The Biobrio ISSN : 2393-9508 e-ISSN: 2582-4902
An International Quarterly Journal of Life Sciences
Website: www.thebiobrio.in SJIF:8.259
12(3&4): 1397-1403, 2025

Some common medicinal plants used in protecting skin from Sun damage in district Ranchi, Jharkhand, India

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Received : 30th August, 2025 ; Accepted : 27th September, 2025
DOI:- https://doi.org/10.5281/zenodo.17579216

ABSTRACT

The current discussion relates to the rise of UV radiation reaching the Earth as a result of ozone layer depletion. Such dangerous UV rays cause several skin issues, including tanning, sunburn, redness or irritation, inflammation, hyperpigmentation (melasma), dryness, premature aging, and even skin cancer. Medicinal plants possess remarkable abilities to treat nearly all types of skin ailments known to humans for centuries. In this study, we documented several commonly used medicinal plants for healing sun-damaged skin within the region. The data was gathered from villages located across six adjoining blocks of Ranchi district. The surveyed villages were from the blocks- Nagri, Angara, Ormanjhi, Kanke, Bundu, and Mandar-yielded records of ten widely used medicinal plants, representing nine botanical families and ten distinct genera. These include *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., *Mallotus philippensis* (Lam.) Müll. Arg., *Mentha arvensis* L., and *Ocimum basilicum* L.

Key Words - Sun damage, Sunscreen, Medicinal plants, Skin problems, Traditional knowledge

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INTRODUCTION

The depletion of the ozone layer has led to a noticeable rise in global ultraviolet (UV) radiation levels, which has emerged as a serious environmental concern. This thinning of the stratospheric layer is primarily caused by the accumulation of ozone-depleting substances such as halocarbons, including CFCs and HCFCs-released into the atmosphere through human activities. There are various harmful skin health problems associated with prolong and/or high dose exposure to ultraviolet radiation. Some of the common skin problems include dryness of skin, tanning, sunburn, redness or itchiness, inflammation, hyper pigmentation, premature wrinkling and skin cancer. Tanning and sunburn occur due to excessive accumulation of melanin, a skin pigment, in response to long and repeated sun exposure to reduce the amount of UV rays penetrating the skin. (https://www.medicinenet. com/sunburn_and _sun_poisoning/article.htm#7 _tips_to_prevent_a _sunburn_and_skin_cancer). Prolonged exposure to ultraviolet (UV) radiation harms the skin's elastin fibers, causing them to weaken and break down. This leads to sagging, stretching, and the early appearance of wrinkles. UV radiation also triggers oxidative stress, resulting in the generation of free radicals. These unstable molecules steal electrons from surrounding molecules, destabilizing them and initiating a chain reaction of free radical formation. Such processes inflict damage on cellular structures, proteins, and DNA (Lobo *et al.*, 2010). A

wide range of chemical-based sunscreens is used globally for protection against harmful sun exposure. Most commercially available formulations contain active ingredients such as zinc oxide, titanium dioxide, avobenzone, octisalate, octocrylene, padimate O, and octyl methoxycinnamate. While these products act quickly to block or absorb ultraviolet radiation, prolonged use may pose potential risks to skin health. For instance, elevated levels of benzophenone 3 in women have been linked to a higher likelihood of delivering underweight female infants, and continuous application of zinc oxide or titanium dioxide can promote light-induced free radical generation, which may further damage healthy cells (Wolff *et al.*, 2008).

Several photoallergic compounds are commonly incorporated into sunscreen formulations, including para aminobenzoic acid (PABA), oxybenzone, cyclohexanol, benzophenones, salicylates, and cinnamates. In addition, certain chemotherapeutic agents used in the treatment of skin cancer such as 5 fluorouracil, vinblastine, and dacarbazine are photosensitizing drugs that can trigger severe skin reactions upon exposure to sunlight (https:// www.medicinenet.com/sun-sensitive_ drugs_photosensitivity_to_drugs/ article.htm#sun-sensitizing_drugs_photo sensitivity_definition_ and_facts). Furthermore, some moisturizing creams and lotions, particularly those containing benzocaine, may also harbor skin sensitizing chemicals capable of provoking allergic responses (https:// www.medicinenet.com/sunburn_and_sun_poisoning/article.htm #7_tips_to_ prevent_a_sunburn_and_skin_cancer). Since ancient times, various herbs have been traditionally employed by indigenous communities to protect the skin from sunburn (Korac and Khambholja, 2011). These herbal remedies are administered either topically or orally. The photoprotective effect of plant extracts applied to the skin primarily arises from their ability to reflect, scatter, and absorb ultraviolet (UV) radiation (D'Orazio *et al*., 2013). Many plants also exhibit strong antioxidant activity, which, when consumed orally, aids in neutralizing free radicals. Naturally occurring compounds such as anthocyanins, proanthocyanidins, carotenoids, vitamins E and C, resveratrol (*Vitis vinifera* L.), safranal (Crocus sativus L.), boldine (*Peumus boldus* Molina), quercetin (*Vitis vinifera* L.), piperine (*Piper longum* L.), apigenin (*Matricaria chamomilla* L.), silymarin (*Silybum marianum* (L.) Gaertn.), curcumin (*Curcuma longa* L.), 4-nerolidylcatechol (*Pothomorphe umbellata* (L.) Miq.), wheat germ oil (*Triticum aestivum* L.), and pumpkin seed oil (*Cucurbita maxima* Duchesne ex. Lam.) have been reported to possess both photoprotective and antioxidant properties (Röpke *et al.*, 2003; Golmohammadzadeh *et al*., 2010; Korac and Khambholja, 2011; Saewan and Jimtaisong, 2013; Georgiev *et al.*, 2014; Choochana *et al.*, 2015).

Jharkhand is endowed with remarkable floral diversity, encompassing numerous medicinal plant species that are effective in treating a wide spectrum of ailments. Although extensive ethnobotanical surveys and research have documented the medicinal applications of many plant species for various health conditions across the state (Jain & Tarafder, 1970; Sharma *et al.*, 2003; Mahto *et al.*, 2007; Kumar, 2009; Ashutosh *et al.*, 2010; Kaushal & Abbas, 2012; Prasad *et al.*, 2012; Anamika & Kamini, 2016), there is comparatively limited information regarding their potential in sunscreen or photoprotective applications. Traditional knowledge of medicinal plants with photoprotective properties is now rare, being preserved only by a small number of elderly individuals. Younger generations are increasingly inclined towards chemical-based solutions, leading to a gradual erosion of this valuable herbal heritage.

The present study seeks to revive and preserve the diminishing traditional knowledge of herbal plants valued for their ability to mitigate the harmful effects of sun exposure on the skin. Fieldwork was conducted in the vicinity of villages surrounding the University Campus, DSPMU, Ranchi. The primary objective was to document the traditional uses of selected common medicinal plants with respect to

photoprotection. The collected data highlight several locally available species traditionally employed in treating various skin ailments resulting from prolonged exposure to sunlight. Ten such plants were identified, each known for one or more beneficial properties, including cooling, sun-blocking, anti-inflammatory, anti-carcinogenic, and/or cell-repairing effects on sun-exposed and damaged skin. Notably, some of these species also possess anti-cancer properties.

MATERIALS & METHODS

Study Area

The present ethnobotanical study was carried out in some villages (Barsa, Basila, Gutuwa, Asri, Dimra, Jidu, Ichadag, Parsatoli, Hochar, Kokdaro, Arradih, Amjora, Masmano, Sakarpara) in South Chotanagpur division, Ranchi District central Jharkhand. Following are the geographical features: coordinate is ~23°N latitude, 85°E longitude, Elevation: ~413 meters (1355 feet) above sea level, Area: ~5,097 km². Terrain is undulating plateau with forested hills and seasonal rivers and is part of the Chotanagpur Plateau. In short climate type is humid subtropical with dry winters (Köppen Cwa), average annual temperature: ~27.2°C (81°F), warmest month: May (~38.7°C / 101.7°F) and coldest month: January (~14.6°C / 58.3°F).

Methodology

An extensive and intensive field survey was undertaken in the study area to document ethnotaxonomical plant species valued for their photoprotective properties. Information was gathered through personal interviews with local residents, particularly traditional healers (Vaidhyas), elderly men and women, and shepherds. From each village, 8–10 elderly individuals possessing traditional knowledge were consulted to ensure accurate and comprehensive data collection. The compiled information was then cross verified and supplemented using relevant published literature.

RESULTS

Based on the collected data, ten medicinal plant species were identified, representing nine botanical families- Asphodelaceae, Asteraceae, Brassicaceae, Cannabaceae, Cucurbitaceae, Euphorbiaceae, Lamiaceae, Rutaceae, and Solanaceae and ten distinct genera of angiosperms. These species have been traditionally employed for generations in the treatment of skin ailments associated with sun damage. Detailed information on each plant, including its botanical and vernacular names, morphological characteristics, plant part(s) utilized, and specific medicinal applications in photoprotection, is presented below

a) *Aloe barbadensis* Mill.

Vernacular name: Ghrit-kumari, Kwar Patha, Family: Asphodelaceae

Botanical description: 60-100 cm tall, very short-stemmed plant, succulent leaves with serrated margin, flowers are produced on a spike upto 90 cm tall, each flower being pendulous, with yellow tubular corolla 2-3 cm; forms arbuscular mycorrhiza; fruit loculicidal capsule.

Plant part used: Pulp of leaf

Ethnomedicinal uses: Pulp of leaf applied on sun-burns; daily as a sunscreen; good for the dryness of skin and preventing premature wrinkling, relieves skin rashes, pain and discomfort of excessive sun exposure.

b) *Artemesia nilagirica* (C.B. Clarke) Pamp.

Vernacular name: Nagdona, Davana, Damanak, Family: Asteraceae

Botanical description: Perennial, much branched herbs or under-shrubs, 1-2.5 m high, hairy-pubescent; stem ribbed, pubescent. Leaves ovate-elliptic, lobed or incised, densely tomentose. Heads discoid, 2-3 mm across, in leafy, panicle-racemes. Involucre bracts small, seriate. Florets tubular, bisexual, brownish-yellow, corolla 3 or 5-toothed. Achenes minute, glabrous.

Plant part used: Leaves, young twigs

Ethno medicinal uses: Leaf paste or volatile oil is applied for cooling effect; applied for dryness, itchiness and redness of the skin; have anti-inflammatory properties.

c)*Brassica campestris* L.

Vernacular name: Sarson Family: Brassicaceae

Botanical description: Annual herb upto 1m tall. Leaves cauline and ramal, simple, alternate, sessile, glabrous, upper leaves entire, lower leaves lyrate, exstipulate, unicostate reticulate venation; Inflorescence racemose. Flower pedicellate, hermaphrodite, actinomorphic, yellow, hypogynous. Ovary bicarpellary, syncarpous, septate longitudinally by a replum; fruit siliqua.

Plant part used: Seeds, leaves

Ethnomedicinal uses: Seed oil mixed with little amount of turmeric powder is applied externally on the sunburnt skin, and skin inflammation. It can be applied daily on the exposed skin for sunscreening. Leaves used in cooking provide a good antioxidant source. It helps in preventing premature ageing and skin cancer. The seeds (powdered) have anti-cancerous property.

d) *Cannabis sativa* L.

Vernacular name: Bhaang, Ganja Family: Cannabaceae

Botanical description: Annual-perennial, aromatic herbs or under-shrubs, to 2.5 m high. Leaves palmately 3-7 foliate or partite. Plant dioecious. Male flower in lax terminal panicled-cyme. stamens 5. Female flowers solitary or clustered, axillary, sessile, forming leafy spikes. Fruit achene, with persistent perianth. Seeds globose or ovoid.

Plant part used: Seeds

Ethnomedicinal uses: Seed oil is applied externally as a sunscreen, protecting from tanning and sun-burn; can also be used for hyperpigmentation.

e) *Citrus medica* L.

Vernacular name: Bada nimbu Family: Rutaceae

Botanical description: An evergreen tree, 3-6 m tall, with sharp thorns on twigs; leaves elliptic or ovate, alternate, oblong, toothed, with winged petiole; fragrant. Flower solitary or in cluster, complete; fruit is a hesperidium, yellow in colour, oil glands present all over the surface; seeds pointed, smooth, elliptic or ovate, 9-10 mm long.

Plant part used: Fruit

Ethnomedicinal uses: Fruit juice is applied on the sun tanned skin (gives fast effect), drinking lemon juice prevents premature ageing, repairs dry skin, high anti-oxidant property helps in preventing skin cancer to occur; also used to treat dark spots or sun- spots.

f) *Cucumis sativus* L.

Vernacular name: Khira Family: Cucurbitaceae

Botanical description: Annual, scabrous, climbing herbs. Stem slender, sulcate, pubescent. Leaves broadly ovate or orbicular, palmately, 5-lobed; margins dentate, both surfaces hispid. Flowers yellow, unisexual, monoecious, mostly solitary axillary. Calyx tube adnate to ovary. Fruit elongate, berry.

Plant part used: Fruit

Ethnomedicinal uses: Acts as a natural sunscreen. Juice is applied externally for faster cooling effect on sun-tans and sunburnt skin; prevents premature wrinkling of the skin, reduces dryness, redness and inflammation; lightens dark spots.

g) *Lycopersicon esculentum* Mill.

Vernacular name: Tamatar Family: Solanaceae

Botanical description: Annual, erect or decumbent ascending herbs; stem somewhat angular or cylindrical, covered with glandular hairs. Leaves 1-2 pin- natifid or partite, varied in shape and size; segments ovate-lanceolate, irregularly dentate, glandular - hairy on both sides. Flowers yellow, in 1-several flowered cymes. Fruits red, smooth, sometimes grooved, varies in shape and size, with green persistent calyx at the base.

Plant part used: Fruit

Ethnomedicinal uses: A natural sunscreen, removes tanning, hyperpigmentation and brightens skin (fruit juice alone is applied or with curd/honey); rich antioxidant property (eaten raw) helps in cell repairing preventing premature ageing and cancer.

h) *Mallotus philippensis* (Lam.) Müll Arg.

Vernacular name: Raini, Rohini, Sindhuri, Family: Euphorbiaceae

Botanical description: Evergreen trees upto 12m high. Leaves alternate, ovate or ovate-oblong to lan- ceolate, acuminate, entire or serrate, red gland-dotted beneath; petioles rusty pubescent. Flowers yellowish, unisexual; clusters of male in terminal panicled racemes; female flowers solitary. Perianth 3 – lobed. Stamens 15-25. Capsules 3-lobed, 6-12 mm across, covered with crimson powder when ripe; seeds globose, smooth, black.

Plant part used: Leaves

Ethnomedicinal uses: Gives cooling relief to the sun damaged skin; reduces inflammation; prevents premature ageing and promotes cell repairing; have anti-cancerous property.

i) *Mentha arvensis* L.

Vernacular name: Pudina Family: Lamiaceae

Botanical description: Perennial, erect or prostrate ascending herbs, to 90 cm high. Leaves ovate to lanceolate, toothed. Flowers white-lilac, in many, dense and distant whorls, forming slender, leafy inflorescence. Calyx almost equally 5-lobed. Corolla about 8 mm long, hairy outside, slightly larger than calyx; 4-lobed, equal. Stamens 4, usually exserted. Fruit nutlets.

Plant part used: Leaves, top shoot

Ethnomedicinal uses: Leaf extract or essential oil is applied externally on the inflamed and sunburnt skin for cooling relief.

j) *Ocimum sanctum* L.

Vernacular name: Tulsi Family: Lamiaceae

Botanical description: Perennial herb, aromatic, stem quadrangular, leaves opposite or whorled; Inflorescence verticillaster, flower zygomorphic, purple, hermaphrodite; corolla bilipped; stamens 4, didynamous, or 2; ovary 2-4 celled, gynobasic style; fruit schizocarpic, a group of 4 nut-lets each with one seed.

Plant part used: Leaves, flowers

Ethnomedicinal uses: Leaf paste applied on the sun- burned skin for cooling and healing purposes; essential oil can be applied on reddened, itchy and or inflamed skin; also known to have good anti-cancerous potential.

DISCUSSION

The present investigation has revealed lesser-known applications of several locally available medicinal plants in photoprotection. Documented species include *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., *Mallotus philippensis* (Lam.) Müll. Arg., *Mentha arvensis* L., and *Ocimum basilicum* L. Among these, *Aloe barbadensis* Mill., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., and *Lycopersicon esculentum* Mill. function as natural sunscreens, aiding in the treatment of sun tanned and sunburned skin. Additionally, *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Cucumis sativus* L., *Mallotus philippensis* (Lam.) Müll. Arg., *Mentha arvensis* L., and *Ocimum basilicum* L. are valued for their cooling properties, alleviating pain and discomfort associated with sun-damaged skin. Prolonged sun exposure can cause skin dryness, leading to scaling, itching, and cracking, while dryness is also a common side effect of certain chemotherapeutic treatments for cancer.

Several medicinal plants are traditionally used to treat skin dryness caused by prolonged sun exposure, including *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Citrus medica* L., and *Cucumis sativus* L. Certain species also possess notable anti inflammatory properties, making them effective in alleviating redness, itching, and inflammation resulting from extended UV exposure. These include *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cucumis sativus* L., *Mallotus philippensis* (Lam.) Müll. Arg., *Mentha arvensis* L., and *Ocimum basilicum* L. Hyperpigmentation (melasma) of sun exposed skin is another common consequence of photodamage, which can be managed naturally using *Aloe barbadensis* Mill., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., and *Lycopersicon esculentum* Mill. Plants rich in antioxidants such as *Aloe barbadensis* Mill., *Brassica campestris* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon*

esculentum Mill., and *Mallotus philippensis* (Lam.) Müll. Arg. play a vital role in preventing premature ageing and cancer, while supporting cell repair processes that restore damaged skin. Furthermore, *Brassica campestris* L., *Mallotus philippensis* (Lam.) Müll. Arg., and *Ocimum basilicum* L. exhibit significant anti-carcinogenic potential, making them promising natural alternatives to conventional chemotherapy for skin cancer.

CONCLUSION

With advancements in modern medicine, scientists have developed numerous allopathic formulations to treat a wide range of diseases, from common ailments such as colds and influenza to life threatening conditions like cancer. However, these treatments often entail significant economic costs and may cause adverse health effects. Prolonged exposure to sunlight can result in tanning, premature ageing, and sunburn, which in severe cases may progress to skin cancer. At present, chemotherapy is a common treatment for skin cancer, employing drugs such as cisplatin, doxorubicin, 5 fluorouracil (5 FU), and topotecan. While effective, these agents are associated with multiple side effects, including hair loss, oral ulcers, loss of appetite, nausea, vomiting, increased susceptibility to infections, and fatigue. In contrast, the use of medicinal plants greatly reduces the likelihood of such adverse effects, making them a safer alternative. The traditional knowledge of photoprotective medicinal plants has been preserved and passed down through generations by local healers (Vaidhyas), shepherds, and other elderly community members. The traditional custodians of herbal medicinal knowledge in the study area are now predominantly elderly, while the younger generation appears largely unaware of this heritage. Our findings indicate that awareness regarding the use of these plants for the prevention and treatment of sun-induced skin damage is limited among local communities. Without timely investigation and documentation, this valuable ethnobotanical wisdom risks being lost permanently. There remains significant potential to identify additional medicinal plants with remarkable sunscreen and photoprotective properties through systematic ethnobotanical research. Such knowledge can be further validated and applied in the development of improved herbal sunscreen formulations, making safe and effective products accessible to the global population. This study aspires to revive and preserve traditional medicinal plant knowledge, ensuring its optimal utilization for the benefit of humankind.

RECOMMENDATIONS

The present study highlights significant medicinal applications of locally available, wild growing plants in the context of photoprotection. Some of these species are also cultivated in unconventional settings. With the rising global demand for herb based medicinal and cosmetic products, the potential for growth in the herbal industry is substantial. Consequently, the cultivation of such valuable plants is likely to become increasingly important, offering promising economic benefits for farmers. These species can be integrated into existing agricultural systems as border crops, intercrops, or seasonal rotations alongside conventional crops, following established crop rotation practices. Moreover, most of the plants identified require minimal care and maintenance, making them relatively easy to cultivate.

ACKNOWLEDGEMENT

We are thankful to the villagers of the study area for sharing their valuable ethno-medico taxonomical knowledge and co-operation. It is their effort for the conservation of this traditional treasure.

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