Journal of Ethnopharmacology 192 (2016) 292–301

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jep

Medicinal plant diversity and traditional healing practices in eastern Nepal

Nawal Shrestha [a,*], Saugat Shrestha [b], Laxmi Koju [c,d], Krishna Kumar Shrestha [e], Zhiheng Wang [a]

[a] Department of Ecology, College of Urban and Environmental Sciences, Peking University, Beijing 100871, China
[b] Dhankuta Multiple Campus, Tribhuvan Univeristy, Dhankuta, Nepal
[c] Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing 100190, China
[d] University of Chinese Academy of Sciences, Beijing 100049, China
[e] Ethnobotanical Society of Nepal (ESON), Guchha Marg, New Road, Kathmandu, Nepal

ARTICLE INFO

Article history:
Received 7 January 2016
Received in revised form
20 July 2016
Accepted 23 July 2016
Available online 25 July 2016

Keywords:
Ethnomedicine
Fidelity level
Himalayan medicine
Informant consensus factor
Sankhuwasabha
Tinjure-Milke-Jaljale

ABSTRACT

Ethnopharmacological relevance: The rich floral and ethnic composition of eastern Nepal and the widespread utilization of locally available medicinal plants offer remarkable opportunity for ethnomedicinal research. The present paper aims to explore medicinal plant diversity and use in the remote villages of eastern Nepal. It also aims to evaluate ethnopharmacological significance of the documented use reports and identify species of high indigenous priority.

Materials and methods: The study was undertaken in four villages located in the Sankhuwasabha district in eastern Nepal. Ethnomedicinal information was collected through structured interviews. The homogeneity of informant's knowledge and the relative importance of documented medicinal plants were validated by informant consensus factor and use value, respectively. Species preference for treatment of particular diseases was evaluated through fidelity level.

Results: We reported medicinal properties of 48 species belonging to 33 families and 40 genera, for the treatment of 37 human ailments. The uses of 10 medicinal plants were previously undocumented. The informant consensus factor (F_{IC}) ranged between 0.38 and 1 with about 50% of values greater than 0.80 and over 75% of values greater than 0.70, indicating moderate to high consensus among the informants on the use of medicinal plants in the region. *Swertia chirayita* was the most preferred species with significantly high use values, followed by *Paris polyphylla* and *Neopicrorhiza scrophulariiflora.*

Conclusions: The remote villages in eastern Nepal possess rich floral and cultural diversity with strong consensus among informants on utilization of plants for local healthcare. The direct pharmacological evidence for medicinal properties of most species indicates high reliability of documented information. Careful and systematic screening of compounds isolated from these plants could possibly provide good opportunity for the discovery of novel medicines to treat life-threatening human diseases. We recommend prioritization of medicinal plants and reinforcement of existing cultivation practices for sustainable management of high-priority species.

1. Introduction

The investigation of plants for their use in medical treatment has been practiced by many cultures throughout history. Given their extensive range of knowledge on medicinal plants utilization, indigenous people remain the ultimate source for retrieving this information for the purpose of application, particularly in modern medicines (Idu, 2009). Ethnobotanical investigations in the past have led to the development of important anti-cancer drugs such as *podophyllotoxin* (Imbert, 1998) and *reserpine* (López-Muñoz et al., 2004) as well as drugs such as *vinblastine* (Raviña, 2011) to treat hypertension. However, in absence of proper documentation, many traditional methods and general knowledge of medicinal flora is being lost. In addition, many useful species are being wiped out from their natural habitats due to increasing anthropogenic pressure, and consequently, certain medicinal traditions are at risk of extinction (Shrestha et al., 2014).

Nepal is an excellent repository of cultural heritage and the use of plants as folklore medicines has been practiced since the beginning of human civilization. Local plant-based therapy is a

* Corresponding author.
E-mail address: nawalshrestha@gmail.com (N. Shrestha).

http://dx.doi.org/10.1016/j.jep.2016.07.067
0378-8741/

common practice in the rural communities of Nepal (Manandhar, 1998). While this is not only medical options available, most communities lack direct access to modern medicine and it is estimated that about 80% of the population depends upon herbal medicines (Rajbhandari and Bajracharya, 1994). Approximately 1700 species of flowering plants are currently being utilized as medicines in Nepal (Baral and Kurmi, 2006) and the number is expected to grow as infrastructure allows greater access to unexplored parts of the country. Ethnobotanical studies in the past have focused more on the Himalayan districts of western and central Nepal (Joshi and Edington, 1990; Manandhar, 1998; Shrestha and Dhillion, 2003; Bhattarai et al., 2006; Kunwar et al., 2006; Rokaya et al., 2010; Uprety et al., 2010; Luitel et al., 2014; Shrestha et al., 2014) whereas the ethnomedicinal documentation from eastern Nepal is relatively sparse.

Tinjure-Milke-Jaljale (TMJ), commonly known as Rhododendron Conservation Area, represents an important habitat in East Nepal, encompassing two major ecoregions: (1) Eastern Himalayan alpine shrubs and meadows and (2) Eastern Himalayan broad-leaved forest. This small area (585 km^2) harbors about 250 species of flowering plants with 17 endemic, 9 endangered and 14 threatened species (IUCN Nepal, 2010). The area has a mixed cultural setting with people from various ethnic groups (*Rai*, *Limbu*, *Chhetri*, *Brahmin*, *Sherpa*, *Tamang* and *Gurung*). The utilization of medicinal and aromatic plants (MAPs) is a common practice among the local inhabitants. The majority of these species have high commercial value and a large proportion of them enter domestic and international markets through legal as well as illegal routes.

Previous studies from the TMJ area have mainly focused on enumeration of angiosperm flora (Ohba and Akiyama, 1992; Limbu et al., 2012a) and rangeland weeds (Limbu et al., 2012b). Although ethnobotanical studies exist for regions around the TMJ area (eg. Rai, 2003; Gautam, 2011), they were mere enumerations and therefore, lack significant utility for ethnobotanical research. At present, information on the number of medicinal plants growing within the TMJ area, particularly Sankhuwasabha district, and knowledge on their therapeutic potential are largely inadequate. The only ethnobotanical study from Sankhuwasabha district is that of Parajuli (2000). However, he focused on only one municipality from the district. A larger part of this district, especially areas lying within the TMJ are yet unexplored. Therefore, with an aim to explore ethnomedicinal practices in the culturally and biologically rich mountainous landscape of eastern Nepal, we have undertaken this study in four major Village Development Committees (VDCs) of Sankhuwasabha district lying within the TMJ area. Specifically we aim to (a) explore the diversity of plants used in *Nundhaki, Madimulkharka, Tamafok* and *Mawadin* VDCs of Sankhuwasabha district, (b) estimate variability in the use of medicinal plants with comparison to existing literature, (c) evaluate informant consensus on the use of plants for medical purposes, (d) identify preferred species of medicinal plants and (e) evaluate if knowledge on medicinal plant utilization varies with age and ethnicity.

2. Materials and methods

2.1. Study area

The TMJ area lies between 27°6′57″ to 27°30′28″ N latitude and 87°19′46″ to 87°38′14″ E longitude, covering an area of about 585 km^2 of three districts: Sankhuwasabha, Terhathum and Taplejung in the Eastern Development region of Nepal (Fig. 1; IUCN Nepal, 2010). The area covers 7 Village Development Committees (VDCs) of Sankhuwasabha, 10 VDCs of Terhathum and 6 VDCs of Taplejung.

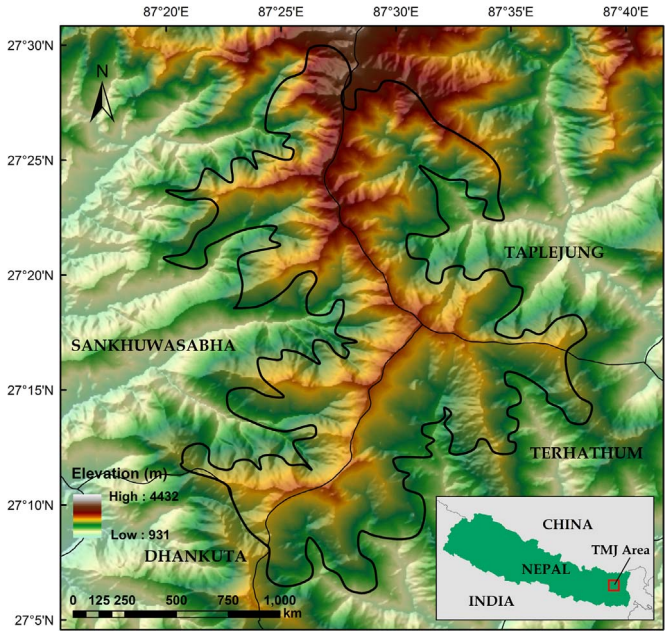

Fig. 1. Map of Tinjure-Milke-Jaljale (TMJ) area in eastern Nepal.

The area falls under the lesser Himalaya and represents a high degree of variation in topography within an elevation range of 1700–5000 m. The greater part of the area (43%) has moderately sloped (5–30°) terrain. More than 26% of the area has steep slopes with an inclination of about 30–40° and the remaining 31% has very steep slopes with inclination greater than 40°. The climate ranges from warm temperate in the lower region followed by cool temperate in the mid-hills to alpine in the upper hill slopes. Precipitation varies from 1000 to 2300 mm; the average rainfall is about 1650 mm (IUCN Nepal, 2010). We conducted our study in 4 major VDCs: *Nundhaki, Madimulkharka, Tamafok* and *Mawadin* of the Sankhuwasabha district lying within the TMJ area.

2.2. Data collection

We followed ethical guidelines adopted by the International Society of Ethnobiology (ICE) and carried out interviews and field observations based on standard ethnobotanical methods (Martin, 1995; Alexiades, 1996; Cotton, 1996). We obtained prior informed consent from the local people verbally before we interviewed them. We met the local people and community leaders and clearly outlined them the purpose of our visit and the intent of our research. We initiated data collection only after receiving verbal approval from them. We employed random and snowball sampling techniques to identify potential participants and interviewed a total of 59 people (47 men and 12 women) between the ages of 25–75 years. The respondents included individuals from various ethnic and socioeconomic backgrounds, including local faith healers, medicinal plant collectors, medicinal plant cultivators, traders and knowledgeable community members. The majority of respondents were *Sherpa* (31%), followed by *Chhetri* (30%), *Brahmin* (17%), *Limbu* (10%), *Tamang* (10%) and *Gurung* (2%). Eighty percent (80%) of the respondents were fairly literate (just able to read and write), 8% had no formal education, 10% had secondary school education and only 2% had higher education.

We used *Nepali* language to interview local people, since it was the commonly understood language in the study area. In some cases, we sought the help of a local translator to communicate with *Sherpa* people. Structured interviews were conducted to collect information on the use of plants, including the parts used, mode of preparation and administration. We first conducted