



Ethnobotanical Study on Wealth of Homegardens in Gosiling Gewog of Tsirang District

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To document the medicinal uses of homegarden plants by local healers.

Study Design: Semi-structured interview was conducted with the prior approval from the gewog official. Five local healers were contacted for interview before field visits based on their popularity and experience of using medicinal plants in their locality.

Place and Duration of Study: The study was conducted at Gosiling gewog, Tsirang District, Bhutan between May and June 2016. The homegarden and agricultural practices are common amongst people in this gewog.

Methodology: Six local healers were identified based on their experience on ethnomedical practice. Multiple approaches were taken such as botanical inventories, collection of plant specimens, structured and informal interviews with local healers including freelisting and preference ranking to collect the information on medicinal use/s using questionnaires.

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Results: Forty six plant species from 45 genera and 37 families were recorded with their ethnomedicinal uses by the local healers against various ailments and diseases.

Conclusion: This study suggests that most of the medicinal plants available within homegardens are commonly used by the healers.

Keywords: Ethnobotany; Tsirang; local healers; homegardens; medicinal plants.

1. INTRODUCTION

The Flora of Bhutan records 5603 species of vascular plants [1], many of which are used in the traditional medicinal systems. Bhutan is considered a diversity hotspot as it has still maintained its biodiversity through decades of strong conservation leadership, rugged terrain and slower development compared to the rest of the world. Over 600 medicinal plants have been identified [1,2,3]; many of which are regularly used by local healers. Ethnobotanical studies of the plants used by these healers in many areas of Bhutan have been previously conducted [4-10]. However, not much have been reported about the southern *gewogs* (village block) on diseases like witch craft related ailments, malaria, jaundice and typhoid. Therefore, this study specifically focused on plants used by local healers in Tsirang district in Gosiling *gewog*, Bhutan.

Biogeographically, Bhutan falls in the eastern Himalayan region between the cold, dry Tibetan plateau and the hot, humid plains of India. The country can be divided into three distinct ecoflorist zones; the Alpine zone at above 4000 meters above sea level (masl) with mainly scrub vegetation and pasturelands, the temperate zone between 2000-4000 masl with conifer and broadleaf forests and lastly the subtropical zone between 150-2000 masl with hardwood and tropical forests. The extensive topography and altitudes has made it a fertile garden for both high and low altitude plants. Ethnobotanical studies of the plants used by local healers in many areas of Bhutan have been previously conducted but not all regions of Bhutan have been covered. This study attempts to conduct an ethnobotanical study of medicinal plants and their uses of homegardens used by healers in Gosiling *gewog* Tsirang District in Bhutan. Homegardens are one of the most important study areas for ethnobotanists [11]. Homegardens in this *gewog* is a common practice including cultivation of medicinal plants. Considerable research has been carried out on Ethnobotany of Homegardens in other parts of the world [11-20]. Homegardens of Bhutan

remaining unexplored, recording the uses of medicinal plants by the healers and their botanical identifications were significant.

2. METHODOLOGY

The study was conducted in Gosiling *gewog* under Tsirang district in southern region of Bhutan between May and June, 2016. Multiple approaches were taken to collect the data for the study, which comprised of botanical inventories; collection of plant specimens; structured and informal interviews with some key informants e.g. traditional healers and elderly persons were identified and contacted for interview.

2.1 Study Site

Tsirang District is located in the south-central part of the country and has an area of 638.80 Sq.km with elevations ranging from 400 to 2000 masl. The coordinates of Gosiling is 27° 1' 05" to 27° 2' 35" North and 90° 6' 0" to 90° 9' 15" East About 78% of land is under forest cover mainly of broadleaf and chirpine species, while arable land constitutes 13.73% [21]. The temperate climatic conditions and diverse agro-ecological features are favourable for agricultural production hence it is the main source of income for people in this *gewog*. The study area is Gosiling *gewog* which lies towards central north of Tsirang (Fig. 1).

2.2 Processing and Analysis of Ethnobotanical Data after Field Visits

Ethnobotanical data were organized in a way that facilitates statistical analysis in applicable cases. Potential fields like collection number, local plant name, scientific plant name, habit, plant parts used, uses, preparation, habitat, locality, name of the informant and commentaries were recorded.

2.3 Data Presentation

Six local healers were identified based on their experience of ethnomedicinal practice within their locality. Ethnomedicinal uses of homegarden plants were recorded in the field with help of healers and two sample specimens for each

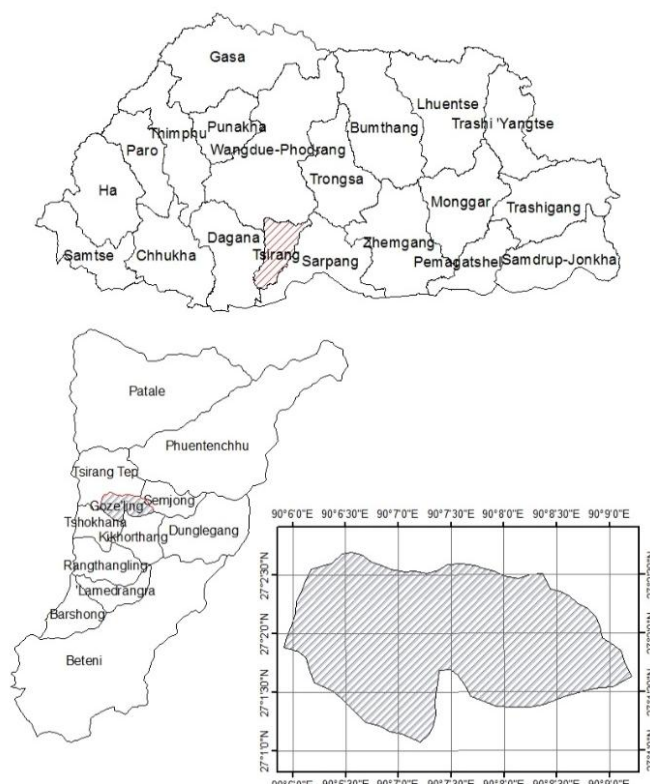


Fig. 1. Study site

plant were collected for herbarium processing. Local terms were translated to their ethnomedical uses to possible English terms.

Ethnobotanical data like collection number, local plant name, scientific plant name, habit, parts used, their uses, ethnomedicinal preparation, habitat, locality, name of the informant, commentaries were recorded during field visits and in the field using direct interviews and a semi-structured questionnaire and carefully tabulated and analyzed after coming back from the field. The information about the traditional use of homegarden plants was collected through interviews followed by identification and collection of voucher specimens with the help of the key informants [11] including free listing and preference ranking (PR) [22,23,24]. Medicinal plants listed are based on freelisting and PR carried out in the field by the local healers with the help of researchers. PR of the use of medicinal plants for treating diseases by 5 healers. Highest number is most preferred; lowest number is least preferred. Rank was determined based on the total score of each species and species with 1st rank given is

indicated as most effective medicinal plant for respective treatment. Colored photographs and voucher specimens were prepared to identify plants.

The plants were identified using the Flora of Bhutan (Volume 1- 3) [25-32] and internet resources. Herbarium specimens were processed and deposited in college herbarium section in Sherubtse College in Trashigang.

3. RESULTS AND DISCUSSION

A total of 46 plant species from 45 genera and 37 families were recorded. Euphorbiaceae had 4 species, Asteraceae and Urticaceae had 3 species and other families. Out of 2-4 plants suggested by the healers, plants scoring as highest rank for the respective treatments were listed (Table 1).

List of unidentified medicinal plants with voucher specimen number, local name, ethnomedicinal preparations and uses are also recorded (Table 2). Documentations on use of ethnobotanical/ medicinal uses of plants collected from wild were

reported by Wangchuk [4,6,7] from Trashigang (Eastern district) and other regions of Bhutan, however documenting homegarden medicinal plants was not reported despite of the fact that local healers quite often use plants available within their homegardens (Rup Narayan Pradhan, Personal communication, May 25, 2015). More than 60% of the specimens collected were either domesticated by the people for their day-to-day uses or found in their homegardens. Plant specimens with voucher No. TIF1003 and TIF1004 reported to be used by healers but not collected from the study area. This suggests that there is good plant diversity in those areas which supports the local community in their livelihood. It has been observed that single plant or its part(s) is sometimes used to treat single ailment and sometimes more than one or combination of more than one plant and their parts are used for single treatment or more than one treatment of diseases. This observation indicates that many of the plants used by local healers are known to each other but parts and doses used by them are varying among the healers which ultimately indicates therapeutic potential of plants used by them requires further ethnopharmacology study.

Different plant parts viz. whole plant (10%), leaves (45%), roots (12%), stem (13%), latex (4%), bark (4%), fruits (4%), seeds (2%), rhizome/tubers (4%) and bud (2%) are used by the local healers to treat the diseases. Leaves are most frequently used followed by the stem and roots. This gives an idea on possible plant extracts of therapeutic potential from different plant parts. The bud/seeds are the least used plant part from among the plants reported here.

However, Tenzin [9] reported that seed was the most frequently used plant parts in their study of lower elevation medicinal plants from Bhutan. This may be due to the fact that our study is focused on a specific locality of Gosiling selecting key informants based on their experience of long practice and home garden selection. Poultice was the most common method of ethnomedicinal preparation followed by crushing and pounding. This indicates local healers ethnomedicinal practice is mostly limited to external physical body level injuries like cuts and burns, body/headache after long hour physical agriculture related work and witch-craft related ailments. Poultice which is applied topically on affected part/s of the body therefore becomes the common practice among the healers. Ailments which require medical attentions are preferably

referred to nearby Basic Health Units available with the *gewog* or to the district hospital. Dependent on ethnomedicines have been fading away over the time as people share their comparative experience on reliability of ethnomedicines to allopathy (Partiman Allay, Personal Communication, May 18, 2015). Oral administration unless being recommended by the patient who had being cured by previously the healer/s is not common. Reasons could be the ethnomedicines in the form of decoction/concoction served to the patients by the healers have been reported to be either ineffective or slow in their curing action which are administered to patients with chanting repetitive healing mantra. However, frequent patients visiting local healers for first-aid and for to get immediate relief from headache, lymph swelling, and witch-craft related ailments indicate that the plants used by the local healers to treat ailments along with mantra reaffirm their practices. These medicinal plants are also prescribed in the form of juices and decoctions. Other methods of preparation include powdering, making concoctions, directly chewing, roasting, boiling and making soup, making infusions and lastly direct rubbing on body part (Fig. 2).

While many of the medicinal plants are used to treat minor injuries such as wounds or cuts or to reduce fevers or to increase one's appetite, there are some that are used to treat major diseases such as jaundice, malaria, pneumonia and witch-craft related ailments. For instance, *Cuscuta reflexa* L. is made into a paste and eaten to treat jaundice. Abassi [33] has previously documented this in their paper and the method of preparation is also very similar. Such ethnomedicinal practices irrespective places and healers where and who practices reaffirm the therapeutic potential of the plants. *Centella asiatica* and *Ocimum gratissimum* L. has been documented to treat pneumonia. There are reports of *Centella asiatica* being used to treat various skin conditions such as leprosy, lupus, to heal minor wounds and skin irritations, and more recently a patent was issued for the application of acetic acid and its derivatives to treat *pulmonary fibrosis* [34,35]. Asiatic acid is the active ingredient extracted from *Centella asiatica*. *Ocimum gratissimum* on the other hand is known to have antibacterial properties and widely used to treat upper respiratory tract infections, diarrhea, headache, ophthalmic, skin diseases, pneumonia, and also as a treatment for cough, fever and conjunctivitis [36].

Table 1. List of medicinal plants used by local healers with ethnopreparations and uses in the study area

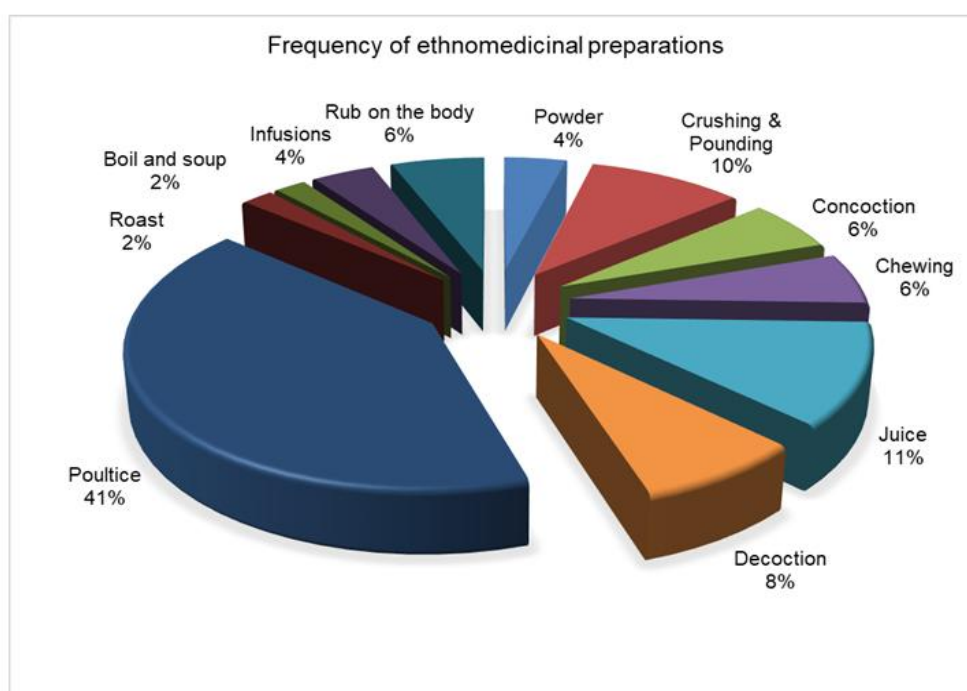
Sl. #.	Voucher. No	Botanical name	Family	Local name	Ethno-preparation	Uses
1	TIF6005	<i>Acorus calamus</i> L.	Acoraceae	Bojo	Root paste taken orally	Appetizer, anti-ticks or insecticides. Food poison.
2	TIF2010	<i>Zephyranthes</i> sp.	Amaryllidaceae	Piazyfool	Make paste and apply topically	Swelling on neck
3	TIF3005	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Ghod-taprey	Make paste (no added water) and liquid administered orally.	Pneumonia. For internal wounds.
4	TIF1004	<i>Rauvolfia serpentina</i> (L.) Benth. exKurz	Apocynaceae	Banku line	Liquid of whole part is administered orally in using lid of whisky bottle and also.	Fever (Kharabjoro).
5	TIF1003	<i>Areca catech</i> L.	Arecaceae	Adikapal	Paste is applied topically on the opposite part of head with pain	Beetle nuts, joint pain
6	TIF5005	<i>Sansevieria trifasciata</i> Prain	Asparagaceae	Bagaypatta/Thobley Bagay.	Paste applied toically	Lymph swelling
7	TIF6020	<i>Artemisia vulgaris</i> L.	Asteraceae	Teteypati	Whole leafy part is used under mattresses. Also applied /rubbed externally on the body	Insects repellent. Skin diseases.
8	TIF6023	<i>Ageratina adenophora</i> (Spreng.) R.M.King & H.Rob.		Bhon-mara	Leaves and stem are crushed and applied externally the body	For cut and wound to stop bleeding. Snake bite, cuts and wounds.
9	TIF3013	<i>Chromolaena odorata</i> (L.) R.M.King&H.Rob		Achami + Halhali	Mixture paste in rubbed on affected part	Ring worm
10	TIF6019	<i>Cannabis sativa</i> L.	Cannabiaceae	Ganza		
11	TIF1012	<i>Carica papaya</i> L.	Caricaceae	Riped Mewa or papaya	Juice or curry of un-ripped papaya taken orally	Diabetes and blood purifier
12	TIF6016	<i>Poranopsis paniculata</i> (Roxb.) Roberty	Convolvulaceae	Shikare-lara	Crushed roots used as poultice	For joining of wounds/cuts. For internal wounds, ulcers.
13	TIF2006	<i>Cheilocostus speciosus</i> (J.Koenig) C.D.Specht	Costaceae	Bedlawri	Juice taken orally	Urinary tract infection. Body aches and UTIs.
14	TIF3015	<i>Kalanchoe integra</i> (Medik.) Kuntze	Crassulaceae	Ajambari	Leaves extract applied topically	Wound
15	TIF2001	<i>Cuscuta reflexa</i> L.	Cuscutaceae	Poiley-laro	Paste and juice taken orally	Jaundice

Sl. #.	Voucher. No	Botanical name	Family	Local name	Ethno-preparation	Uses
16	TIF1008	<i>Euphorbia tithymaloides</i> L.	Euphorbiaceae	Chetu	A teaspoon pounded leaf administered orally	Small amount, Large amount toxic. Appetizer
17	TIF6007	<i>Euphorbia hirta</i> L.		Dude jhar	Paste applied topically on affected part	Ringworm.
18	TIF1-009	<i>Mallotus philippensis</i> (Lam.) Müll.Arg.		Sidhurey	A glass of decoction administered orally every morning	Ghano (Ulcer).
19	TIF2007	<i>Ricinus communis</i> L.		Kapasi	Hot paste applied topically	Joint pain and fractures.
20	TIF2017	<i>Cassia fistula</i> L.	Fabiaceae	Raj Birsey	Seed extract administered orally	Bleeding and breast milk problem
21	TIF6001	<i>Swertia</i> sp.	Gentianaceae	Chutro	Decoction and root paste administered orally	Malaria. Sprains, appetizer and food poisoning.
22	TIF3004	<i>Molineria capitulata</i> (Lour.) Herb.	Hypoxidaceae	Dothisara	Poultice	Lymph swelling
23	TIF3010	<i>Iris domestica</i> (L.) Goldblatt & Mabb.	Iridaceae	Tarawarey	Liquid extract taken orally	Appetizers.
24	TIF6015	<i>Mentha</i> sp.	Lamiaceae	Mint-Pudina	Liquid extract taken orally	Pressure. For blood purification and prevent diseases
25	TIF2016	<i>Ocimum gratissimum</i> L.		Tulsi or Ram Tulasa	Decoction	Pneumonia
26	TIF2012	<i>Punica granatum</i> L.	Lythraceae	Dharim	Make a paste, along with little sugar and liquid taken orally	Diarrhoea.
27	TIF2015	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem-pata	Decoction	High fever
28	TIF1006	<i>Ficus semicordata</i> Buch.-Ham. ex Sm.	Moraceae	Khaniew	Sap is applied topically	Suppress boils
29	TIF6004	<i>Psidium guajava</i> L.	Myrtaceae	Guava (Ambak).	Juice from tender leaves taken orally	Pressure and diarrhoea, vomit.
30	TIF6019	<i>Nephrolepis cordifolia</i> (L.) K. Presl	Nephrolepidaceae	Pani-amala	Soak in cold water and juice squeezed is drank every morning	Lowers high Blood pressure and blood sugar
31	TIF6007	<i>Oxalis corniculata</i> L.	Oxalidaceae	Sorrel (Eng)	The whole plant is powdered & sprinkled over the other medicines	Retain fragrance of the medicines

Sl. #.	Voucher. No	Botanical name	Family	Local name	Ethno-preparation	Uses
32	TIF2008	<i>Plantago asiatica</i> subsp. <i>erosa</i> (Wall.) Z. Yu Li	Plantaginaceae	Naseyjhar	Whole plant paste applied topically	For cut or wound. Swelling on neck.
33	TIF3005	<i>Cynodon dactylon</i> (L.) Pers	Poaceae	Dubho	Hot leaves paste applied as poultice	Joint pain and fractures
34	TIF6008	<i>Persicaria hydropiper</i> (L.) Delarbre	Polygonaceae	Pirayjhar	Used as poultice	Wounds
35	TIF1001	<i>Pteris biaurita</i> L.	Pteridaceae	Unew	Used as poultice	Wound or cut healing
36	TIF6003	<i>Murraya koenigii</i> (L.) Spreng	Rutaceae	Curry patta	Leaves eaten raw or with curry	Diabetes, pressure and fever.
37	TIF3009	<i>Viscum album</i> L.	Santalaceae	Harchur,	Applied as hot poultice and changed weekly	Joint Sprains. Broken bones.
38	TIF6009	<i>Houttuynia cordata</i> Thunb	Saururaceae	Ghandeyjhar	Leaves juice taken orally	Diarrhoea, babies crying at night
39	TIF3012	<i>Astilbe rivularis</i> Buch.-Ham. ex D.Don	Saxifragaceae	Bhuro-okhati	Dry roots are chewed anytime or taken as decoction	Body aches
40	TIF6014	<i>Bergenia ciliata</i> (Haw.) Sternb.		Pakhanbed	Stem used for brushing teeth	Gum bleeding, tooth ache and also for wounds cut.
41	TIF3003	<i>Girardinia diversifolia</i> (Link) Friis	Utricaceae	Sissnu	Leaves cooked with rice maize or finger millet flour	Lowers or controls BP
42	TIF4001	<i>Boehmeria hamiltoniana</i> Wedd.		Chiplej	Poultice applied on affected part	Allergy and pneumonia. Joint pain and fractures
43	TIF3003	<i>Urtica parviflora</i> Roxb.		Nettle plant	Poultice applied on bitten part	Dog bites
44	TIF3014	<i>Gmelina arborea</i> Roxb.	Verbenaceae	Khamari	Bark crushed to paste is made into liquid in a glass of sugar water and taken orally	Swelling (Lymph nodes).
45	TIF2009	<i>Aloe vera</i> (L.) Burm.f.	Xanthorrhoeaceae	Guekumari	Succulent part is eaten fresh	Mouth sores. Decrease sugar level and good for gastric problem.
46	TIF1007	<i>Kaempferia rotunda</i> L.	Zingiberaceae	Bhuichampa	Poultice applied on affected part	Bones fractures

Table 2. List of unidentified medicinal plants with voucher specimen number, local name, ethnomedicinal preparations and uses

Voucher specimen no	Local name	Part of the plant	Ethnomedicinal preparation	Treatments/ uses
TIF2002	Kalochitu	Leaves	Paste and liquid. Two times, two spoonful administered orally.	Stomach ache
TIF3007	Loreyjhar	Leaves	Make paste and apply topically	Used as blood anticoagulant
25TIF6008	Tareyjhar	Leaves	Make paste with tomato leaves and apply topically.	Used as fish poison and applied for healing wounds.
TIF6012	Negur-montie.	Leaves	Make paste and liquid administered orally.	For sore throat.
TIF6002	Nakeyma	Leaves	Mixed with curry <i>patta</i> , boil and liquid administered orally.	Diabetes.

**Fig. 2. Frequency of Ethnomedicinal preparations**

Lastly, *Swertia chirayita* has been recorded in our study as herb used for the treatment of malaria and there is evidence to suggest that this herb indeed has been used to reduce malarial fevers [37]. Regarding the origin of the traditional knowledge about the medicinal use of these plants and how they were developed; the local healers stated that much of the knowledge has *Ayurvedic* origins and some are based on experiences as well as information from other practitioners. Most of the plants used by the different local healers are common, owing to the knowledge gained from the treatment sought from an experienced practitioner in the locality.

4. CONCLUSION

Our findings indicate that there still prevails the culture of local healers in Gosiling *gewog* of Tsirang *Gewog*. Although the inventory of plants used is limited the fact that there are still local healers and clients depended on each other, is encouraging and keeping the tradition alive. There is very good ethnomedicinal knowledge still prevailing in the traditional society of southern foothills of the Bhutan Himalaya particularly among the traditional healers and elderly persons. Interesting fact to note is that the medicinal plants identified and used by the local

healers without any scientific knowledge has been proven to have positive effects in treatments. With the free and easy access to modern health care and medicines, albeit most people have shifted to modern healthcare system provided by the Royal Government of Bhutan (RGoB), use of ethnomedicines along with chanting healing mantras, as expressed by local healers is still alive amongst local people. Therefore, need for documenting TK on ethnomedicines and mantra used by local healers could prove to be addition of new plant species of therapeutic potential in Bhutanese Traditional Medicine System.

LIMITATION OF THE STUDY

This study does not give an exhaustive ethnobotanical documentation of the study area. A comprehensive study could reveal enormous ethnomedicinal information from this region of Bhutan, which could be useful in future. There could be many plant species of medical importance that could have forgone being mentioned as the healers wanted to protect their intellectual property.

ETHICAL APPROVAL

The ethnomedicinal knowledge was collected from the informants from the Gosiling *gewog* under Tsirang District Bhutan. The identity of the informants and their Traditional Knowledge (TK) is acknowledged in this study report. The information collected is properly credited to the informants involved. The draft ABS policy framed by NBC also ensures that the benefits that arise from the commercial and research utilization of Bhutan's genetic resources and associated traditional knowledge be properly disbursed at the national level. This study is carried within the scope of ABS policy. Prior to field visit, official approval was sought from *gewog* officials.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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