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Ethnomedicinal plants used to treat skin diseases by Tharu community of district Udham Singh Nagar, Uttarakhand, India

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ABSTRACT

Ethnopharmacological relevance: Tharu community is the largest primitive indigenous community of the Uttarakhand, India. In this article we have scientifically enumerated medicinal plants and herbal preparations used by the Tharu community to treat various skin diseases, and discussed dermatological properties of these plants in the light of previous ethnomedicinal, microbiological, pharmacological, toxicological, phytochemical and clinical studies.

Materials and methods: Ethnomedicinal survey was conducted in different villages of Tharu community located in district Udham Singh Nagar, Uttarakhand, India. Ethnomedicinal information on plants used to treat various skin diseases was collected from 122 individuals (93 males and 29 females), including 35 experienced herbal practitioners and 87 local villagers. For each of the recorded plant species the use value (*UV*) and fidelity level (*FL*) was calculated. The informant consensus factor (F_{ic}) was also calculated to find out the homogeneity in the information given by the informants.

Results: A total of 90 plant species belonging to 86 genera and 48 families were used by the Tharu community to treat various skin diseases *viz*., wounds (38 spp.), boils (32 spp.), cuts (18 spp.), leprosy (11 spp.), eczema (10 spp.), itching (7 spp.), ringworm (5 spp.), burns (4 spp.), leucoderma (4 spp.), cracked heels (2 spp.), dandruff (3 spp.), body infection (2 spp.), chilblains (2 spp.), hair fall (2 spp.) and toes infection (2 spp.). Information on botanical name, family, vernacular name, ailments treated, mode and dose of herbal preparations, *UV* and *FL* values are provided for each of the recorded species. According to *UV* value most preferred plant species used to treat skin diseases by Tharu community was *Ricinus communis* L. followed by *Tridax procumbens* (L.) L., *Azadirachta indica* A. Juss., *Ageratum conyzoides* and *Allium cepa* L.

Conclusions: The present study has revealed significant information on various medicinal plants used to treat skin diseases by Tharu community. Literature review has confirmed most of the claims made by the Tharu community regarding treatment of various skin diseases by the reported plants. The literature review has also revealed that products from very few of the reported plants are available in market, while most of the reported plants are still under preclinical or clinical trials. There are various known phytochemicals, and antibiotic, antibacterial, antiviral and antifungal agents present in these plants

Abbreviations: AAPE, arachidonic acid (AA) induced paw edema model; ABTS, 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) assay; AIA, anti-inflammatory activity; AOTS, acute oral toxicity study; APE, adjuvant induced paw edema model; BKPE, Bradykinin induced paw edema model; BWM, burn wound model; C, cultivated; CAP, carrageenan air pouch model; CFAA, complete Freund's adjuvant (CFA) induced arthritis model; CHG, chlorhexidine gluconate; CIP, carrageenan induced peritonitis model; CODE, croton oil induced dermatitis of the mouse ear model; CPE, carrageenan induced paw edema model; CPG, cotton pellet granuloma model; CTS, chronic toxicity study; DPE, dextran induced paw edema model; DPPH, 2,2-diphenyl-1-picrylhydrazyl assay; DSW, dead space wound model; DXM, dexamethasone; EWM, excision wound model; F_{ic}, consensus factor; FL, Fidelity level; FoPE, formaldehyde induced paw edema model; FPE, formaline induced paw edema model; FRA, framycetin; FRAP, ferric reducing antioxidant powder assay; FSC, framycetine sulfate cream; H, herb; HPE, histamine induced paw edema model; HRBC, human blood cell membrane stabilization method; HTPE, 5-hydroxytryptamine induced paw edema model; IPE, immunologically induced paw edema model; IWM, incision wound model; KPE, kaolin induced paw edema model; LPE, leukotriene induced paw edema model; NA, not available; NEO, neosporin; NFZ, nitrofurazone; NPE, nystatin induced paw edema model; NT/NM, non-toxic/no mortality; PAPE, phlogistic agents induced paw edema model; PGNIN, peptidoglycan (PGN) induced inflammatory reaction; PGPE, prostaglandin E2 induced paw edema model; PIW, punch incision wound model; PPCIN, polyinosinic: polycytidylic acid (polyI:C) induced inflammatory reaction; PVI, povidone iodine ointment; RP, reducing power; S, shrub; SATS, sub acute toxicity study; SOF, soframycin; SPE, serotonin induced paw edema model; SSD, silver sulphadiazine; ST, sulphathiazole; TAC, total antioxidant capacity; TC, number of times cited in the reviewed literature to treat any skin disease in India; TPAPE, tetradecanoylphorbol acetate (TPA) induced paw edema model; Tr, tree; *UV*, use value; W & C, both wild as well as cultivated; W, wild; XEE, xylene induced ear edema model; ZNO, zinc oxide

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which may be synthesized or transformed to make pharmaceuticals. Some of the reported plants have shown promising results in preclinical trails and there is a need of clinical trials to see their safety and efficacy in treating various skin diseases. These plants may be targeted for development of new medicines, ointments or drugs for the treatment of skin diseases. However further toxicological, preclinical and clinical studies are needed to validate claims about little worked out plant species reported in the present study *viz*., *Sida cordata* (Burm. F.) Borss. Waalk., *Millettia extensa* (Benth.) Baker, *Caesulia axillaris* Roxb., *Ehretia laevis* Roxb., *Vanda tessellate* (Roxb.) Hook. Ex G.Don. and *Eualaliopsis binata* (Retz.) C.E. Hubb. Further studies on these plants are recommended to assess their potential in development of new skin care products.

1. Introduction

The human skin is the outer covering of the body that provides contact with the environment and protects human body from unfavorable external factors. According to Grice et al. (2009), "Human skin is a large, heterogenous organ that protects the body from pathogens while sustaining microorganisms that influence human health". Skin ailments affect people of all sex and ages, right from the neonate to the elderly stage, causing harm to human health in number of ways. It has been estimated that skin diseases amount to as high as 34% of all occupational diseases (Spiewak, 2000; Abbasi et al., 2010a). It is supposed to be the most common ailment amongst rural population (Policepatel and Manikrao, 2013). Skin diseases or infectious dermatological conditions are common in tropical countries where most of the population live in underdeveloped areas with lack of sanitation and inattentiveness to hygienic food habits. Skin diseases such as ringworm, itching, wound, skin disorders, leprosy, dermatitis, skin allergy, eczema, psoriasis, scabies and swelling are caused by a variety of micro-organisms and uncomfortable environment (Suresh et al., 2012). Traditional herbal medicines have played an important role in the management of dermatological conditions (Saikia et al., 2006). Hundreds of medicinal plants worldwide are used in the traditional medicine for treatment of skin diseases caused by bacteria, fungi and viruses (Kumar and Vidyasagar, 2008).

Uttarakhand Himalaya is a rich reservoir of biodiversity including enormous plants species and wildlife. It is a house to many indigenous communities like Bhotias, Boxas, Gujjars, Tharus, Rajis and Jaunsaries, who have excellent traditional knowledge on medicinal plants used to treat various human health problems. Apart from these, many other forest dwelling communities and local people also possess unique knowledge on uses of medicinal plants available in the region. Several researchers have documented ethnomedicinal plants used for treating various human health related ailments by different indigenous communities in sub-Himalayan region of Uttarakhand (Gaur, 1999; Gaur et al., 2010; Gaur and Sharma, 2011; Sharma and Painuli, 2011; J. Sharma et al., 2012; Sharma et al., 2013a, 2013b; Gairola et al., 2013). Although, Tharu community is the largest primitive indigenous community of the Uttarakhand, but very little information is available about ethnomedicinal plants used by this community. Recently J. Sharma et al. (2011, 2012) and Sharma et al. (2013b) have recorded some ethnomedicinal information on plants used by Tharu community to treat some general diseases, jaundice and epilepsy, respectively. But information about plants used to treat various skin diseases by Tharu community of Udham Singh Nagar is almost lacking except some preliminary information recorded by J. Sharma et al. (2011) about plants used to treat wounds (10 plants) and cuts (2 plants). Therefore, it was realised that the documentation of ethnomedicinal knowledge of this community is required. Keeping the aforesaid facts in view, the present study was undertaken to scientifically enumerate medicinal plants and herbal preparations used by Tharu community to treat various skin diseases, and discuss dermatological properties of these plants in the light of previous ethnomedicinal, microbiological, pharmacological, toxicological, phytochemical and clinical studies.

2. Research strategy and methods

2.1. Study area

The Uttarakhand state is situated in the northern part of India between 28°43′ and 31°28′N latitude and 77°34′ and 81°03′E longitude, and shares an international boundary with Tibet Autonomous Region in the north and Nepal in the east (Fig. 1). It embodies mountainous terrain ranging from 300 to 7800 m asl and has a geographic area of 53,483 km^2, which is even bigger in size than nearby Himalayan country of Bhutan. The state has very rich biological wealth and cultural heritage, and because of its unique geography and diverse climatic conditions it possesses the large number of medicinal plant species. Majority of the land area in Uttarakhand is mountainous (93%) and 64.79% area is covered by the forests (FSI, 2011). The present study was conducted in different villages inhabited by Tharu community in district Udham Singh Nagar of Uttarakhand, popularly known as the "Gateway to Kumaon hills". There are three main sub-divisions of Udham Singh Nagar – Rudrapur, Kashipur and Khatima. The district consists of seven tehsils *viz*., Bajpur, Gadarpur, Jaspur, Kashipur, Kichha, Khatima and Sitarganj. District is located in the Terai region and is endowed with a very rich fertile land. Agriculture is the mainstay and there are several agriculture related activities and industries located here. It is surrounded by Nainital district in the north, Bijnour, Moradabad and Rampur in the west, Bareilly and Pilibhit in the south and district Champawat in the east. It also shares south east boundary with the international border of the Nepal. Reserved forest area lies at the borders of district Nainital and Champawat. The villages visited in district Udham Singh Nagar to collect ethnomedicinal information were Bawanpuri, Beeriya, Bhagora, Bhagori, Bharuni, Bidora–Majola, Chamarpur, Chaumela, Dhohra–Pajaniya, Enjania, Gaganpur, Gaurikheda, Ghosari, Harriaya, Karkata, Kharoona, Khujri, Kicha, Lamkhera, Lauka, Magarsanda, Malara, Nadai, Nakulia–Bithora, Paseni, Sadhunagar, Sehjani, Sisalkhera, Sisoona, Sitargang, Taumala, Tisoor and Tukari–Bichua.

2.2. Studied community and ethnomedicinal survey

Frequent field trips were undertaken in different seasons *viz*., winter (November–March), summer (April–June) and rainy (July–October) in order to collect information on ethnomedicinal plants used to treat various skin diseases by Tharu community. Tharu community is the largest primitive indigenous community of the Uttarakhand, who lives in interior forests sustaining a close association with their ambient environment. They are shy and relatively timid people due to lack of exposure outside their community. Tharus have Mongoloid facial features and a unique