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Ethnomedicinal Reports On Ten Taxa of *Rhododendron* L. (Ericaceae) From Darjeeling Himalaya (India)

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ABSTRACT

As a result of detailed ethnobotanical investigation throughout Darjeeling himalaya since 2019 to 2022, several new and noteworthy ethnomedicinal first hand herbal drug dosimetry were documented in ten taxa of *Rhododendron* L. from different parts of Darjeeling himalaya. It was based on oral interviews mostly with elderly and knowledgeable Gorkha Nepalese people in Darjeeling hills. Gorkha Nepalese communities like Tamang, Thami, Rai, Chhetri, Gurung, Sharma, Pradhan and Sherpa are the principal knowledge informants who were mostly contributing to this ITKs. Present paper deals with documentation of ethnomedicinal traditional uses and practices to cure more than 25 different types of human diseases by the Gorkha Nepalese communities in different parts of Darjeeling hills since time immemorial.

Keywords: *Rhododendron*; Darjeeling himalaya; Ethnomedicine; Gorkha Nepalese, India.

INTRODUCTION

Since May 2019 till December 2022 under Department of Science & Technology and Biotechnology, Government of West Bengal sponsored major research project, several ethnobotanical field visits were conducted throughout hilly regions of Darjeeling himalaya. As a result, a good number of new and noteworthy first hand ethnomedicinal novelties including herbal drug dosimetry were documented based on oral interviews mostly with elderly and knowledgeable Gorkha Nepalese people in Darjeeling hills. Based on documented first hand ethnobotanical information, Darjeeling himalaya may be considered as the treasure trove of Indigenous Traditional Knowledge (ITKs). Seven different castes of Gorkha Nepalese community interviewed during field visits were Thami, Rai, Tamang, Sharma, Gurung, Pradhan and Sherpa. Literature reviews revealed that these ITKs are mostly new to science (Biswas and Chopra, 1956; Bhattacharya *et al.*, 2015; Chhetri *et al.*, 2005a; Chhetri *et al.*, 2005b; Ding *et al.*, 2017; Ganjhu *et al.*, 2015; Gurung and Palit, 2007; Hussain and Hore, 2007; Jain, 1991; Panda, 2008; Panda and Thami,

2022; Panda *et al.*, 2024; Rai and Bhujel, 1999; Rai *et al.*, 1998; Rai *et al.*, 2013; Rajbhandari *et al.*, 2009; Saha *et al.*, 2011; Saini, 2000; Tamang and Yonzon, 2004; Yonzon *et al.*, 1984).

Gorkha Nepalese communities such as Tamang, Thami, Rai, Sharma and Sherpa are the principal knowledge informants who are contributing a lot to this ITK's Treasure Trove. Present paper deals with ten wild plant taxa of *Rhododendron* L. in Darjeeling hills, which describe to cure a good number of human ailments. Human diseases such as nose ulcer, tonsil, back pain, chronic cough and bronchitis, covid 19 viral fever, diabetes mellitus, stomach pain, low immunity, abdominal pain, dysmenorrhoeal pain, asthma, high blood pressure, piles, loose motion or diarrhoea, old wounds, chronic gastritis, fevers, body pain, throat pain due to cold, cold and cough, vomiting etc. are either cured or mostly relieved by using different parts (with a particular dose) of these plants documented during oral interviews at different localities of Darjeeling hills.

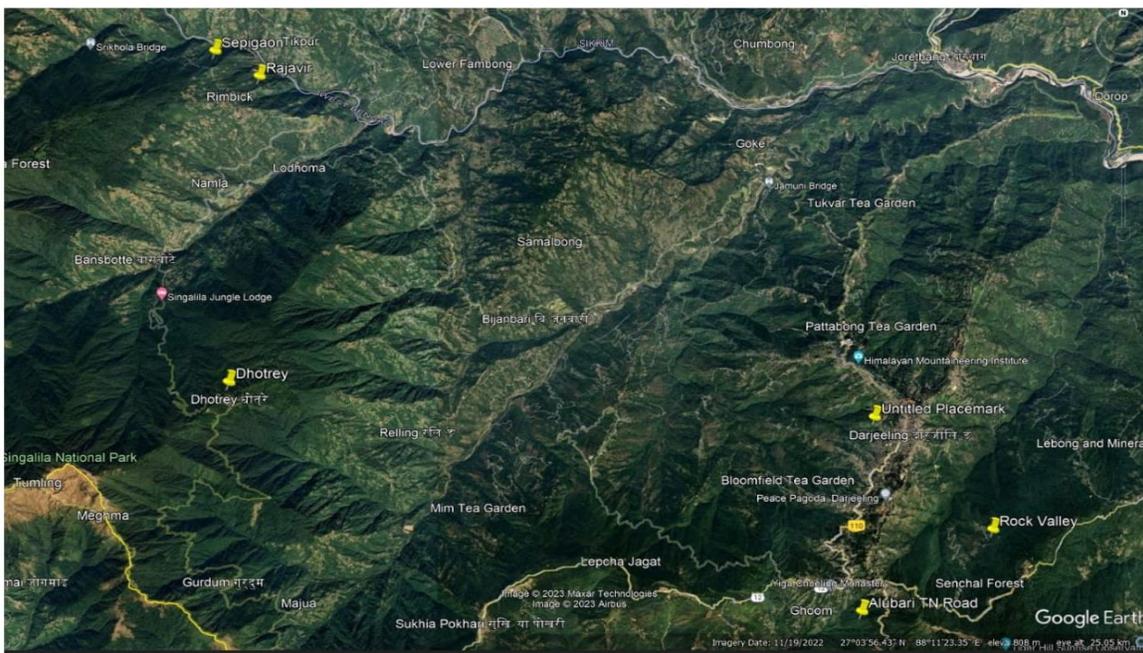
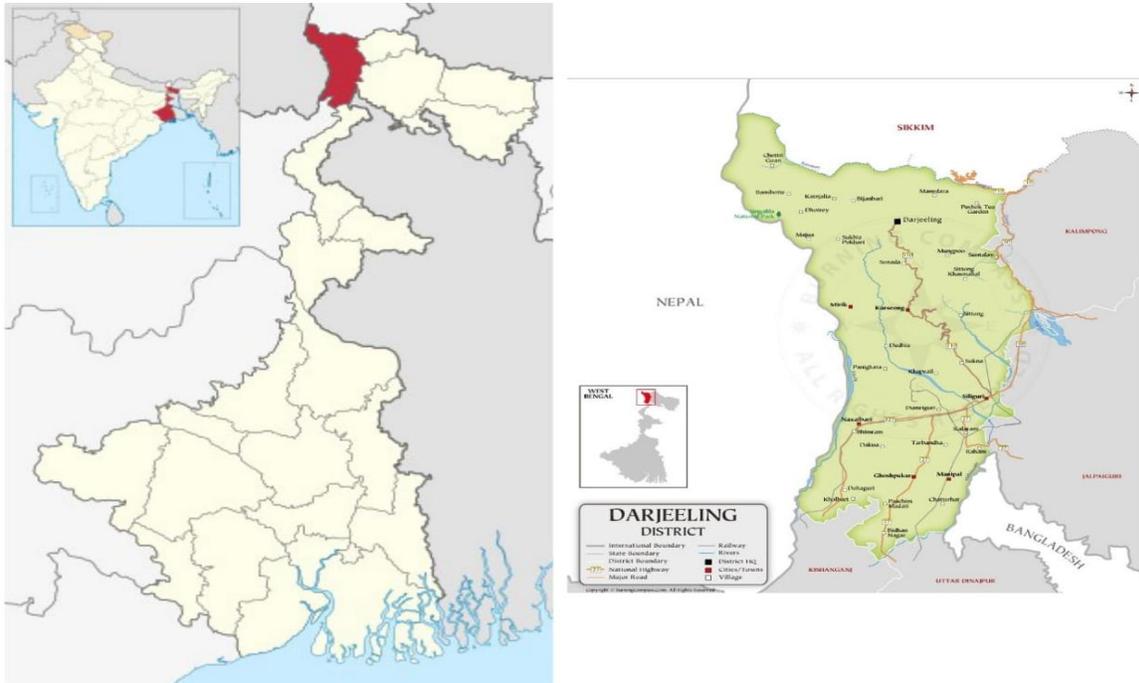
Therefore, present paper embodies mostly unknown Gorkha Nepalese ethnomedicinal practices of 10 wild plant taxa of *Rhododendron* L. along with their first hand prescribed dosimetry against above mentioned diseases including voucher information, vernacular names, names of knowledge informants and also provides live photographic documentation taken during interviews and study area map.

Methodology

Study area

With an area of about 807.9 sq. miles (2,092 sq. km), present Darjeeling district consists of four subdivisions such as, Darjeeling Sadar, Kurseong, Mirik and Siliguri (plain areas). The foothills of Darjeeling Himalaya comes under Siliguri subdivision, is known as Terai, while areas of the rest three subdivisions mostly come under the hills of Eastern Himalaya are called Darjeeling hills (Map 1). Darjeeling district is located 27°02'15"N Lat. and 88°15'47"E Long. The district is bounded on the north by Sikkim, on the south by Kishanganj district of Bihar, on the east by Kalimpong and Jalpaiguri districts and on the west by Nepal. The district is characterized by its varying altitudes ranging from 90 m (Khoribari area) to 3780 m (Sandakphu) harbouring diverse elements of tropical, subtropical, temperate and alpine vegetation.

Demography: As per 2011 Census, total population of present Darjeeling district including plain areas comprises about 15,95,191, of which about 6,24,071 from Darjeeling hills area. The sex ratio is about 970



Map 1. Study Area map of present Darjeeling Himalaya in West Bengal and India maps showing localities (Google Earth) (Source: BurningCpmpass.com; en.wikipedia.org/ Wiki/ Darjeeling_district).

females per 1000 males (2011 census). Literacy rate is about 79.56%. The major religion is Hinduism (Nepalese Hindu) followed by Buddhism. Original inhabitants of the Darjeeling hills were the Lepchas or Rongpa. Other Gorkha-Nepalese communities with a long history in Darjeeling hills include Limbu,

Bahun, Tamang, Gurung, Moktan, Thami, Chhetri, Rai, Sarki, Sharma, Kami, Damai, Mukhia and Thapa, although some populations belonging to Lepchas or Rongpa (the ravine folks), Bhutias and Tibetans are also observed at different localities of Darjeeling hills. Nepalese is the predominant language.

Present Socio-economic conditions: Agriculture is the main occupation, however most people are engaged with Tea industry which is not only the main source of livelihood but has also played an important role in the field of economy and earnings. Besides, some are working as porters at urban towns, some are working as Carpenters, Artists, Lamas, Farmers as well as in Govt. services.

Field Survey, interview and documentation: As a result of ethnobotanical field survey since 2019 to 2022 at different localities of Darjeeling hills, first hand mostly unknown information on various human ailments were documented for ten *Rhododendron* taxa through verbal interrogations with experienced and elderly Gorkha Nepalese people belonging to seven different castes viz., Thami, Rai, Tamang, Sharma, Gurung, Pradhan and Sherpa (total=42) including forest guards (04), porters (06) and local Nepalese medicinemen (04) who were sometimes employed as field guides. Before conducting oral interrogations,

a Prior Informed Consent (PIC) as per CBD guidelines (either in the form of audio-video or verbal consent) was taken from each knowledge provider of Darjeeling hills every time during data documentation explaining about the detailed of Access and Benefit Sharing (ABS). Ethical approvals were taken from all knowledge providers in the form of declaration along with sample questionnaire (Figure 1). Total 42 experienced Nepalese people belonging to seven different castes were verbally interviewed with the age groups mostly belong to 50–70 years (some belong to 30–40 age groups) that

include both males (total=20) and females (22). The data thus collected were further verified among different castes of Nepalese people in a particular area for a particular plant taxon and finally cross-checked with the help of available published literature (Bhattacharya *et al.*, 2015; Chhetri *et al.*, 2005a; Chhetri *et al.*, 2005b; Gurung and Palit, 2007; Hussain and Hore, 2007; Panda, 2008; Panda and Thami, 2022; Panda *et al.*, 2024; Rai *et al.*, 1998; Rai *et al.*, 2013; Rajbhandari *et al.*, 2009; Saha *et al.*, 2011). Detailed information regarding local name(s), part(s) used, mode of administration or preparation and

dosimetry were recorded in the field note book. The quality of herbs and additives used for medicinal therapeutic purpose were not measured. Botanical identity was confirmed at CAL (Central National

22/05/2022

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Annex 1. Ethnobotanical and socio-cultural questionnaire sheet adopted for this study

Location surveyed SANDAKPHU to ALE VILLAGE

Geographic location (GPS) :

Person under investigation

Age : < 20 [20-30] [30-40] [40-50] [50-60] plus of 60 ans

Sex: Female Male

Level of study: illiterate Prim Sec Univ

Marital Status: Married Single Divorced Widowed

Profession : LOCAL PORTER and GUIDE

Do you use herbal medicine? Yes No

If so, you used it because it's...?

Effective Cheaper Acquisition Ineffective drug

The plants used by the respondent:

Vernacular name: NILO CHIMAL

Scientific name: *Rhododendron Campanulatum* ~~Watt~~ G. Don

Type of plant: Cultivated Spontaneously

Use of the plant: Therapeutic Cosmetic

Parts used: Stem Leaf Root Branch Fruit FLOWER (COROLLA)

Condition of the plant: Fresh Dry

Drying method: Shade drying Solar drying

Method of preparation: Infusior Decoction Cataplasm Raw Cooked

Mode of administration : Oral massage rinsing

Harvest period: Summer Autumn Winter Spring

Dosage: 3 to 4 corolla are allowed to boil in a glass of water for 3-4 hours. After cooling, the extract is taken to cure

Duration of treatment: 7-days

Diseases treated: Tonsillitis, Throat Pain due to cold;

Side effects: Yes No

If yes, what are these effects: Not yet.

ITK informer: PHURBU TSHERING & BHUTIA
Age-36 of Ale village, Sandakphu

फुरवु सेरिङ भुटिया

Herbarium, Howrah). Voucher specimens were deposited at Maulana Azad College Kolkata (MAC) herbarium and Biodiversity Conservation Lab herbarium, Govt General Degree College Chapra (GGDCC). The methodology followed in this work is as prescribed by Jain (1991).

Figure 1. Sample Questionnaire for an ethnomedicinal plant taken during oral interviews at Sandakphu, Darjeeling district (oral interview with Sri Phurbu Tshering Bhutia of Ale village, Sandakphu for ‘Nilo Chimal plant’, *Rhododendron campanulata* G. Don (Ericaceae).

Result and Enumeration

Ten taxa of *Rhododendron* L. (Ericaceae) are enumerated alphabetically with their authenticated correct binomial name, local name(s), knowledge provider(s), mode of use including dosimetry (when available) and voucher information. All local names are documented only from the the Gorkha Nepalese of Darjeeling hills, therefore, after local name, different castes of the Gorkha Nepalese community are also mentioned within parenthesis.

1. *Rhododendron arboreum* Sm. subsp. *arboreum* var. *arboreum* (**Figure 2A-H**)

Local name: *Laliguras* (Nepalese Gorkha communities of Darjeeling hills: Thami, Rai, Tamang, Sharma, Gurung, Pradhan and Sherpa). *Knowledge Provider(s):* 14 Gorkha Nepalese people:- a. Kessang Sherpa [age 48] and Passang Sherpa [82], owner of Sherpa Lodge, Lamaydhura. First hand information documented: i. Juice of fresh corolla is applied on nasal mucous membrane to cure nose ulcer. Extract of water-soaked dried corolla is also effective to cure nose ulcer. Verbal interviews were conducted at Lamaydhura on 17th May 2019 by the senior author (SP).

b. Lucky Sherpa [age 50], owner of Swayambhu Lodge, Timburey Village, Darjeeling. ITKS documented: The dried red coloured corolla is used to eliminate the pain of fish spine stucked in the throat. First hand information documented on 22nd October 2019 by SP and again on 4th December 2021 by Priyankar Roy (PR).

c. Pabitra Rai [age 62], Sepigaon. ITKS documented: Red corolla is used for flavoring alcohols and for making wines which is used for curing throat pain due to cold. First hand information documented in December, 2022 (SP & PR).

d. Mr. Kundan Tamang [age 52], Dhotrey, Darjeeling. ITKS documented--*dosimetry-I:* Only Corolla (either dried or fresh: 500g wt) of *Laliguras* plant is used to keep in a container containing hot water for three days. Also pouring into it 250g sugar and 50g wt zinger. After 3 days, extract is kept inside clean glass bottles. This extract is taken to stop loose motion or diarrhoea. 1 teaspoon full 3 times a day for adult and 2 times a day for children. *Dosimetry-II:*

Fresh or dry corolla are just boiled in water and the extract may be taken directly to cure Diarrhoea or loose motion. ITKs documented by SP and PR on 4th December 2022.

e. Makar Tamang [age 52], Dhotrey, Darjeeling: Fresh or dry corolla extract of Lalignuras plant used to cure— i. Diarrhoea, ii. Body pain, iii. Tonsil, iv. cold and cough, v. back pain. *Dosimetry*: 3 to 4 fresh corolla or 6-7 dry corolla extract daily any time of the day. ITKs documented by SP and PR on 4th December 2022.

f. Mr. Jai Kumar Thami (age 79: Alubari TN Road, Darjeeling), Mr. Polma Rai (age 65: Sepigaon, Darjeeling), Smt. Usha Rai (age 60: Rajavir, Rimbik, Darjeeling), Smt. Chandrakala Rai (age 55: Sepigaon), Mr. Lalbir Rai (age 74: Rajavir). First hand ITKs documented: *Dosimetry*: Inner barks are cut into pieces and allowed for sun drying and finally made into powdery dust. One teaspoon full of this powder is mixed and well-stirred in a glass of mild warm water, and administered to take to cure chronic cough and bronchitis. It is continued till 45 days (reported by Lalbir Rai, Polma Rai and Usha Rai of Rajavir, Darjeeling). ITKs documented by SP and PR on 5th to 7th December 2022.

g. Dushila Rai [age 60], Rajavir village, Darjeeling. First hand ITKs documented. *Dosimetry*: extract of dried or fresh corolla [3 to 4] are taken daily preferably in the morning to cure loose motion/diarrhoea. It is prescribed at least 3 days for one time per day. ITKs documented by SP and PR on 5th December 2022.

h. Mr. Chandra Prakash Rai [age 72], Rajavir village, Darjeeling. First hand ITKs documented-*dosimetry*: 3 to 4 fresh or 5 to 6 dry corolla are allowed boiling in 500 ml water for 3 minutes. After cooling extract is taken to cure Covid-19 viral fever [after dinner for 7 days]. ITKs documented by SP and PR on 5th December 2022.

i. Mr. Sandip Rai [age 32], Alubari TN Road, Darjeeling: “where you find Lalignuras plant [*Rhododendron arboreum* Sm. subsp. *arboretum* var. *arboreum*], there is heaven and you will be immortal [Ajambari] and all sources of medicines are there only. If you go there you will be healthy and your all types of diseases will disappear. If anybody shouts “Guras, Guras, Guras”, nobody will touch him/her”. ITKs documented by SP and PR on 7th December 2022.

j. Mr. Jai Kumar Thami [age 79], Alubari TN Road, Darjeeling. First hand ITKS documented-*dosimetry*: Bark powder [1 teaspoon full] mixed in a glass of mild hot water, after stirring a while, it is taken to cure Diabetes melitus. Also fallen corolla of Laliguras plant are sundried and kept for future preparation of 'Rhododenron Wine' which is taken to relieve body pain after a long walk. ITKs documented by SP and PR on 7th December 2022.

k. Mr. Chhabilal Chhetri [age 28], Lodhoma: ITKs documented-*dosimetry*-I: fresh or sun-dried red corolla are eaten raw [4 -5] daily for 3 days to cure Covid 19 viral fever, cold & cough, tonsil and abdominal pain. ITKs documented by SP and PR on 4th December 2022.

Voucher specimen: Alubari TN Road, Darjeeling, 6800 ft, 26.02.2021, S. Panda & Party 00109 (GGDCC); Sepi-Srikhola, Darjeeling district, 5800 ft, 18.04.2021, P. Roy 25 (MAC); Dhotrey, 8200 ft, 04.12.2022, S. Panda & Party 07 (MAC); Sepigaon, Darjeeling district, 6000 ft, 06.12.2022, S. Panda & party 015 (MAC); Alubari TN Road, Darjeeling, 6700 ft, 07.12.2022, S. Panda & Party 43A (MAC).

2. *R. arboreum* Sm. subsp. *cinnamomeum* (Wall. ex G. Don) Tagg var. *roseum* Lindl. (**Figure 2 I-J**)

Local name: *Laliguras jato* (Nepalese Gorkha community of Darjeeling hills: Rai, Tamang, Thami). *Knowledge Provider(s)*: 4 Gorkha Nepalese people:- a. Pinky Rai [age 90], owner Pritam's Homestay, Sepi (Srikhola). First hand ITKs documented: Red corolla is used for flavoring alcohols and for making wines which is used for curing throat pain due to cold. ITKs documented in June and Sept, 2019 (SP) as well as in April 2021 (PR).

b. Mr. Kundan Tamang [age 52], Dhotrey, Darjeeling. First hand ITKs documented- *dosimetry* I: corolla (either dried or fresh: 500g wt) of this plant is used to keep in a container containing hot water for three days. Also pouring into it 250g sugar and 50g wt zinger. After 3 days, extract is kept inside clean glass bottles. This extract is taken to stop loose motion or diarrhoea. 1 teaspoon full 3 times a day for adult and 2 times a day for children. *Dosimetry*-II: fresh or dry corolla are just boiled in water and the extract may be taken directly to cure diarrhoea or loose motion. ITKs documented by SP and PR on 4th December 2022.

c. Makar Tamang [age 52], Dhotrey, Darjeeling: Fresh or dry corolla extract of this plant used to cure i. diarrhea, ii. body pain, iii. Tonsil, iv. cold and cough, v. back pain. *Dosimetry*: 3 to 4 fresh corolla or 6-7 dry corolla extract daily any time of the day.

d. Mr. Jai Kumar Thami [age 79], Alubari TN Road, Darjeeling: *Dosimetry*: i. Bark powder [1 teaspoon full] mixed in a glass of mild hot water, after stirring a while, it is taken to cure Diabetes melitus. ITKs documented by SP in February 2021 and by SP and PR on 7th December 2022.

Voucher specimen: Alubari TN Road, Darjeeling, 6800 ft, 26.02.2021, S. Panda & party 36 (MAC); Sepi-Srikhola, 18.04.2021, 5900 ft, P. Roy 26 (MAC); Dhotrey, 8200 ft, 04.12.2022, S. Panda & Party 08 (MAC); Alubari TN Road, Darjeeling, 6700 ft, 07.12.2022, S. Panda & Party 43B (MAC).

3. *R. arboreum* Sm. subsp. *cinnamomeum* (Wall. ex G. Don) Tagg var. *cinnamomeum* (**Figure 2 K-L**)

Local Name: Laliguras jato (Nepalese Gorkha community of Darjeeling hills: Sherpa, Rai, Chhetri). *Knowledge Provider(s)*: 5 Gorkha Nepalese people:- a. Mr. Yangzee Sherpa [age 87], owner of Singalila lodge, Kalapokhri. First hand ITKs documented: i. The dried blood red corolla are boiled in hot water and often used to cure diarrhoea, vomiting and stomach pain. ITKs documented on 18th April, 2022 by PR.

b. Mr. Passang Sherpa [age 36], Kalipokhri: ITKS documented-*dosimetry*: corolla [3-4 fresh or 5-6 dry] are allowed boiling for 2 minutes in 500g water. After cooling extract is taken to cure Covid 19 viral fever. ITKs documented by PR on 18th April 2022.

c. Smt. Gyani Rai [age 44], BK Bhanjang: ITKs documented-*dosimetry-I*: fresh or sun-dried red corolla are eaten raw [4 -5] daily for 5 days to cure Covid 19 viral fever and tonsil. *Dosimetry-II*: wine prepared from red corolla [5 kg corolla+1.5 kg sugar+250g salt+yeast plant together are kept for boiling in a container for 3 days followed by fermentation. Total process requires at least 15 days. After that filtrate is taken as ‘wine’] is taken regularly to increase body’s immunity,

especially during viral fever. Wine is also taken to relieve body's pain after long trekking. ITKs documented by PR on 18th April 2022.

d. Mr. Chandra Bahadur Rai (Age: 65 years), an owner of Sidhartha Lodge at Tumling, Darjeeling. First hand ITKs documented: i. Fallen sundried corollas are used to prepare local wine (Rhododendron Wine) after fermentation to cure throat pain due to cold, stomach pain and dysmenorrhoeal pain. First hand ITKs documented on 24th Feb. 2021 at Tumling by SP and PR.

Voucher specimen: Alubari TN Road, Darjeeling, 6800 ft, 26.02.2021, S. Panda & P. Roy 0077 (MAC); Kalapokhri, Singalila NP, Darjeeling district, 10800 ft, 18.04.2022, P. Roy 53 (MAC); BK Bhanjang, Singalila NP, Darjeeling district, 11200 ft, 18.04.2022, P. Roy 57 (MAC).

4. *R. arboreum* Sm. subsp. *delavayi* (Franch.) D.F. Chamb. var. *delavayi* (**Figure 3A**)

Local Name: Laliguras jato (Nepalese Gorkha community of Darjeeling hills: Sherpa). *Knowledge Provider(s):* only one Gorkha Nepalese people:- Mr. Nima Sherpa [age 54], Manebhanjang, a registered porter: ITKS documented-*dosimetry:* red corolla are used to prepare good quality 'Rhododendron Wine'. Corolla of these plant are mixed with corolla of *R. arboreum* subsp. *cinnamomeum* var *rosea* [1:3 ratio] to prepare good quality 'Laliguras Wine'. This wine is taken to cure any type of viral fevers including Covid 19 viral fever. Wine is also taken to relieve body pain during long trekking. Porters usually take this type of home-made wine at Kalipokhri and BK Bhanjang. *Voucher specimen:* BK Bhanjang, Darjeeling, 11000 ft, 19.05.2019, S. Panda 0093 (MAC).

5. *Rhododendron barbatum* Wall. ex G. Don (**Figure 3 B-C**)

Local Name: Rato Chimal (Nepalese Gorkha community of Darjeeling hills: Sherpa). *Knowledge Provider(s):* only one Gorkha Nepalese people:- Mr. Nima Sherpa [age 54], Manebhanjang, a registered Porter. First hand ITKs documented: Gums present at the base of petioles and flower bases are used in pharmaceutical industry for the preparation of capsule coat. ITKs documented by SP on 17th September 2019. *Voucher specimen:* 1 km down from Sandakphu towards Gurdum, Darjeeling, 11000 ft, 17.09.2019, S. Panda 00127 (MAC).

6. *Rhododendron campanulatum* D. Don (**Figure 3 D-E**)

Local Name: Nilo Chimal (Nepalese Gorkha community of Darjeeling hills: Rai, Bhutia, Sherpa). *Knowledge Provider(s):* 4 Gorkha Nepalese people:- a. Mr. Karnabahadur Rai [age 76] & Chandraprakash Rai [age 72], Rajavir village, near Rimbik. First hand ITKs documented-*dosimetry-I:* corolla of Nilo Chimal [15 corolla in 1 litre water+50g sugar+yeast plant (*Polygala arillata*)] kept inside 1 litre glass bottle for fermentation [15 days], and after fermentation, filtrate/extract [Nilo Chimal Wine] is taken to cure viral fever incl. Covid 19, and to relieve body pain. *Dosimetry-II:* Inner bark of Nilo Chimal made into powder and kept for future use. 1 teaspoonfull powder mixed in a glass of water [500 mL] and allowed it boiling for 3 minutes. After cooling the extract is taken to cure piles. ITKs documented by SP and PR on 6th December 2022.

b. Mr. Phurbu Tshering Bhutia [age 36], Ale village, Sandakphu. First hand information documented: *Dosimetry:* 3 to 4 corolla are allowed to boil in a glass of water for 3 to 4 minutes. After cooling, the extract is taken to cure tonsillitis and throat pain due to cold. ITKs documented by SP and PR on 22 May, 2022.

c. Smt. Pinki Sherpa [age: 59], Ale village, Sandakphu. First hand information documented: i. very small amount of powdered dried leaves and twigs of this plant are mixed with tea and administered to drink to cure fever. ii. leaves, twigs and gums of this plant are applied on old wounds to cure it. First hand ITKs documented on 12th May, 2021 at Alle village, Sandakphu by SP & PR.

Voucher specimen: Sandakphu, Darjeeling, 12300 ft, 22.05.2022, S. Panda & Party 92 (MAC); 1 km from Sandakphu toward Gurdung, 11800 ft, 05.12.2022, S. Panda & Party 017 (MAC).

7. *R. cinnabarinum* Hook. f. (**Figure 3 F-G**)

Local Name: Ghantiphul, Khorsane phul (Nepalese Gorkha community of Darjeeling hills: Rai and Bhutia). *Knowledge Provider(s):* 5 Gorkha Nepalese people:- a. Mr. Polma Rai [age 65], Sepigaon. First hand ITKs documented: red corolla are eaten raw by the local Sherpas of Kalipokhri to get energy during long walk. ITKs documented by SP & PR on 6th December 2022.

b. Smt. Usha Rai [age 60] & Chandrakala Rai [age 50], Rajavir village, near Rimbik-*dosimetry*: 3 to 4 corolla are eaten raw or after boiling in a glass of water [2 minute] the extract is taken to cure throat pain due to cold and any types of fever. ITKs documented by SP & PR on 6th December 2022.

c. Mr. Chandra Prakash Rai [age 72], Rajavir village near Rimbik. First hand ITKS documented-*dosimetry*: 4 to 5 corolla are allowed to boil in a glass of water [500g] for 3 minutes. After cooling extract is taken to cure chronic gastritis including gastric ulcer problem. ITKs documented by SP & PR on 6th December 2022.

d. Mr. Phurbu Tshering Bhutia [age 36], Ale village, Sandakphu. First hand ITKs documented-*dosimetry*: 4 to 5 corolla are allowed to boil in a glass of water [500g] for 4-5minutes. After cooling extract is taken for at least 7 days for lowering high blood pressure. Informant provided to a foreigner who had high blood pressure, after taking this extract dose, just after half an hour, he felt good and measured his normal pressure at Ale village in May 2019. ITKs documented by SP & PR on 22nd May 2022.

Voucher specimen: Sandakphu, Darjeeling, 12300 ft, 22.05.2022, S. Panda & Party 94 (MAC).

8. *Rhododendron grande* Wight (**Figure 3 H-I**)

Local Name: Chimal (Nepalese Gorkha community of Darjeeling hills: Bhutia). *Knowledge Provider(s)*: only one Gorkha Nepalese people:- Smt. Doma Bhutia (Age: 48 years), an owner of Sherpa Lodge, Lamay Dhura, Darjeeling. First hand ITKs documented: i. Juice of Corollas of this plant is used to cure nose ulcer and any types of nasal diseases. ITKs documented by SP & PR on 24th Feb. 2021 at Lamay Dhura. *Voucher specimen*: Lamay Dhura, Darjeeling, 7100 ft, 24.02.2021, S. Panda & party 00100 (MAC).

9. *Rhododendron triflorum* Hook. f. (**Figure 3 J-K**)

Local Name: Machino phool (Nepalese Gorkha community of Darjeeling hills: Rai). *Knowledge Provider(s)*: 2 Gorkha Nepalese people:- a. Mr. Polma Rai (age 65) & Smt. Pabitra Rai (age 62), Sepigaon. First hand ITKs documented: i. Flowers, twigs and leaves after sun drying are directly

used as good quality incense by the Rai community since time immemorial. Rai community used its incense to cure asthma, and other types of respiratory breathing problem. ITKs documented on 6th December 2022 by SP & PR.

b. Smt. Biraja Gurung (age 67), Tumling. Vernacular name: *Machino Phool*. First hand information documented: i. Flowers, twigs and leaves after sun drying are directly used as good quality incense by the Gurung community since time immemorial. They used its incense in Monastery as well as at their homes. ITKs documented in May 2022 by SP & PR. *Voucher specimen*: Sandakphu-Gurdung trek route, Darjeeling, 10200 ft, 6th December 2022, S. Panda & party 97 (MAC).

10. *Rhododendron vaccinioides* Hook. f. (**Figure 3L**)

Local Name: Saluma, Sunpati (Nepalese Gorkha community of Darjeeling hills: Thami).

Knowledge Provider(s): only one Gorkha Nepalese people:- Mr. Jai Kumar Thami (age 79), Alubari TN Road. First hand ITKs documented-*dosimetry*: tender leaves [50g] allowed boiling for 3 minutes, and after cooling extract is taken directly or with tea to cure throat pain, cold and cough by the Tamang community since time immemorial. ITKs documented on 7th December 2022 by SP & PR. *Voucher specimen*: Alubari Jungle Busty, Darjeeling, 6000 ft, 7th December 2022, S. Panda & party 112 (MAC).

CONCLUSION

Ethnomedicinal first hand information based on seven communities of the Gorkha Nepalese in Darjeeling Hills unravels to cure or relieve more than fifteen human disease already mentioned in the Result and Enumeration section. Detailed ethnomedicinal potentialities including folk dosimetry of these ten taxa of *Rhododendron* L. in Darjeeling hills are mostly new and unknown to science. Ethnomedicinal First hand information with their detailed folk dosimetry as revealed by these seven Gorkha Nepalese Communities (Gurung, Rai, Sharma, Tamang, Thami, Sherpa and Pradhan) are also newly documented to science, not only in Darjeeling Himalaya, but also from the entire Himalayas.

Conflict of Interest

Both authors have equal contributions of this work and declare no conflict of interest.

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CAPTIONS OF FIGURES 1–3 & MAP 1

Map 1. Study Area map of present Darjeeling Himalaya in West Bengal and India maps showing localities (Google Earth) (Source: BurningCmpass.com; en.wikipedia.org/ Wiki/ Darjeeling_district).

Figure 1. Sample Questionnaire for an ethnomedicinal plant taken during oral interviews at Sandakphu, Darjeeling district (oral interview with Sri Phurbu Tshering Bhutia of Ale village, Sandakphu for ‘Nilo Chimal plant’, *Rhododendron campanulata* G. Don (Ericaceae).

Figure 2. Ethnomedicinal reports of Darjeeling *Rhododendron* L.: A–H. *Rhododendron arboreum* Sm. subsp. *arboreum* var. *arboreum*—A. flowering twig, B. Mr. Jai Kumar Thami of Alubari TN Road interviewed with ‘Laliguras plant’ flowering twig, C. Smt. Pabitra Rai of Sepigaon interviewed with this plant image, D. Mr. Chhabilal Chhetri of Lodhoma interviewed with this plant image, E. Mr. Jai Kumar Thami of Alubari TN Road showing sun-dried corolla of ‘Laliguras plant’ for the purpose of preparation of ‘Rhododendron Wine’, F. Mr. Kessang Sherpa of Lamaydhura revealing ITKs about this plant, G. Smt. Dushila Rai of Rajavir village revealing ITKs about this plant, H. Mr. Chandra Prakash Rai (extreme right) of Rajavir village along with survey team revealing ITKs about this plant; I–J. *Rhododendron arboreum* Sm. subsp. *cinnamomeum* (Wall. ex G. Don) Tagg var. *roseum* Lindl.—I. habit of var. *rosea* observed at Alubari TN Road, Darjeeling; J. Mr. Jai Kumar Thami interviewed with the image of this plant; K–L. *Rhododendron arboreum* Sm. subsp. *cinnamomeum* (Wall. ex G. Don) Tagg var.

cinnamomeum: K. flowering twig of this species observed at Kalapokhri, L. Mr. Yangzee Sherpa, the owner of Singalila Lodge at Kalapokhri revealing ITKs about this plant.

Figure 3. Ethnomedicinal reports of Darjeeling *Rhododendron* L.: A. Close up of flowering twig and habit of *Rhododendron arboreum* Sm. subsp. *delavayi* (Franch.) D.F. Chamb. var. *delavayi* observed at Bikey Bhanjang; B-C. *Rhododendron barbatum* Wall. ex G. Don—B. Dissected flowering parts based on Sandakphu collection, C. Mr. Nima Sherpa of Manebhanjang revealing about ITKs of this plant; D-E. *Rhododendron campanulatum* D. Don—D. Flowering twig and habit of this plant observed at Sandakphu, E. Mr Phurbu Tshering Bhutia revealing ITKs about this plant; F-G. *Rhododendron cinnabarinum* Hook. f.—F. Flowering twig and habit of this plant observed at Sandakphu, G. Mr Phurbu Tshering Bhutia revealing ITKs about this plant; H-I. *Rhododendron grande* Wight—H. Flowering twig of this plant observed at Lamaydhura, I. Smt. Doma Bhutia of Lamaydhura revealing ITKS about this plant; J-K. *Rhododendron triflorum* Hook. f.—J. Flowering twig of this plant observed at Sandakphu-Gurdung Trek Route, K. Smt. Biraja Gurung revealing ITKs about this plant; L. habit of *Rhododendron vaccinioides* Hook. f. observed at Alubari Jungle Busty.



Figure 2.



Figure 3.