AN ETHNOBOTANICAL STUDY OF WILD MEDICINAL PLANTS USED BY MIGRATORY SHEPHERDS – A TRIBAL COMMUNITY OF WESTERN HIMALAYAS

RADHA1*, PURI S2, KUMAR S2

1Department of Botany, School of Biological and Environmental Sciences, Shoolini University of Biotechnology and Management Sciences, Solan, Himachal Pradesh, India. 2Department of Botany, College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh, India.

Email: radhuchauhan7002@gmail.com

Received: 31 December 2018, Revised and Accepted: 21 February 2019

ABSTRACT

Objectives: Migratory shepherds of Kinnaur, Shimla, and Sirmour districts in Himachal Pradesh of the western Himalayas have rich traditional knowledge of medicinal plants and its uses, in this respect; an ethnobotanical survey was carried out from 2017 to 2018.

Methods: The required information on ethnomedicines used by tribal migratory shepherds was collected through personal field visits, interview method and using a pretested questionnaire.

Results: It was observed that in all 78 species were used by shepherds en route from high hills to low hills. In high hills 35 species, in mid hills 20 species, and low hills 23 species were found to be used as ethnomedicine source.

Conclusion: This study shows that shepherds in tribal areas are highly dependent on ethnobotanical remedies, which evolved over generations of experience and practices, for health care. The common diseases were treated by ethnomedicinal plants such as cough, cold, body pain, Skin infection, wounds, diarrhoea, respiratory problems, and sunburn. The collected detailed information on the list of plants and their therapeutic practices among tribal migratory shepherds may be helpful to improve the future pharmaceutical applications.

Keywords: Ethnomedicines, Shepherds, Livestock, Biodiversity.

© 2019 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/) DOI: http://dx.doi.org/10.22159/ajpcr.2019.v12i4.31130

INTRODUCTION

The Indian Himalayan region is characterized by its unique ecosystem with a wide range of climates and habitat types which supports different flora and fauna [1]. The Himalaya Hotspot is home to the world’s highest mountains. The mountains of Himalaya rise abruptly, resulting in a variety of ecosystems [2]. Himachal Pradesh, a North Indian state, is located in the western part of the Himalaya. The state has a wide geographical area (55,673 km²) and altitudinal variation (350–7000 m asml) with a rich assortment of biotic components [3]. Himachal Pradesh has a forest cover of 22% and rich in medicinal plant species. The plant medications of inhabitants, handed down by word of mouth from one generation to the next generation, gradually became part of the knowledge of ancient civilization [4-8]. Majority of the rural societies possess significant traditional knowledge of natural resources, which they have inherited from their forefather. They closely depend on this knowledge for a variety of reasons related to the social order, health care, economy, shelter, food, etc. However, if the efforts are not made with instant effect, the rich traditional knowledge possessed by tribal society will diminish soon. This calls for an urgent need to document ethnomedical plant species. Ethnobotanical information is already given by many workers in different districts of Himachal Pradesh such as Lahaul and Spiti, Chamba, Mandi, and Kinnaur [9-13]. Moreover, Himachal Pradesh has led to tribal ways of life, adherence to the primitive customs and myths and traditions representing on enormous and difficult terrain of scattered human settlement [14]. The present study is an effort to enhance such surveys and make an addition to utilization of some of the wild medicinal plant species by tribal migratory shepherds which are not recorded earlier from the studied sites. The ethnobotanical information on medicinal plant species of the studied area is expected to provide new dimension’s forever expanding the pharmaceutical industry.

METHODS

Himachal Pradesh, a North Indian state, is situated in the heart of Western Himalaya and has a varied geographical grouping, mosaic sociocultural diversity and huge wealth of natural resources [15,16]. The present study is undertaken in Himachal Pradesh situated between 75°45’55”–79°04’20”E longitude and 30°22’40”–33°12’40”N latitude. Physiographically, the state consists of three distinct regions outer Himalaya, mid-Himalaya, and greater Himalaya. The outer Himalaya, also called Shivalik hills, ranges from 350 to 1500 amsl. The mid hills cover an area up to 3500 m. The greater Himalaya also called a high altitude alpine zone generally starts from an elevation of 3510m and above. It includes higher altitude areas of Kullu, Kinnaur, Lahaul, Spiti, and Chamba districts. Due to diverse ecological conditions and altitudinal differences, the state is rich in plant species, which includes around 3400 species of flowering plants ranging from alpine to tropical zone [1].

Kinnour district of Himachal Pradesh is well known for migratory shepherding, where the shepherds move from their places to low hills on a set route to enter sites in Shimla and Sirmour districts. The present study documents the use of ethnomedicines used by migratory shepherds of district Kinnour Himachal Pradesh. A total of five field surveys were carried out taking into account the migratory route of the shepherds from high hills to low hills. In the higher reaches of Kinnour district, the Kinnuare (shepherds) started the movement from five different villages of Kinnour and these were Kamru, Sangla, Baseri, Rackcham, and Chitkul. Besides, the place of origin of shepherds, surveys were done for four other places, namely – Chopal (mid hills), Churdhar (mid hills), Remulaji (low hills), and Poanta-Sahib (low hills). These four places were their part of the migratory route. The migratory shepherd’s groups were selected randomly for an interview during field visits.
Shepherds’ migration started from Kamru (2700 m), Sangla (2600 m), Batseri (2700 m), Rakchham (3100 m), and Chitkul (3450 m) in July. These originated sites of migratory shepherds located at high altitude remain cutoff from the rest of the world due to heavy snowfall during winters. The information on ethnobotanical medicines was collected using a pre-tested questionnaire, interview, through participatory discussion and observation from July 2017 to October 2018. The specimens of ethnobotanical medicines being used by migratory shepherds for their health care were collected, dried, and mounted on herbarium sheets, with label information describing when and where they were collected. Plants were identified either in the field itself or with the help of experts from Botanical Survey of India (BSI) Dehradun, Uttarakhand and Forest Research Institute (FRI) Dehradun, Uttarakhand. Vouchers of plants were places in the herbarium of Shoolini University, Solan [17].

RESULTS

Harsh environmental conditions cause seasonal migration of shepherds from high hills to low hills in Himachal Pradesh (Fig. 1). Seasonal migration is a traditional process in the tribes of the Himalayan region. It was observed that the majority of shepherds start their migration from their villages (Fig. 2) in July. However, a few also migrate in August and September, but there is no migration as the winters sets in. The migratory shepherds move in a group of their family members. The

| S. No. | Particulars                        | Study villages |
|-------|-----------------------------------|----------------|
|       |                                   | Kamru          | Sangla         | Batseri        | Rakchham       | Chitkul        |
| 1.    | Altitude (m)                      | 2700 m         | 2600 m         | 2700 m         | 3100 m         | 3450 m         |
| 2.    | Group size (No.)                  | 5              | 6              | 6              | 5              | 5              |
| 3.    | Average family income (Rs., Lakh/annum) | 3              | 2              | 4              | 2              | 3              |
| 4.    | Horses (No.)                      | 2              | 2              | 4              | 2              | 3              |
| 5.    | Dogs (No.)                        | 2              | 3              | 4              | 2              | 3              |
| 6.    | Flock size (sheep and goats)      | 654            | 712            | 990            | 640            | 780            |
| S. No. | Botanical name | Family | Common name | Flowering and Fruiting period | Parts used | Habit | Voucher specimen number | Ailments/diseases treated | Ethnobotanical Uses |
|-------|----------------|--------|-------------|-------------------------------|------------|-------|-------------------------|--------------------------|------------------------|
| 1     | Abies spectabilis (D.Don.) Spach. | Pinacea | Kolroi, Tosh, Talispatra | April–May, Cones ripen during September–October May–July | Leaves | Tree | SUBMS/BOT-431 | Asthma, Fever, Bronchitis | Juice of leaves is used. |
| 2     | Asparagus filcinus D. Don. | Asparagaceae | Chiriyakhana, Sahasisuli, Sharanoi Satyanasali, Bharband | Throughout the year | Whole part | Herb | SUBMS/BOT-388 | Malaria | The whole plant is used to make a tea and as much tea as possible is drunk until symptoms disappear. Whole plant is used. |
| 3     | Argemone mexicana L. | Papaveraceae | Satyanashi, Bharband | Throughout the year | Whole part | Herb | SUBMS/BOT-455 | High Blood Pressure, Body pain, Respiratory infection | Fruits are edible and highly nutritious. Roots decoction is given in jaundice. Decoction of rhizome prescribed to cure cold and joint pains. Leaves and flowers used for fever. Seeds mixed with Cynodon dactylon and paste prepared and used on the fractured part then covered with the bark of Betula utilis. |
| 4     | Achillea millefolium L. | Asteraceae | Bhutalesi | June–December | Whole part | Herb | SUBMS/BOT-378 | Bone fracture | Juice of roots is used. |
| 5     | Berberis lycium Royle. | Berberidaceae | Karmashal | March–July | Fruits, roots | Shrub | SUBMS/BOT-659 | Nutritious for health, Jaundice | Fruits are edible and highly nutritious. Roots decoction is given in jaundice. Decoction of rhizome prescribed to cure cold and joint pains. Leaves and flowers used for fever. Seeds mixed with Cynodon dactylon and paste prepared and used on the fractured part then covered with the bark of Betula utilis. |
| 6     | Bergenia ciliate (Haw.) Sternb. | Saxifragaceae | Pashanbhed | June–August | Rhizomes, leaves, flowers | Herb | SUBMS/BOT-352 | Cold, Joint pains, Fever | Juice of whole grass is used. |
| 7     | Betula utilis D. Don. | Betulaceae | Bhojpatra | May–October | Seeds | Tree | SUBMS/BOT-387 | Urinary infections, Dysentery, Sunburn | Seeds are used for the treatment of urinary infections. The juice of the roots is used in the treatment of dysentery. The juice of the stem is applied to sunburn. Juice of tubers and leaves is used. |
| 8     | Celtis tetrandra Roxb. | Ulmaceae | Khirk | February–April | Seeds | Tree | SUBMS/BOT-378 | Indigestion | Juice of whole grass is used. |
| 9     | Cannabis sativa L. | Cannabaceae | Bhang | June–September | Leaves | Herb | SUBMS/BOT-658 | Abdominal pain | Leaves of Cannabis sativa burn over flame and smoke is used for abdominal pain. |
| 10    | Cynodon dactylon L. Pers. | Poaceae | Doob, Durva | Throughout the year | Whole part | Grass | SUBMS/BOT-338 | Headache, Skin allergy, Cough, Cold, High Blood Pressure | Juice of whole grass is used. |
| 11    | Chenopodium album L. | Chenopodiaceae | Bathua | June–September | Seeds, roots, stem | Herb | SUBMS/BOT-660 | Urinary infections, Dysentery, Sunburn | Seeds are used for the treatment of urinary infections. The juice of the roots is used in the treatment of dysentery. The juice of the stem is applied to sunburn. |
| 12    | Dioscorea deltoidea Wall. Ex Grisdb. | Dioscoreaceae | Singli mingli | July–October | Tubers, leaves | Climber | SUBMS/BOT-661 | Skin allergy, Constipation, wound healing, Burns Jaundice | Juice of tubers and leaves is used. |
| 13    | Euphorbia hirta L. | Euphorbiaceae | Duddhi | November–April. | Stem, leaves | Herb | SUBMS/BOT-662 | Cold, Coughs, Asthma, Respiratory problems | Juice of stem and leaves is used. |
| 14    | Ephedra gerardiana Wallich ex C. A. Meyer. | Ephedraceae | Rachi, Budagur, Ghhe | May–September | Whole part | Shrub | SUBMS/BOT-422 | | Tea of leaves is used. |
| S. No. | Botanical name                  | Family                | Common name | Flowering and Fruiting period | Parts used     | Habit     | Voucher specimen number | Ethnobotanical Uses                                               |
|-------|--------------------------------|-----------------------|-------------|------------------------------|----------------|-----------|------------------------|---------------------------------------------------------------|
| 15    | Ficus religiosa L.              | Moraceae              | Peepal      | November–February             | Leaves, bark   | Tree      | SUBMS/BOT-361          | Powder of dried bark and needles is used.                    |
| 16    | Azadirachta indica L.           | Meliaceae             | Neem         | April–September              | Leaves, fruits | Shrub     | SUBMS/BOT-330          | Bark, leaves, and seeds are used.                            |
| 17    | Juniperus communis L.           | Cupressaceae          | Bethar, Pethri| March–September              | Bark, needles | Shrub     | SUBMS/BOT-366          | Juice of bark and needles is taken internally.                |
| 18    | Heracleum lanatum Michx.       | Apiaceae              | Patrala, Padara| June–July                   | Roots          | Herb      | SUBMS/BOT-399          | Juice of bark and needles is taken orally.                    |
| 19    | Hymalanthus trifoliatus        | Urticaceae            | Kandali      | July–September               | Leaves, shoots | Herb      | SUBMS/BOT-357          | Juice of shoots and roots is used.                           |
| 20    | Hymalanthus trifoliatus        | Urticaceae            | Kandali      | July–September               | Leaves, shoots | Herb      | SUBMS/BOT-357          | Juice of shoots and roots is used.                           |
| 21    | Rubus ellipticus Sm.            | Rosaceae              | Anehhu, Hinsalu, Aakhe | February and April | Fruits       | Shrub     | SUBMS/BOT-665          | Juice of roots is taken orally.                               |
| 22    | Solanum nigrum L.              | Solanaceae            | Kantkari    | April–August                 | Fruits       | Shrub     | SUBMS/BOT-666          | Juice of fruits is used.                                      |
| 23    | Valeriana officinalis L.        | Caprifoliaceae        | Muskbala    | March–April                  | Leaves, roots | Herb      | SUBMS/BOT-334          | Leaves and seeds are considered a popular remedy of fever.   |
| 24    | Valeriana officinalis L.        | Caprifoliaceae        | Muskbala    | March–April                  | Leaves, roots | Herb      | SUBMS/BOT-334          | Leaves and seeds are considered a popular remedy of fever.   |
| 25    | Valeriana officinalis L.        | Caprifoliaceae        | Muskbala    | March–April                  | Leaves, roots | Herb      | SUBMS/BOT-334          | Leaves and seeds are considered a popular remedy of fever.   |
| 26    | Valeriana officinalis L.        | Caprifoliaceae        | Muskbala    | March–April                  | Leaves, roots | Herb      | SUBMS/BOT-334          | Leaves and seeds are considered a popular remedy of fever.   |
| 27    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 28    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 29    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 30    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 31    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 32    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 33    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 34    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |
| 35    | Thalictrum aquilegifolium L.    | Rosaceae              | Thaliq           | June–July                  | Roots, shoots | Herb      | SUBMS/BOT-352          | Juice of leaves is used.                                      |

Table 2: (Continued)
| S. No. | Botanical name          | Family         | Hindi name | Flowering and fruiting | Parts used            | Voucher no. | Ailments/diseases treated                                                                 |
|-------|-------------------------|----------------|------------|------------------------|-----------------------|-------------|------------------------------------------------------------------------------------------|
| 1     | Bergenia ciliata (Haw.) | Saxifragaceae  | Pashanbhed  | June–August             | Rhizomes, leaves, flowers | SUBMS/BOT-667 | Cold, Joint pains, Fever                                                                  |
| 2     | Chenopodium album L.    | Chenopodiaceae | Bathua     | June–September          | Seeds, Roots           | SUBMS/BOT-668 | Urinary infections, dysentery, sunburn, Urti, eruptions, Skin allergy                     |
| 3     | Commelina benghalensis L. | Commelinaceae | Kana, Kankawa | Throughout the year     | Leaves, Roots, Flowers | SUBMS/BOT-669 | Diarrhea, Stomach disorder, Eye problems                                                  |
| 4     | Cannabis sativa L.      | Cannabaceae    | Bhang      | June–September          | Leaves                 | SUBMS/BOT-348 | Abdominal pain                                                                            |
| 5     | Dioscorea deltoidea Wall. | Dioscoreaceae | Singli mingli | July-October           | Tubers, Leaves, Rhizomes | SUBMS/BOT-353 | Skin allergy, Constipation, Wound healing, Burns                                           |
| 6     | Hypericum oblongifolium Choisy. | Hypericaceae | Basant     | May–September           | Roots                  | SUBMS/BOT-345 | Urinary infections                                                                        |
| 7     | Hedychium spicatum Sm.  | Zingiberaceae  | Kapurkachri | July–October            | Rhizomes               | SUBMS/BOT-384 | Cough, Asthma, Headache, Skin infections                                                  |
| 8     | Lyonia ovalifolia (Wall.) | Ericaceae     | Ayar, Airan Alhan | April–September       | Leaves, Buds           | SUBMS/BOT-371 | Throat infections, Insecticides                                                             |
| 9     | Morchella esculenta Fr. | Morchellaceae  | Guchhi     | March–October           | Whole part             | SUBMS/BOT-446 | Indigestions                                                                              |
| 10    | Punica granatum L.      | Punicaceae     | Daru       | April–December          | Fruits                 | SUBMS/BOT-577 | Nutritious for health                                                                     |
| 11    | Prunus cerasoides D.Don | Rosaceae       | Pajja      | December–March          | Fruits                 | SUBMS/BOT-576 | Fruits are used                                                                            |
| 12    | Picrorhiza kurroa Royle | Scrophulariaceae | Karru, Kutki | June–August             | Roots, Rhizomes        | SUBMS/BOT-577 | Mucositis, Cold Ulcers, Abscess                                                          |
| 13    | Urtica dioica L.        | Urticaceae     | Bichhu Booti | June–October           | Leaves, Shoots         | SUBMS/BOT-672 | Spurt of foot                                                                               |
| 14    | Urtica palviflora Roxb. | Urticaceae     | Kandali    | March–September         | Leaves, Shoots         | SUBMS/BOT-671 | Juice of bark and seeds and Fruits is used                                                 |

Table 3: Ethnomedicinal plants used by migratory shepherds in mid hills, (Chopal in Shimla-district and Churdhar in Sirmour-district) Himachal Pradesh.
Table 4: Ethnomedicinal plants used by migratory shepherds in low hills, Renukaji and Poanta-Sahib of district Sirmour

| S. No. | Botanical name | Family | Hindi name | Flowering and fruiting | Parts used | Habit | Voucher no. | Ailments/ diseases treated | Ethnobotanical uses |
|--------|----------------|--------|------------|------------------------|------------|-------|-------------|---------------------------|-------------------|
| 1      | *Amaranthus viridis* L. | Amaranthaceae | Jungali chauliya | July–October | Leaves, Roots | Herb | SUBMS/BOT-401 | Skin infections | Juice of leaves and roots is applied. |
| 2      | *Abras precatorius* L. | Fabaceae | Ratti, Gunchi | October–May | Leaves | Climber | SUBMS/BOT-428 | Wound healing Malaria | The juice of leaves is used. *Argemone Mexicana* tea is used. |
| 3      | *Argemone Mexicana* L. | Papaveraceae | Satyanashi, Bhurband Arusa, Vasaka | Throughout the year | Whole part | Herb | SUBMS/BOT-586 | Cough, asthma, cold | Juice of leaves is used. |
| 4      | *Adhatoda vasa* Nees. | Acanthaceae | December-June | Leaves | Herb | SUBMS/BOT-382 | Urinary infections, dysentery, Sunburn Abdominal pain | Juice of dried leaves and Bark is used. Juice of seeds, roots, and stem is used. Leaves of *Cannabis sativa* burn over flame and smoke is used. |
| 5      | *Bauhinia veriegata* (L.) Benth. | Fabaceae | Kachnar | April–November | Leaves, bark | Tree | SUBMS/BOT-638 | Skin cuts | Juice of leaves is applied. |
| 6      | *Chenopodium album* L. | Chenopodiaceae | Bathua | June–September | Seed, roots, stem | Herb | SUBMS/BOT-585 | Nutritious for health Fever, Cough, Cold | Juice of dried flowers, seeds and leaves are used. Leaves fruits and stem are used. Juice of leaves is used. Tender leaves and twigs are cooked as a vegetable. Juice of dried flowers is used. |
| 7      | *Cannabis sativa* L. | Cannabaceae | Banga | June–September | Leaves | Herb | SUMS/BOT-584 | Nutritious for health | Fruits are edible. |
| 8      | *Eupatorium adenophora* (Spreng.) King and H. Rob. | Asteraceae | Pamakani | March–April | Leaves | Shrub | SUBMS/BOT-398 | Skin allergy | Juice of leaves and roots are applied. |
| 9      | *Hypericum perforatum* L. | Hypericaceae | Basant, Balsana | May–September | Leaves, roots | Roots | SUBMS/BOT-408 | Skin allergy | Juice of leaves and roots are applied. |
| 10     | *Hypericum oblongifolium* Choisy. *Juglans regia* L. | Hypericaceae | Akhrot | April–October | Roots, Bark, Leaves, Fruits | Herb | SUBMS/BOT-342 | Skin allergy | Juice of roots is used. Bark, leaves and fruits are used. |
| 12     | *Prunus cerasoides* D.Don | Rosaceae | Pajja | December-March | Fruits | Tree | SUBMS/BOT-341 | Nutritious for health | Fruits are edible. |
| 13     | *Ocimum sanctum* L. | Lamiaceae | Tulsi | June–September | Flowers, seeds, leaves | Herb | SUBMS/BOT-369 | Nutritious for health | Fruits are edible. |
| 14     | *Pyracantha crenulata* (D. Don.) M. Roem. | Rosaceae | Bedu, Chhota seb | March–June | Leaves, fruits, stem | Shrub | SUBMS/BOT-434 | Tonic, fever | Juice of leaves is used. |
| 15     | *Pinus roxburghii* Sarg. | Pinaceae | Chir | March-May | Leaves | Tree | SUBMS/BOT-393 | Joint pains Nutritious for health Gough, Cold, Fever | Juice of leaves is used. Tender leaves and twigs are cooked as a vegetable. Juice of dried flowers is used. |
| 16     | *Phytolacca acina* Roxb. | Phytolaccaceae | Jharka, Jalga | June–September | Leaves, Twigs | Herb | SUBMS/BOT-582 | Joint pains Nutritious for health Gough, Cold, Fever | Juice of leaves is used. Tender leaves and twigs are cooked as a vegetable. Juice of dried flowers is used. |
| 17     | *Rhododendron arboretum* Sm. | Ericaceae | Burans | March-September | Flowers | Tree | SUBMS/BOT-364 | Nutritious for health | Juice of leaves is used. Tender leaves and twigs are cooked as a vegetable. Juice of dried flowers is used. |
| 18     | *Rhus parviflora* Roxb. | Anacardiaceae | Samakdan, Samakdan | July-August | Bark | Shrub | SUMS/BOT-581 | Headache | The paste prepared from the dried Bark is used. Juice of fruits is used. The juice of leaves and roots is applied. Juice of leaves and roots is used. Tender leaves and shoots cooked as a vegetable. Juice of leaves is applied. |
| 19     | *Solanum surratense* Burm. f. | Solanaceae | Kantkari | April-August | Fruits | Herb | SUBMS/BOT-458 | Stone in Bladder Root infection | Juice of leaves is used. Tender leaves and roots is used. Tender leaves and shoots cooked as a vegetable. Juice of leaves is applied. |
| 20     | *Solanum nigrum* L. | Solanaceae | Mokoi, Dhakh | April-July | Leaves, roots | Herb | SUBMS/BOT-580 | Stone in Bladder Root infection | Juice of leaves is used. Tender leaves and roots is used. Tender leaves and shoots cooked as a vegetable. Juice of leaves is applied. |
| 21     | *Urtica dioica* L. | Urticaceae | Bichhu Booti | June-October | Leaves, roots, shoots | Herb | SUBMS/BOT-579 | Nutritious for health | Juices of leaves and seeds is used. Tender leaves and shoots cooked as a vegetable. Juice of leaves is applied. |
| 22     | *Vitex negundo* L. | Verbenaceae | Nirgandhi Tirmir | March-September | Leaves, Bark, seeds, fruits | Herb | SUBMS/BOT-578 | Joint pains Fever, tooth pain | Juice of leaves is applied. |
| 23     | *Zanthoxylum armatum* DC. | Rutaceae | Dooli, Tirmir | April-June | Leaves, Bark, seeds, fruits | Herb | SUBMS/BOT-365 | Joint pains Fever, tooth pain | Juice of leaves is applied. |

*Notes: S. No.* stands for sequence number, *Botanical name* refers to the scientific name of the plant, *Family* indicates the plant family to which the species belongs, *Hindi name* is the common name of the plant in Hindi, *Flowering and fruiting* denotes the period when the plant flowers and fruits, *Parts used* refers to the parts of the plant that are used, *Habit* indicates whether the plant is a herb, shrub, tree, climber, etc., *Voucher no.* is the voucher number for the specimen collected, *Ailments/ diseases treated* lists the ailments or diseases that the plant is used to treat, and *Ethnobotanical uses* provides information on how the plant is utilized ethnomedicinally.*
migration flock includes both goats and sheep and size of the flock varies (Table 1). Shepherds move first to grazing pasture in Chopal (district Shimla) irrespective of their origin place of migration. The shepherds take along with them 2–4 horses for carrying tents and provisions. Often four to five dogs also accompany the shepherds, and in fact, these dogs are trained in protecting the goats and sheep from wild animals and also keep the flock together. The disparity of flock size generally is an indicator of the status of farmer’s livestock holding capacity. The present study also indicated that shepherds having a high number of the flock are comparatively well off compared to those with less number. Many studies have reported that flock size is directly associated with migration distance, flock with larger size travel longer distance as compared to small size flocked [18,19]. In our study, it was found that irrespective of flock size, the shepherds travel the same distance. In the second stage, the shepherds then move to Churdhar ranges and from here to Renukaji in Sirmour district. The routes of migration are generally fixed (Fig. 2) and proper permission is obtained from the authorities for the purpose. Finally, in the months of September–October, they reach the low hills in Poonhaar-Sahib in Sirmour district and temporarily settle here up to March, and start their return journey to their respective places by end March (spring season). It was also observed that the shepherds are not highly qualified and it varied from 1st class to 12th class (Fig. 3).

The present studies revealed that the livelihood of shepherd’s family is dependent either getting food and fruits from the forests/trees on the path they tramp and selling the meat and milk products from their herds. The wild plants not only serve as their food but also for their livestock. It was observed that during their migration from upper hills to lower hills a total of 78 medicinal species were being used by the migratory shepherds, and a few of these belonged to the same families. All these medicinal plants are an integral part of shepherd’s health-care during migration (Tables 2–4). The collection of various medicinal plants and plant parts varied from plant to plant, depending on their availability and usability. During their seasonal migration, the shepherds are much dependent on forest products for their requirements of fruits, vegetables, and medicines.

As the shepherds move from their respective place of origin (high hills), it was noted that 35 species (herbs, shrubs, and trees) were found to be used by the shepherds for their health care (Table 2). Interestingly, the shepherds informed that their preference for medicine is Picrorhiza kurroa (herb) as it is one of the important medicinal plants in their tribe. Similarly, in the mid-hills 20 plant species were found to be taken as medicine as the shepherds move toward Shimla hills (Table 3). Some of the medicinal plant species such as Chenopodium album, Bergenia ciliata, Cannabis sativa, Dioscorea deltoidea, Picrorhiza kurroa, and Urtica palviflora found in mid hills were also present in higher hill regions (Table 3). Three species, namely Cannabis sativa, Vitex negundo, and Zanthoxylum armatum were frequently used for medicinal purposes. The use of many of these medicinal plants has also been reported by many workers from different parts of Himachal Pradesh [20,21].

Due to variation in climatic conditions from high hills to low hills (Table 4), shepherds were commonly affected by many common diseases such as cough, asthma, cold, skin allergy, and fever. Five species from low hills, namely Adhatoda vasica, Hypericum oblongifolium, Rhododendron arboreum, and Urtica dioica were frequently used by shepherds to treat common diseases. The shepherds during migration generally move along the roadside and rarely adopt bridals pathways or shortcuts. For their own stay, they use makeshift tents and shift tents frequently within 5–6 days. There is always a scarcity of food and fodder for themselves and livestock. For this, they explore adjoining areas, particularly degraded lands, fallow fields, and village commons. It was interesting to note that their migration patterns closely mirrors the seasonal availability of natural food, fodder, and medicinal plants. In Khamchendzonga National Park, it was observed that migration movements match with seasonal fodder resource availability [22]. Shepherds during en route migration face constraints such as food, fodder, water deficit, veterinary facilities, wild animals, predators, and sometimes road accidents of their livestock. Such constraints have also been reported by many previous studies [23–26].

**DISCUSSION**

It is also emphasized that sufficient interest has not been put in conserving and promoting traditional wild medicinal plants. The need is to adopt large scale plantation of these medicinal plants within forests as well as along roadsides so that the migratory shepherds are benefitted. Unfortunately, deforestation activities and the changing climatic conditions have made the availability of medicinal plants as a scarce resource to the migratory shepherds. Plants and plant products play an important role in the lives of these migratory shepherds. The critical review of the past work done and the results of this survey suggest that wild medicinal plants are very important for migratory shepherds living in tribal areas of Himachal Pradesh. The documentation of the ethnobotanical approach is an improvement for enhancing the understanding of native knowledge systems [27–28]. The present trends for surviving healthy long life entirely dependent on the traditional medicines and it possesses several natural constituents to eliminate the critical causes of the disease [29,30]. Plants are a rich source of free radical scavenging molecules such as terpenoids, vitamins, lignins, phenolic acids, flavonoids, tannins, quinones, alkaloids, coumarins, betalains, amines, and other metabolites which are rich in antioxidant property. The antioxidants property in plant products helps in the stimulation of biological system against oxidative damage [31–33]. In the modern day world traditional ethnomedicinal plants play a significant role in the health-care system, but due to lack of interest between the younger generation and their tendency to migrate to cities for lucrative jobs, a wealth of traditional knowledge is decreasing. The need of the hour is to harness this important traditional knowledge and preserve this traditional knowledge for the benefit of future generation. The information generated from the study regarding the ethnomedicinal plants used by tribal migratory shepherds needs a through phytochemical investigation including physicochemical extraction and isolation along with few clinical trials. This could help in creating mass awareness regarding their conservation within the region.

**CONCLUSION**

In the present investigation, the traditionally using plants as medicinal value by migratory shepherds a tribal community of Western Himalaya were identified. They are using the plants for cough, cold, fever, asthma, skin allergy, bone fracture, abdominal pain, jaundice, body pain, bone fracture, malaria, wound healing, etc. in various forms such as decoction, powder, paste, and juice. The foremost important thing is to give awareness and training to tribal migratory shepherds on a critical review of the past work done and results of this survey. This valuable survey may be useful to improve the pharmaceutical and application in the future.

**ACKNOWLEDGMENT**

We are grateful to the migratory shepherds and local peoples of the study area for their cooperation in providing valuable information about
etno aspects. Thanks to experts from BSI Dehradun, Uttarakhand, and FRI Dehradun, Uttarakhand for the identification of ethnomedicinal plant specimens collected from study sites.

**AUTHORS’ CONTRIBUTIONS**

The concept, design, and questionnaire of the study were done by Radha. Fieldwork and literature study was done by Radha. Interpretation of data was prepared by Radha, Dr. Sunil Puri and Dr. Sanjeev Kumar. Revision of the article was done by Radha and Dr. Sanjeev Kumar.

**CONFLICTS OF INTEREST**

We declare that we have no conflicts of interest.

**REFERENCES**

1. Singh JP, Roy MM, Radotra S. Technical Bulletin. Jhansi: Grasslands of Himachal Pradesh. Director, Indian Grassland and Fodder Research Institute; 2009.
2. Myres N, Mitremer RA, Mitremer CG, da Fonseca GA, Ken J. Biodiversity hotspots for conservation priorities. Nature 2000;403:853-8.
3. Wildlife Institute of India. Protected Areas of Himachal Pradesh; 2014. Available from: http://www.wii.gov.in.
4. Negi KS, Gaur RD, Tiwari JK. Ethnobotanical notes on the flora of Haruki Doon (district Uttarkashi), Garwal Himalaya UP, India. Ethnobotany 1999;11:9-17.
5. Khanna KK, Ramesh K. Ethno‑medicinal plants used by Gujjar tribe of Himachal Pradesh. Indian Forester 2003;129:979-98.
6. Thakur R, Singh R, Saxena P, Mani A. Evaluation of antibacterial activity of *Prosopis juliflora* (SW.) DC. stems. Afr J Tradit Complement Altern Med 2014;11:182-8.
7. Sharma PK, Lal B. Ethnobotanical notes on medicinal and aromatic plants of Himachal Pradesh. Indian J Tradit Knowl 2005;4:424-8.
8. Rawat DS, Kharwal AD. Ethnobotanical studies of weed flora in Shivalik Hills, Himachal Pradesh, India. Int J Adv Res 2014;2:218-26.
9. Singh KN, Kumar A, Lal B, Todaria NP. Species diversity and population status of threatened plants in different landscape elements of the Rohtang Pass, Western Himalaya. J Mountain Sci 2008;5:73-83.
10. Balamurugan V, Krishnamoorthy P, Veerregowda BM, Sen A, Rajak KK, Bhanuprakash V, et al. Seroprevalence of peste des petits ruminants in cattle and buffaloes from Southern Peninsular India. Trop Anim Health Prod 2012;44:301-6.
11. Chauhan NS, Lal B. Commercially important medicinal and aromatic plants of Parvati Valley, Himachal Pradesh. J Econ Taxonomic Bot 2003;27:937-42.
12. Thakur K, Puri S. Ethnobotanical plants of bandli wildlife sanctuary, Mandi, Himachal Pradesh. Int J Adv Res 2016;4:106-8.
13. Tambe S, Rawat GS. Traditional livelihood based on sheep grazing in the Khandherdzonara national park, Sikkim. Indian J Tradit Knowl 2009;8:75-80.
14. Rao KA, Rao KS, Rao SJ, Ravi A, Anitha A. Studies on migration of sheep flocks in north coastal zone of Andhra Pradesh: Identification of traditional migration tracts. Indian J Small Rumin 2009;8:75-80.
15. Suresh A, Gupta DC, Mann JS. Trends, determinants and constraints of sheep migration in Rajasthan-an economic analysis. Agric Econ Res Rev 2011;24:235-65.
16. Kaintura S, Kumar N, Kothiyal P. Correlation of antihypertensive drugs and new onset diabetes: A review. Int J Pharm Sci 2017;8:36-40.
17. Kalaiselvan M, Gopalan R. Ethnobotanical uses of medicinal plants by irula tribes of Bolampatty valley, Nilgiri biosphere reserve (NBR), Southern Western Ghats, India. Asian J Pharm Clin Res 2014;7:22-6.
18. Ranganathan R, Vijayalakshmi R, Parameswari P. Ethnomedicinal survey of Jawadhul hills in Tamil Nadu. Asian J Pharm Clin Res 2012;5:45-9.
19. Agarwal P, Mishra A. Pharmaceutical quality audits: A review. Int J Appl Pharm 2019;11;14:22.
20. Maurya H, Kumar T. Formulation, standardization and evaluation of polyherbal dispersible tablet. Int J Pharm Pharm Sci 2019;11:158-67.
21. Ansari N, Chandel D. Antioxidant studies on methanol and aqueous extracts of *Gymnosporia montana* plant. Int J Pharm Pharm Sci 2019;11:65-70.
22. Arirudrai B, Janani B, Rao US. Evaluation of antioxidant and chemopreventive potential of methanolic extracts of leaf of *Aegle marmelos* attributes towards ductal carcinoma studied in mcf7 cells. Int J Pharm Pharm Sci 2019;11:21-5.
23. Sharma M, Biswajit D. Medicinal plants of North-East region of India: A small review. Int J Curr Pharm Res 2019;10:11-2.