* 63: 965 – 981.
- Gaire, B.P. & Subedi, L. 2011. Medicinal plant diversity and their pharmacological aspects of Nepal Himalayas. *Pharmacognosy J.* 2: 6 – 17.
- Gogoi, G. & Das, A.K. 2015. Ethnomedicobotanical survey against gastro-intestinal diseases in the Dhakuakhana area of Lakhimpur District in Assam, India. *Pleione* 9(1): 178 – 185.
- Griggs, J.; Manandhar, N.P.; Towers, G.H. & Taylor, R.S. 2001. The effects of storage on the biological activity of medicinal plants from Nepal. *J. Ethnopharm.* 77: 247 – 252.
- Heinrich, M.; Rimpler, H. & Barrera, N.A. 1992. Indigenous phytotherapy of gastro-intestinal disorders in a lowland Mixe community (Oaxaca, Mexico): ethno-pharmacologic evaluation. *J. Ethnopharm.* 36: 63 – 80.
- Hooker, J.D. 1872-1897. *The Flora of British India*, Vols. 1 – 7. Reeve & Co. Ltd., Ashford, Kent., London.

- Jain, S.K. 1987. *A Manual of Ethnobotany*, Scientific Publication, Jodhpur.
- Jain, S.K. 1991. *Dictionary of Indian Folk Medicine and Ethnobotany*. Deep Publications, New Delhi.
- Jain, S.K. & Rao, R.R. 1977. *Hand book of field and herbarium methods*, Today & Tomorrow's Printers and Publishers, New Delhi.
- Jalal, J.S. & Garkoti S.C. 2013. Medicinal plants used in the cure of stomach disorders in Kumaon Himalaya, Uttarkhand India. *Acad. J. Med. Plants* 1(7): 116 – 121.
- Jordan, S.A.; Cunningham, D.G. & Marles, R.J. 2010. Assessment of herbal medicinal products: challenges, and opportunities to increase the knowledge base for safety assessment. *Toxicol. Appl. Pharm.* 243: 198 – 216.
- Joshi, A.R. & Joshi, K. 2005. *Ethnobotany and Conservation of Plant Diversity in Nepal: Status, Bibliography and Agenda for Sustainable Management*, 1st edn. RubRick, Kathmandu, Nepal.
- Kala, C.P. 2005. Current status of Medicinal plants used by traditional Vaidys in Uttaranchal Sate of India. *Ethnobot. Res. Appl.* 3: 267 – 278.
- Kanjilal, U.N.; Kanjilal, P.C; Das. A. & Purkaystha, C. 1934. *Flora of Assam*, Vol. 1, Assam Govt. Press, Shillong.
- Kanjilal, U.N.; Kanjilal, P.C. & Das, A. 1938. *Flora of Assam*, Vol. 2, Assam Govt. Press, Shillong.
- Kanjilal, U.N.; Kanjilal, P.C.; Das. A. & Dey, R.N. 1939. *Flora of Assam*, Vol. 3, Assam Govt. Govt. Press, Shillong.
- Kanjilal, U.N.; Kanjilal, P.C; Das, A, & Dey, R.N. 1940. *Flora of Assam*, Vol. 4, Assam Govt. Govt. Press, Shillong.
- Kirtikar, R. B. & Basu, B. D. 1935. *Indian Medicinal Plants*, Vol. I - IV. Lalit Mohan Basu, Allahabad.
- Kanwar, P.; Sharma, N. & Rekha, A. 2006. Medicinal plants use in traditional healthcare systems prevalent in Western Himalayas. *Indian J. Trad. Knowl.* 5(3): 300 – 309.
- Karki, A. & Tiwari, B.R. 2007. Prevalence of acute diarrhea in Kathmandu valley. *J. Nepal Med. Association* 46: 175 – 179.
- Kumari, P; Joshi, G.C. & Tewari, L.M. 2011. Contribution of indigenous anti-diabetic flora in Almora district, Uttarakhand, India. *Curr. Bot.* 2(8): 01 - 07.
- Kunwar, R.M. & Bussmann, R. W. 2008. Ethnobotany in the Nepal Himalaya. *J. Ethnobiol. Ethnomed.* 4: 24.
- Kunwar, R.M.; Upreti, Y.; Burlakoti, C.; Chowdhary, C.L. & Bussmann, R.W. 2009. Indigenous use and ethnopharmacology of medicinal plants in far-west Nepal. *Ethnobot. Res. Applic.* 7: 5 – 28.
- Lama, Y.C.; Ghimire, S.K. & Aumeeruddy-Thomas, Y. 2001. *Medicinal Plants of Dolpo: Amchis' Knowledge and Conservation*. WWF-Nepal, Kathmandu, Nepal.
- Luitel, D.R.; Rokaya, M.B.; Timsina, B. & Münzbergová, Z. 2014. Medicinal plants used by the Tamang community in the Makawanpur district of central Nepal. *J. Ethnobiol. Ethnomed.* 10: 5.
- Madikizela, B.; Ndhlala, A.R.; Finnie, J.F. & Van Staden, J. 2012. Ethnopharmacological study of plants from Pondoland used against diarrhoea. *J. Ethnopharm.* 141: 61 – 71.

- Mahanta, J.; Borah, P.K.; Gogoi, P. & Phukan, A.C. 2006. Traditional medicine in the treatment of gastrointestinal diseases in Upper Assam. *Indian J. Trad. Knowl.* 5(4): 510 – 512.
- Manandhar, N.P. 2002. *Plants and People of Nepal*. Timber Press, Portland, OR, USA.
- Mathabe, M.C.; Nikolova, R.V.; Lall, N. & Nyazema, N.Z. 2006. Antibacterial activities of medicinal plants used for the treatment of diarrhoea in Limpopo Province, South Africa. *J. Ethnopharm.* 105: 286 – 293.
- Mazumdar, J. & Dutta Choudhury, M. 2015. Review on the ethnomedicobotany and phytochemistry of *Sonchus brachyotus* A.P. de Candolle (Asteraceae). *Pleione* 9(1): 201 – 210.
- Mitra, P.K.; Mitra, P.; Das, A.P.; Ghosh, C.; Sarkar, A. & Chowdhery, D. 2010. Screening the efficacy of some East Himalayan Medicinal Plants on ethanol induced gastric ulcer in albino rats. *Pleione* 4(1): 69 – 75.
- Mukherjee, P.K. & Wahile, A. 2006. Integrated approaches towards drug development from Ayurveda and other Indian system of medicines. *J. Ethnopharm.* 103: 25 – 35.
- Neamsuvan, O.; Tuwaemaengae, T.; Bensulong, F.; Asae, A. & Mosamae, K. 2012. A survey of folk remedies for gastrointestinal tract diseases from Thailand's three southern border provinces. *J. Ethnopharm.* 144: 11 – 21.
- Newman, D.J. & Cragg, G.M. 2007. Natural products as sources of new drugs over the last 25 Years. *J. Nat. Prod.* 70: 461 – 477.
- Pande, P.C.; Joshi, G.C. & Kandapal, M.M. 1989. Ethnobotany of Kumaon Himalaya. In: Sah, N.K.; Bhatt, S.D.; Pande, R.K. (eds.), *Himalaya, Environment, Resource and Development*. Shree Almora Book Depot, Almora. Pp. 285 – 298.
- Pangtey, Y.P.S.; Rawat, G.S. & Kalakoti, B.S. 1982. Unusual supplementary wild food plants of Kumaon Himalaya. *Res. Dev.* 1(1): 359 – 380.
- Panthi, M.P. & Chaudhary, R.P. 2006. Antibacterial activity of some selected folklore medicinal plants from west Nepal. *Scientiûc World* 4: 16 – 21.
- Pawlowski, S.W.; Warren, C.A. & Guerrant, R. 2009. Diagnosis and treatment of acute or persistent diarrhea. *Gastroenterology* 136: 1874 – 1886.
- Pohle, P. 1990. *Useful Plants of Manang District: A Contribution to the Ethnobotany of the Nepal-Himalaya*. Franz Steiner Verlag Wiesbaden GMBH, Stuttgart.
- Pushpagandan, P. 1995. Ethnopharmacology of *Trichopus zeylanicus*- The ginseng of Kerala- A review, In: Pushpagandan, P.; Nyman, Uff & George, V. (eds.), *Proceeding of the first National Conference on Ethnopharmacology*. Visual Security Printing Enterprises Pvt. Ltd. New Delhi.
- Pushpagandan, P.; Ijiniu, T.P.; Dan, V.M. & George, V. 2015. Trends in bioprospecting of biodiversity in new drug design. *Pleione* 9(2): 267 – 282.
- Rajbhandari, K.R. 2001. *Ethnobotany of Nepal*. Ethnobotanical Society of Nepal, Kathmandu, Nepal.
- Rajbhandari, M.; Mentel, R.; Jha, P.K.; Chaudhary, R.P.; Bhattarai, S.; Gewali, M.B.; Karmacharya, N.; Hipper, M. & Lindequist, U. 2009. Antiviral activity of some plants used in Nepalese traditional medicine. *Evidence-Based Compl. Alt. Med.* 6: 517 – 522.
- Rawat, G.S. & Pangtey, Y.P.S. 1987. A contribution to the ethnobotany of alpine region of Kumaon. *J. Econ. Tax. Bot.* 11(1): 139 – 148.

- Ryan, E.T. 2011. The cholera pandemic, still with us after half a century: time to rethink. *PLoS Neglected Tropical Diseases* 5: e1003.
- Saikia, B. 2006. Ethnomedicinal plants from Gohpur of Sonitpur district, Assam. *Indian J. Trad. Knowl.* 5(4): 529.
- Saikia, B.; Borthakur, S.K. & Saikia, N. 2010. Medico- ethnobotany of Bodo tribals in Gohpur of Sonitpur district, Assam. *Indian J. Trad. Knowl.* 9(1): 52 – 54.
- Sarkar, Ajita & Das, A.P. 2010. Ethnobotanical formulations for the treatment of Jaundice by the *Mech* tribe in Duars of West Bengal. *Indian J. Trad. Knowl.* 9(1): 134 – 136.
- Sarkar, R.; Prabhakar, A.T.; Manickam, S.; Selvapandian, D.; Raghava, M.V.; Kang, G. & Balraj, V. 2007. Epidemiological investigation of an outbreak of acute diarrhoeal disease using geographic information systems. *Trans. Royal Soc. Trop. Med and Hygiene* 101: 587 – 593.
- Shah, N.C. & Joshi, M.C. 1971. An Ethnobotanical Study of the Kumaon Region of India. *Econ. Bot.* 25(4): 414 – 422.
- Sharma, V. & Joshi, B.D. 2010. Traditional medicines used for dental health care amongst the local people of Almora district of Central Himalaya in India. *Asian J. Trad. Med.* 5(3): 117 – 121.
- Shrestha, K.K.; Tiwari, N.N.; Rajbhandari, S.; Poudel, R.C. & Uprety, Y. 2004. *Ethnobotany in Nepal: Review and Perspectives*. WWF Nepal Program, Kathmandu, Nepal.
- Singh, R. 1993. *Systematic studies of Dicots of Lakimpur District*. Ph.D. Thesis, Gauhati University, Guwahati.
- Sinha, S.C. 1987. Ethnobotany of Manipur- Medicinal Plants. *Front. Bot.* 1: 123 – 152.
- Soejarto, D.D.; Fong, H.H.S.; Tan, G.T.; Zhang, H.J.; Ma, C.Y.; Franzblau, S.G.; Gyllenhaal, C.; Riley, M.C.; Kadushin, M.R.; Pezzuto, J.M.; Xuan, L.T.; Hiep, N.T.; Hung, N.V.; Vu, B.M.; Loc, P.K.; Dac, L.X.; Binh, L.T.; Chien, N.Q.; Hai, N.V.; Bich, T.Q.; Cuong, N.M.; Southavong, B.; Sydara, K.; Bouamanivong, S.; Ly, H.M.; Thuy, T.V.; Rose, W.C. & Dietzman, G.R. 2005. Ethnobotany/ethnopharmacology and mass bioprospecting: Issues on intellectual property and benefit-sharing. *J. Ethnopharm.* 100: 15 – 22.
- Street, R.A. & Prinsloo, G. 2013. Commercially important medicinal plants of South Africa: a review. *J. Chemistry* 2013: 1–16.
- Tuite, A.R.; Tien, J.; Eisenberg, M.; Earn, D.J.D.; Ma, J. & Fisman, D.N. 2011. Cholera epidemic in Haiti, 2010: using a transmission model to explain spatial spread of disease and identify optimal control interventions. *Ann. Internal Med.* 154: 593 – 601.
- Uprety, Y.; Asselin, H.; Boon, E.K.; Yadav, S. & Shrestha, K.K.. 2010. Indigenous use and bio-efficacy of medicinal plants in the Rasuwa district, Central Nepal. *J. Ethnobiol. Ethnomed.* 6: 3.
- WHO 2008. *Traditional medicine*. Fact sheet No. 134. World Health Organisation, New York.