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Review article

A systematic review of medicinal plants used to treat dermatological conditions

Vaibhav Agarwal[1], Ashutosh Badola[1]* and Subhash Chandra[2]

[1]*Department of Pharmaceutics, School of Pharmaceutical Sciences, SGRR University, Patel Nagar-248001, Dehradun, Uttarakhand, India*
[2]*Department of Pharmaceutical Chemistry, SGRR University Patel Nagar-248001, Dehradun, Uttarakhand, India*

*Corresponding authors. E-mail: ashutoshbadolampharma@gmail.com

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ABSTRACT

Medicinal plants play a crucial role in primary healthcare in numerous developing nations, primarily due to limited modern infrastructure, healthcare resources, traditional acceptance, pharmaceutical drug availability, and the effectiveness of these plants in addressing diseases that may not be effectively treated with modern therapies. This analysis delves into the phytochemistry, ethnomedical applications, pharmacological characteristics, and bioavailability of *Berberis aquifolium*, *Curcuma longa*, *Echinacea angustifolia*, and *Thuja occidentalis*, particularly in the context of treating dermatological issues. The research also investigates the potential of these compounds in the pharmaceutical industry, incorporating insights from clinical and toxicological studies. A comprehensive review of scientific literature led to the conclusion that these plants exhibit significant anticancer, anti-diabetic, anti-HIV, anti-inflammatory, analgesic, wound healing, and antimicrobial properties, making them safe for application on human skin.

INTRODUCTION

Over 80% of the world's population still heavily relies on traditional medicines for treating various skin diseases. Worldwide, traditional medicines play a crucial role in healthcare, offering a rich source of potent drugs found in medicinal plants. A diverse array of natural products, including plants, animals, microbes, and minerals, is utilized in the treatment of both human and animal diseases (Chandra and Saklani, 2016). The widespread use of medicinal plants for treating skin diseases and harnessing their antimicrobial properties is well-established (Pandey et al., 2014). Plants contain primary and secondary metabolites, each serving various therapeutic functions. These metabolites act as pressures and deterrents, collectively referred to as plant herbal products (Chandra et al., 2022).

Dermatological disorders range from common skin rashes to severe infections, resulting from factors such as infections, heat, allergens, systemic disorders, and medications. Eczema, psoriasis, acne, and rosacea are among the most common skin disorders. In comparison to creams and ointments, the topical application of gels at pathological sites offers significant advantages in terms of faster drug release (Avinash et al., 2016).

The review conducted so far has examined the dermatological activity of numerous plants and plant-based compounds. Certain plants and their compounds have demonstrated high effectiveness against one or more types of skin disorders, impacting both males and females. Based on their activities, the following plants have been chosen for in vitro assessments of their extracts and other dosage forms for dermatological activities.

MATERIAL AND METHODS

The literature data were gathered from Core Collection, Scopus, Web of Science, PubMed, Google Scholar, MDPI, Science Direct, Google Academic, Clarivate Analytical, and Scientific Electronic Library Online (SciELO) for the period 1990-2022. The search utilized the following keywords: traditional uses, medicinal plants, phytochemistry, and pharmacological activity. These articles were evaluated for their diverse pharmacological activities, substantiated by scientific evidence.

MEDICINAL PLANTS USED TO TREAT DERMATOLOGICAL CONDITIONS

Berberis aquifolium

Berberis aquifolium, commonly known as Oregon grape, is also a significant medicinal plant belonging to the *Berberis genus. B. aquifolium* (Berberidaceae) is an evergreen shrub that grows 1-3 m (Landscape Plants, 2020) (Fig. 1a). It is rich in Vitamin C. Owing to the presence of neurotoxic compounds and dense clusters of yellow flowers in early spring, followed by dark bluish-black berries (Stermitz et al., 2000).

Curcuma longa

Curcuma longa (turmeric, haldi) (Fig. 1b) belongs to the ginger family Zingiberaceae and exhibits a wide range of pharmacological effects, including anti-HIV, antiseptic, anti-inflammatory, antibacterial, antioxidant, anti-fungal, antiviral, antitumor, and antimicrobial activities (Prasad et al., 2011). The primary constituent of *C. longa*, curcumin, is responsible for these beneficial activities. Curcumin demonstrates anticancer, anti-hypertensive, antidiabetic, and anti-inflammatory properties (Nelson et al., 2017; Joshi et al., 2022a, 2022b).

Cyclooxygenase (COX-2) plays a vital role in the initiation of colon cancer. When HT-29 colon cancer cells were treated with different concentrations of curcumin, there was a decrease in the expression of COX-2. Curcumin contributes to the prevention of colon cancer, and breast cancer cell lines (MCF-7) were assessed through SRB and MTT assays for cytotoxicity and cell viability, respectively. The results showed augmented caspase 3/9 activity and initiation of apoptosis, indicating the downregulation of miR-21 and the expression of miR-21 in MCF-7 cells by upregulation of the PTEN/Akt signaling pathway (Joshi et al., 2023; Chandra et al., 2023).

Echinacea angustifolia

Echinacea angustifolia (Fig. 1c) is a perennial herb with spindle-shaped taproots and moderate to dense hairiness (Flora of North America, 1836). The medicinal properties of *E. angustifolia* are also utilized in veterinary practice. Echinacoside, the main root metabolite and a weak antibiotic substance, serves as a marker constituent for both *E. angustifolia* and *E. pallid* (O'Neil et al., 2008).

Fig. 1. Morphological features of Indian *Berberis aquifolium* (a), *Curcuma longa* (b), *Echinacea angustifolia* (c) and *Thuja occidentalis* (d).

Thuja occidentalis

Thuja occidentalis, commonly known as northern white cedar, eastern white cedar, or arborvitae (Fig. 1d), is an evergreen coniferous tree in the cypress family Cupressaceae, native to eastern Canada and much of the north-central and northeastern United States. It is extensively cultivated as an ornamental plant and is rich in

Vitamin C. However, due to the presence of the neurotoxic compound thujone, its internal use can be harmful if continued for prolonged periods or during pregnancy. Commercially, it finds use in rustic fencing, posts, lumber, poles, shingles, and in the construction of log cabins (William, 1990). It is the preferred wood for structural elements like the ribs and planking of birchbark canoes and the planking of wooden canoes. The essential oil within the plant has been employed in cleansers, disinfectants, hair preparations, insecticides, linings, room sprays, and soft soaps. Some have utilized the twigs to make teas for relieving constipation and headaches (USDA/NRCS Plant Guide, 2008). In the 19th century, *T. occidentalis* extract was commonly used as an externally applied tincture or ointment for treating warts, ringworm, and thrush (Hoffmann, 2003).

PHARMACOLOGICAL APPLICATIONS

The treatment of health problems involves a broad spectrum of pharmacological applications derived from plants. Various plant metabolites, both primary and secondary, play a crucial role in addressing these conditions. Within the vast realm of plants, encompassing species such as *Berberis*, *Curcuma*, *Echinacea*, and *Thuja*, a diverse array of phytoconstituents is present. These include carbohydrates, alkaloids, flavonoids, terpenoids, phenols, glycosides, steroids, tannins like ellagitannins and hydrolyzable, and more. The pharmacological applications of these plants and their respective common names are summarized in Table 1. Furthermore, different parts of plants are utilized to isolate or extract various compounds, each possessing distinct activities.

Table 1. Pharmacological applications of *B. aquifolium, C. longa, E. angustifolia,* and *T. occidentalis*

Plant Name	Common Name	Family	Part used	Pharmacological activity	References
Berberis aquifolium	Oregon grape	Berberidaceae	Roots	Anti-tussive activity	Kardosova et al., 2004
				Anti-oxidant activity	Rackova et al., 2004
				Anti-psoriasis activity	Wiesenauer and Lüdtke, 1996)
				Anti-mutagenicity activity	Cernáková et al., 2002
				Antifungal activity	Vollekova et al., 2003
				Antibacterial activity	Cernáková and Kostálová, 2002
Curcuma longa	Haldi	Zingiberaceae	Rhizomes	Gastrointestinal disorders	Dhiman, 2004
				Respiratory disorders:	Mali and Dhake, 2011
				Inflammatory disorders	Jacob et al., 2007
				Hepatoprotective activity	Pandey, 2002
				Antidiabetic activity	Acharya, 1994; Arun and Nalini, 2002
				Neuroprotective activity	Dohare et al., 2008
				Alzheimer's disease	Rao et al., 2012
				Cardiovascular disorders	Cox et al., 2022
				Chemoprotective activity	Park and Conteas, 2010
				Anti-cancer activity	Huang and Jan, 1992
				Anti-allergic activity	Yun-Ho et al., 2010
				Anti-dermatophytic activity	Binic et al., 2013
				Prevents drug resistance	Xu et al., 2011
				Antioxidant activity	Unnikrishnan and Rao, 1995
				Anti-HIV activity	Vlietinck et al., 1998
				Anti-bacterial, anti-fungal and antiprotozoal activity	Khattaka et al., 2005; Oghenejobo et al., 2022
				Anti-fibrinogen activity	Kang et al., 2002
				Wound healing activity	Sidhu et al., 1998
				Anti-mutagenic potential	Li et al., 1998
				Lipid-lowering activity	Asai and Miyasawa, 2001
				Immunomodulatory activity	South et al., 1997
				Radio-protective activity	Cheng et al., 2001
				Antiviral activity	Dony and Wei-Li, 2018
Echinacea angustifolia	Black Sampson	Asteraceae	Roots	Immunomodulatory activity	Barrett, 2003; Wüstenberg et al., 1999
				Antiviral activity	Bodinet and Beuscher, 1991; Binns et al., 2002
				Antibacterial activities	Merali et al., 2003
				Anti-inflammatory activity	Cai et al., 2014; Speroni et al., 2002; Raso et al., 2002
				Wound-healing properties	Facino et al., 1995
				Antitumor activity	Voaden and Jacobson, 1972

				Upper respiratory tract infection	Taylor et al., 2003
				Antidiabetic activity	Shah and Khan, 2014
				Antioxidant activity	Rivero-Perez et al., 2007; Amarowicz et al., 2004
				Anti-proliferative activity	Skehan et al., 1990
Thuja occidentalis	Northern white cedar	Cupressaceae	Leaves	HIV-1 activity	Gohla et al., 1992
				Spleen cell proliferation	Bodinet, 1999
				Cytokine induction	Bodinet and Freudenstein, 1999
				Antibody production	Bodinet et al., 2002
				NO production	Rakotonirainy and Lavédrine, 2005
				Leukocyte counts	Asha et al., 2014
				Influenza virus type A	Leopolsdini et al., 2011
				Antipyretic activity	Silva et al., 2017
				Antiviral activity	Jahan et al., 2010; Hassan et al., 1996
				Antioxidant activity	Tegtmeier and Harnischfeger, 1994
				Anti-inflammatory activity	Stan et al., 2019
				Anticancer activity	Biswas et al., 2011
				Antioxidant activity	Dubey and Batra, 2009a
				Anticancer activity	Torres et al., 2016
				Antidiabetic activity	Dubey and Batra, 2008a
				Antipyretic activity	Aziz et al., 2014
				Hepatoprotective activity	Dubey and Batra, 2008b
				Atherosclerotic activity	Dubey and Batra, 2009b

CONCLUSIONS

The current study aimed to compile an inventory of plants reported for dermatological disorders used throughout India and to provide evidence supporting their utilization in various skin diseases. For this review, bibliographic investigations were conducted from April 2000 to February 2022, involving the analysis of classical textbooks and peer-reviewed papers. This included consulting globally accepted scientific databases spanning the last six decades. Peer-reviewed articles were collected by consulting databases such as Inflibnet, Niscair, Scopus, Scielo, PubMed, and Google Scholar. Only relevant studies published in English were considered.

Botanically correct names were cited after verification from published literature and databases (International Plant Names Index, 2008; USDA-NRCS, 2011; SIGB, 2011). These medicinal plants are likely to play a vital role in human health and longevity, addressing dermatological disorders and contributing to overall body maintenance and wellness. The most potent phytochemicals, including vitamins, phenolic compounds, carotenoids, flavonoids, carbohydrates, and anthocyanins, are well-known for their health benefits. They exhibit potent medicinal properties, such as antioxidant, antimicrobial, antidiabetic, analgesic, anticancer, anti-inflammatory, hepatoprotective, neuro-protective, and antianxiety effects.

AUTHORS' CONTRIBUTIONS

Vaibhav Agarwal, Ashutosh Badola and Subhash Chandra outlined the review. VA Drafted the manuscript. VA, SC and AB edited and reviewed the article.

CONFLICTS OF INTEREST

The author(s) declare(s) no conflicts of interest.

DECLARATION

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