

## Treasure Trove for Dermatologic Therapy

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## Natural Products for Skin Diseases: A Treasure Trove for Dermatologic Therapy

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### Introduction

*Natural Products for Skin Diseases: A Treasure Trove for Dermatologic Therapy* is an enlightening journey through the realm of natural remedies for various skin diseases. The editors have compiled information on effective and holistic treatment approaches that can be applied in clinical settings. This book brings diverse range of topics, including skin protection against harmful radiation, natural remedies for burns and wounds, management of skin pigmentation issues, and herbal treatments for scabies. It also explores the potential of natural cosmetics and their future applications, along with the use of natural products and nanoparticles in skin delivery. All chapters are contributed by experts in dermatology and herbal medicine, and are supplemented with scientific references for advanced readers.

The book primarily serves as a textbook for students in medicine and dermatologists in training. It also serves as a valuable guide for dermatologists, researchers, and healthcare professionals, revealing the treasure trove of benefits that natural products offer for treating skin diseases.

**Audience:** Medical residents, students and dermatologists.

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## Treatment of Scabies with Herbal Medicines

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**Abstract:** Scabies is a chronic and serious community disorder caused by a parasite commonly known as a mite (*Sarcoptes scabiei var hominis*). The long-term infection may lead to chronic complications such as septicemia, acute post-streptococcal glomerulonephritis, heart disease, and secondary infections. The majority of novel medicinal agents from various plant sources are responsible for the management and treatment of several types of chronic disorders. The safe and cost-effective alternative treatment strategy is the use of medicinal plants that plays a potential role against a variety of diseases due to the presence of numerous types of active phytochemicals with no or negligible adverse effect. This study gives a unique summary, including a correlation between traditional medicinal plants and their derived active phytochemicals for the significant treatment of scabies. The literature search was carried out *via* search engines through different databases, including Google Scholar, PubMed, Medline, ScienceDirect, *etc.* A large number of medicinal plants and their active medicinal agents have been reviewed with remarkable therapeutic effects against scabies. There are some limitations due to insufficient data related to limited pre-clinical and clinical trials in this particular area. This review provides a baseline to explore the therapeutic potential of these medicinal plants against skin diseases, especially scabies. However, extensive studies are required to identify, authenticate, and characterize the bioactive compounds present in these plants, which may lead to value addition in pharmaceutical industries *by* providing a cost-effective way of treatment with minimal side effects.

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**Keywords:** Scabies, *Sarcoptes scabiei var hominis*, Burrows, Clinical Study, Epidemiology, Future Prospective, Herbal Medicines, Mites, Natural Products, Skin diseases, Therapeutic Agents, Transmission, World Health Organization.

## INTRODUCTION

Human scabies (also known as seven-year itch) is a highly contagious and itchy ectoparasitic skin infestation caused by microscopic scabies mites - *Sarcoptes scabiei var. hominis* and it is a public health concern in all countries, regardless of socioeconomic class [1, 2]. The scabies mite tunnels into the epidermis and lays eggs, provoking an immunological reaction in the host that results in severe itching and a rash. Scabies mites can live for up to two months on a human. Scabies mites rarely live longer than 48-72 hours outside a human. If scabies mites are exposed to a temperature of 50°C (122°F) for 10 minutes, they will die. Scabies infestation can be worsened by bacterial infection, resulting in skin sores that can lead to more serious complications such as septicemia, cardiovascular disease, and chronic renal disease. With respect to the Individual Countries' requests and the Council's suggestions, by the World Health Organization (WHO)- Strategic and Technical Advisory Group (STAG), scabies and other ectoparasites were added to the list of Neglected Tropical Diseases (NTDs) in 2017. In March 2018, the WHO NTDs Worldwide Working Group on Monitoring and Evaluation suggested that a global scabies burden be determined, diagnostic criteria are developed and, interim guidelines for public health interventions be issued [3, 4] (Table.(1)).

**Table 1. What exactly is scabies?**

<ul style="list-style-type: none"> <li>• Scabies is a skin rash caused by tiny bugs called mites.</li> <li>• <i>Sarcoptes scabiei var. hominis</i> is the parasitic mite that causes human scabies.             <ul style="list-style-type: none"> <li>• To lay eggs and the mite penetrates the skin.</li> </ul> </li> <li>• Scabies burrows beneath the skin and causes itching &amp; tiny red lumps.</li> <li>• Physical contact is an easy way for the mites to spread to other people.</li> <li>• Scabies can also be contracted by touching scabies-infected towels, beds, or clothing.             <ul style="list-style-type: none"> <li>• The rash is quite itchy to the point of being infuriating.</li> </ul> </li> </ul>
--

## Scabies Epidemiology

Scabies is among the most frequent dermatological disorders, popular for a large percentage of skin illnesses in underdeveloped nations. It is appraised that it affects greater than 200 million individuals worldwide at any given moment, while additional research is required to quantify the current burden. In current scabies-associated work, prevalence estimates covered from 0.2 percent to 71 percent. Throughout many tropical regions with insufficient resources, scabies is prevalent, with a 5–10% proportion among youngsters. Scabies infestation and its

possible consequences put a significant financial burden on healthcare systems [5]. Cases are infrequent in high-income economies, but outbreaks in health facilities and vulnerable groups cost national health services a lot of money. Scabies is found all over the world. Little youngsters in places with limited resources are among the most exposed to scabies and their related issues. Infestation rates are much higher in hot, tropical countries, especially where there is a high prevalence of overpopulation and poverty and when access to treatment is constrained [6] (Table.(2)).

**Table 2. Scabies epidemiology**

<ul style="list-style-type: none"> <li>• At every given time, 2 billion people globally are thought to be affected by scabies.             <ul style="list-style-type: none"> <li>• Scabies affects 5-10 percent of youngsters in resource-limited regions.</li> <li>• Scabies can affect people of all ages and socioeconomic backgrounds.</li> </ul> </li> <li>• Scabies is present throughout the world, but it is much more prevalent in warm, tropical nations and densely populated locations.</li> <li>• Scabies outbreaks are common in places like nursing homes, extended-care facilities, and jails.</li> </ul>
--

## Symptoms

The mature female of the scabies mite burrows into the epidermis' top layer, where it lays eggs. In 3–4 days, the eggs hatch, and in 1–2 weeks, the adult mites emerge. After 4–6 weeks, the patient develops an allergic reaction to mite proteins and feces found in the scabies burrow, resulting in severe itching and redness. The majority of people are afflicted with 10–15 mites (Table.(3)). Mostly in finger webs, wrists, upper and lower limbs, and waistline region, there is frequently intense itching, linear burrows, as well as vesicles [7, 8].

**Table 3. How can you know if you have scabies?**

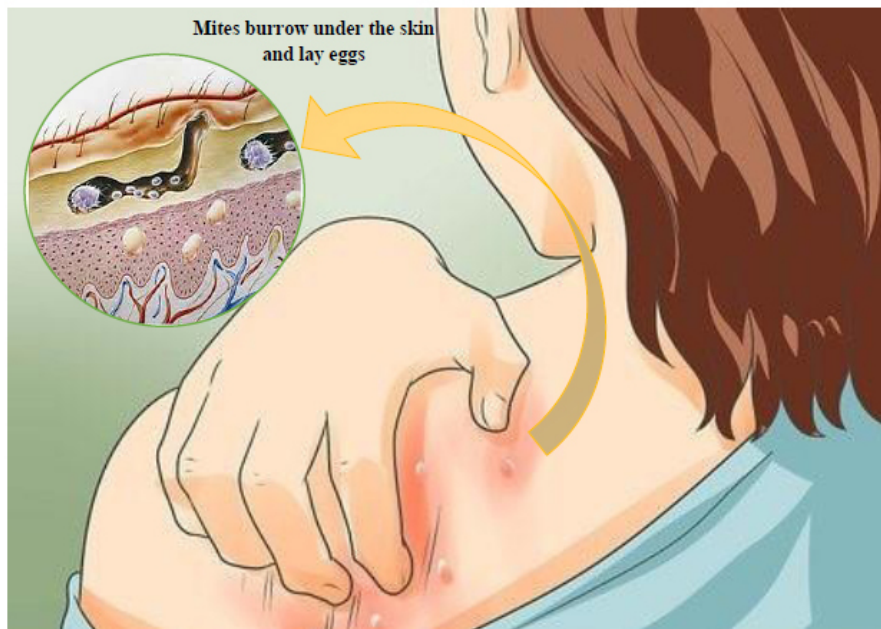
<ul style="list-style-type: none"> <li>• The itching gets progressively worse over time, especially at night.             <ul style="list-style-type: none"> <li>• A rash of tiny red lumps that occasionally appear in a line.</li> </ul> </li> <li>• The lumps are most commonly found on the fingers, wrists, and arms, but they can appear anywhere on the body (except on the face of an adult).</li> <li>• The rash can also appear on the cheeks, scalp (particularly behind the ears), palms of the hands, and soles of the feet in babies.             <ul style="list-style-type: none"> <li>• The rash may be extremely minor in older people, making it difficult to see.</li> <li>• Scabies can spread all over a person's body if he or she has HIV.</li> </ul> </li> </ul>
---

In infants and young children, a much more widespread rash may cover the palms, soles of the feet, ankles, and occasionally the scalp. Inflammatory scabies nodules can be found on adult males' penis and scrotums, as well as around females' breasts. Burrows could be seen in close contacts who still haven't displayed itching due to the time lag between infection and onset of symptoms. People with crusted scabies have thick, peeling crusts that can be found all over the body,

including the face. Symptoms may take 4-8 weeks to appear if a person has never had scabies previously. It's crucial to note that even if one doesn't have symptoms, an infected individual might spread scabies during this period. Symptoms normally occur significantly sooner (1-4 days) in a person who has previously had scabies [9].

### **Burrows**

Female scabies mites could be seen digging just below the skin's surface, causing microscopic tunnels to be seen on the body. Burrows seems on the skin surface as arched and curved (serpiginous) grayish-white or skin-colored threads. These burrows can be difficult to discover because mites are usually small in number (about 10-15 per individual). The penis, breast, or upper arms are the most typical places to find them, along with the folds of skin on the forearm, elbow, or knee, as well as between fingers. The burrow is a scabies diagnostic indication. The egg-laying female produces an intraepidermal path that is usually less than a centimeter long. The burrow's opening may have a modest scale, while the female is confined in the blind end. Most adult humans have burrows on their hands or wrists, while children frequently have burrows on their feet [10]. Burrows can be found in a variety of places (Fig. 1).



**Fig. (1).** Mites burrow under the skin and lay eggs

### **Anatomy of the scabies mite**

The scabies mite is an ectoparasitic arthropod with eight legs that is hardly visible to the human eye. The adult female mite is between 0.3 and 0.5 mm in length. The female mite has an oblong body with two pairs of anterior and posterior legs, which are flat on the under-side and convex on the upper side, respectively. The anterior legs end in long, unjointed stalks called 'suckers,' whereas the posterior legs end in long bristles. The eggs are laid through the tocostome, which is a slit in the middle of the female mite's ventral surface. Male mites are smaller and have a genital apparatus on the outside [11].

### **Biology Of The Scabies Mite**

A mite's life cycle is divided into three stages: egg, nymph, and larva. Larvae hatch two to four days after the eggs are laid, and the full development life cycle takes around 15 days from egg to adult mite. Adult female mites use their front legs and mouth to burrow into the epidermis of human skin, which takes around 15–30 minutes. Adult females survive for four to six weeks and lay four eggs every day in the burrowed cave. She leaves behind empty shells, as well as mite excretory and secretory materials, in addition to her eggs. When the larvae hatch from the eggs, they emerge from their burrow, reach the skin's surface, and seek food and shelter in hair follicles. Experiments on mite reproduction revealed that the largest numbers of mites in an infected host were discovered between 80 and 115 days after infestation, with a maximum parasite rate of 50 to 380 mites [9].

### **Transmission**

Scabies is mainly transmitted person-to-person through close skin contact (e.g., residing in the same household) with an afflicted person. The risk of transmission increases with the degree of infestations, with the highest risk owing to contact with individuals with crusted scabies. Contact with infested personal goods (e.g., clothes and bed linens) is unlikely to transmit common scabies, but it may be significant for those with crusted scabies. Since there is an asymptomatic phase of infestation, the transmission may occur before the initial infested person exhibits symptoms. As a scabies mite takes 15 to 20 minutes to infect its host, holding hands, sexual contact, breastfeeding, and nursing newborns are all high-risk behaviors if someone comes into touch with an infected person. As a result of these factors, family members are the most common source of transmission [10] (Table.4).

Human scabies is not spread by animals. An epidermal barrier breach brought on by scratching and the body's reaction to it can result in secondary bacterial skin infections, which are most frequently brought on by *Streptococcus pyogenes* as

Table 4. How can scabies be prevented from spreading?

<p><b><i>Mites can quickly travel from person to person, and in some cases, to everyone in your home. To prevent the spread of scabies:</i></b></p> <ul style="list-style-type: none"> <li>• Consult a doctor as soon as any symptoms are noticed.</li> <li>• Scabies can only be kept at bay by avoiding lengthy, close, and skin-to-skin contact with an infected person.</li> <li>• Also, until infected patients have completed treatment, avoid touching or sharing clothes, mattresses, or towels with them. <ul style="list-style-type: none"> <li>• It's advised to hold off on having sex until the affected partner has finished treatment.</li> </ul> </li> </ul> <p><b><i>Also, if someone has mites on clothing, towels, or bedding, use one of the following methods to kill them:</i></b></p> <ul style="list-style-type: none"> <li>• All clothing should be washed in hot, soapy water and then dried on high heat. <ul style="list-style-type: none"> <li>• Items that cannot be washed at home should be dry cleaned professionally.</li> </ul> </li> <li>• Stowaway non-washable things, such as stuffed animals and upholstery, in a sealed plastic bag for at least 72 hours so that the mites die.</li> <li>• Throw away the vacuum cleaner bag after cleaning and vacuuming each room in the house.</li> </ul>
--

well as *Staphylococcus aureus*. A kind of surface bacterial skin disease known as impetigo has the potential to worsen and cause immune-mediated issues with vital organs, including the kidney and heart. A distinct type of scabies mite can infect pets, one that does not live or reproduce in people but produces “mange” in animals. If a person comes into close contact with an animal that has “mange,” the animal mite can enter under the person's skin and produce brief itching and irritation [11].

### **Crusted (Norwegian) Scabies**

Crusted, or Norwegian, scabies is one of the chronic types of scabies that affects immunocompromised, old, crippled, or debilitated people. Itching and redness are classic indications and indicators of scabies that may not appear in people with crusted scabies (pruritus). These patients have thick skin crusts that are packed with scabies mites and eggs. Crusted scabies mites are not more virulent than non-crusted scabies mites, although they are far more numerous (up to 2 million per patient). People with crusted scabies are extremely contagious to others because they are afflicted with so many mites. Persons with crusted scabies can transmit scabies indirectly by shedding mites that contaminate items such as their clothing, bedding, and furniture, in addition to direct skin-to-skin contact. To avoid scabies epidemics, those with crusted scabies should undergo prompt and aggressive medical treatment for their infestation. If left untreated, this illness has a high death rate due to secondary sepsis [12].

### **Diagnosis**

There are still no standardized scientific assays known for the detection of scabies. There have been several candidate antigens and antibody immunoassays

studied, but their performance has been unsatisfactory, and none have been widely accepted. Formerly, scabies infestations were detected using traditional PCR targeting on *Sarcoptes scabiei* mitochondrial cytochrome c oxidase subunit 1 (cox1) genome; nevertheless, the confirmed identification frequency was too low to provide reliable results [13]. In most cases, healthcare providers diagnose scabies in their clinics. The diagnosis can sometimes, but not always, be confirmed by looking at skin scrapings under a microscope, although this takes time and can be traumatic for youngsters. The use of a dermatoscope, a hand-held magnifier, may be beneficial; however, dermatoscopes are expensive and not widely available in resource-poor places. Other diagnostic aids in development include low-cost magnification and a quick antigen detection testing procedure [14]. Identifying the mite, mite eggs, or feces (scybala) should be done whenever possible to confirm the diagnosis of scabies. This can be done by carefully removing the mites first from the end of the burrow with the top of a syringe, or by getting a skin scrape to look at under a microscope for mites, larvae, or mite feces. Even if no mites, eggs, or feces are observed, a person can still be infested; less than 10-15 mites may be present in an otherwise healthy infected person [15] (Table.(5)).

**Table 5. How can doctors tell if someone has scabies?**

<ul style="list-style-type: none"> <li>• Rash symptoms are generally enough for doctors to figure it out.             <ul style="list-style-type: none"> <li>• One or two lumps may be scraped open by doctors.</li> </ul> </li> <li>• Under a microscope, doctors examine the scrapings for mites.</li> </ul> <p><b>Major diagnostic criteria (one required to validate the diagnosis)</b></p> <ul style="list-style-type: none"> <li>• Burrows that can be identified have an itchy rash.</li> </ul> <ul style="list-style-type: none"> <li>• Positive scrapings of the epidermis containing eggs or mites or feces.</li> </ul> <p><b>Minor diagnostic criteria (two required for a probable diagnosis)</b></p> <ul style="list-style-type: none"> <li>• Typical irritating rash</li> <li>• Sudden start of unexplained itchy rash</li> <li>• In contact with a person with scabies</li> <li>• Penis papules</li> </ul>
---

## TREATMENT

There is little research on new scabies medications. Probably the two most often utilized scabies therapy at the moment are oral ivermectin as well as topical permethrin. Furthermore, only a small number of nations worldwide have access to these medications, and they are both pricey [16]. For the first line of protection, infected individuals are treated with a topical scabicide, including 5 percent permethrin, 0.5 percent malathion in an aqueous base, 10–25 percent benzyl benzoate emulsion, or 5–10 percent Sulphur ointment. Ivermectin used orally, is also extremely effective and is legal in many nations. The safety of ivermectin in kids under 15 kg or pregnant women has not been proven; hence it should not be

used in these populations until additional safety information becomes available. Itching usually worsens for 1-2 weeks after effective treatment, and those who have been treated should be aware of this. Existing scabicides have several drawbacks, including toxicity, side effects, poor safety evidence in critical populations, resistance development, and treatment failures [17, 18].

Plants have been utilized to cure skin problems throughout human history, and this technique is still used today. This is because most of these herbals are readily available, and inexpensive, and the extracted compounds have few or no adverse effects when compared to drugs created in a laboratory. Plants' therapeutic properties are attributed to phytochemicals, which are organic molecules that have a specific physiological function on the human body. They are plant-derived chemicals, and the term is frequently used to refer to the enormous number of secondary metabolic products found in plants. Novel medicinal agents like Polyphenols, resins, alkaloids, flavonoids, coumarin derivatives, vitamins, and tannins provide medicinal plants their therapeutic potential [19] (Table.(6)).

**Table 6. Advantages of herbal medicines for scabies treatment.**

<ul style="list-style-type: none"> <li>• Safety of the patient with no or few negative impacts             <ul style="list-style-type: none"> <li>• Cost-effectiveness</li> </ul> </li> <li>• Patient acceptability, adaptability, and compliance</li> <li>• Multiple biologically active compounds reduce the potential for resistance.</li> <li>• Herbal medicines' antipruritic, anti-inflammatory, and antibacterial properties can also assist to decrease scabies complications.</li> </ul>
---

## **TRADITIONAL MEDICINAL PLANTS USED FOR THE TREATMENT OF SCABIES**

Globally the use of herbal medicine and Phytochemicals has expanded tremendously over the past three decades; there are more than four billion people (about 80% of the global population) who utilize medicinal plants and their products as a primary source of healthcare and traditional medical practice which involves the use of herbs is viewed as an integral part of the culture in those communities [20 - 22]. Traditional medicine (TCM) is an important example of how ancient and accumulated knowledge is applied in a holistic approach in present-day health care [23]. Compared to existing medications, traditional herbal treatments are said to be cheap, effective, and have few to no adverse effects [24]. Active biometabolites such as glycosides, alkaloids, flavonoids, coumarin compounds, vitamins, and tannins are what give significant therapeutic potential [25, 26]. Although they have little or no negative impacts, biopharmaceutical businesses, and medical practices now rely on medicines made from plants [27, 28]. Different cultures around the world have their native medicinal plants, and some of these distinct varieties of herbs have various therapeutic benefits [29, 30].

Indigenous knowledge is useful for conducting biomedical investigations. The cultural heritage of the medical applications of plants is extremely important for understanding the pharmacological importance of herbal medicines (Fig. 2) [33].

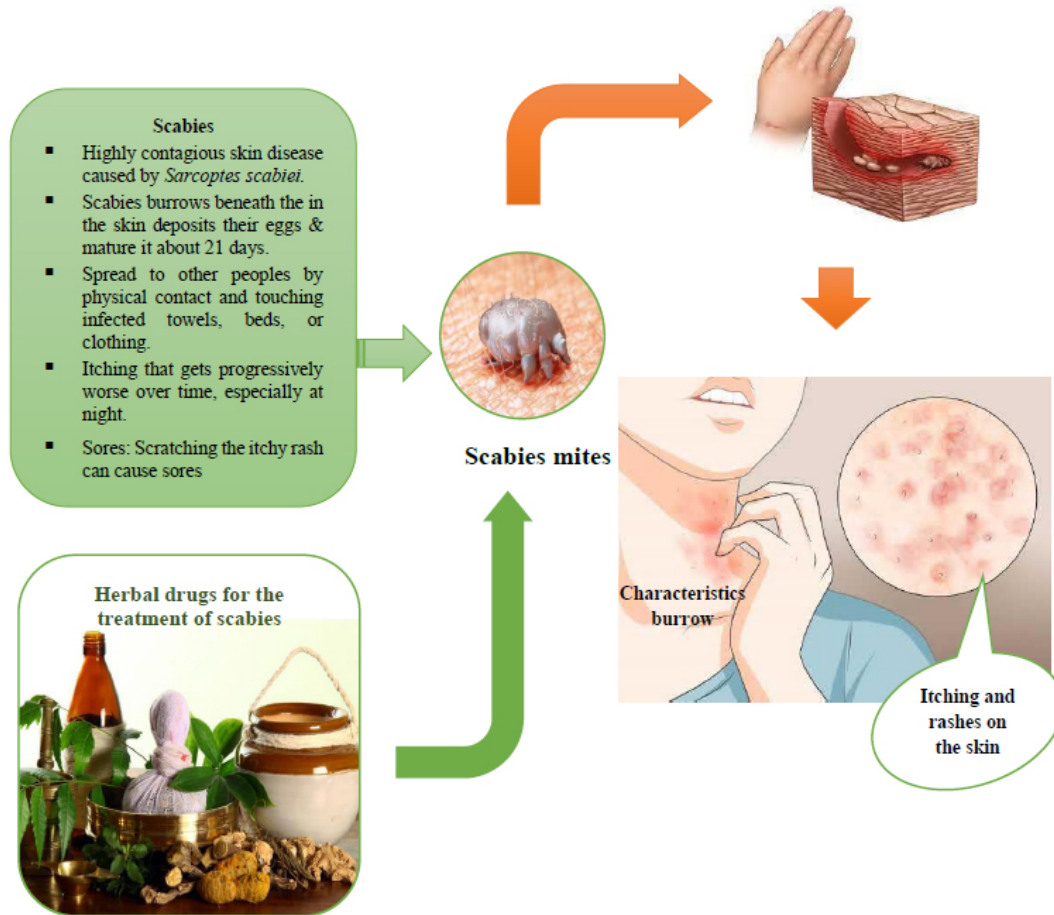


Fig. (2). Graphical representation of scabies and their treatment with traditional medicinal plants.

### *Chrysanthemum Cinerariifolium*

Insecticides called pyrethrins are frequently found in chrysanthemum blossoms. They are a combination of six poisonous compounds for insects. Permethrin is emphasized as a phototoxic insecticide with low cytotoxic effects and almost no allergic side effects that are particularly efficient against a wide range of insects and mites. Permethrin (1 percent cream rinse or 0.5 percent in ethanol) demonstrated safety, dependability, and cosmetic acceptability in the treatment of head lice infestations and the prevention of reinfestations, as well as in failures with lindane leading to the advancements of sensitivity in the lice. These results

were seen only 10–20 minutes after implementation. The permethrin cream used to treat scabies had a 5 percent concentration (2.5 percent for children under 5 years old). Small amounts of permethrin are absorbed through the skin, where it is quickly digested and eliminated in the urine. For eradication campaigns, a single “head to toe” administration is appropriate since it allows lice to be targeted and reduces the occurrence of microbial infection at around the same time. The outcomes of treating 48 children as well as 56 adults with scabies provide evidence for this. Permethrin is suggested in the management of scabies in premature babies, young children, patients with epilepsy and neurological issues, patients who have failed lindane medication and require further medication, pregnant women, breastfeeding mothers, and patients suffering *scabies crustose* [34].

### ***Melaleuca Alternifolia***

Scabies mites were isolated from 20-year-old women who were admitted to the Royal Darwin Hospital with crusted scabies to correlate the acaricidal action of tea tree oil, specifically *M. alternifolia*, and its bioactive constituents on *Sarcoptes scabiei* itch mite varhominis. After three hours of the collection, which governs the use of acaricides, scabies mites were usually placed with the tea tree oil preparations and inspected at defined intervals. Through constant interaction with acaricides and tea tree oil products, the percentage of dead mites is monitored at regular intervals. The active constituents in tea tree oil (5%) and terpinen-4-ol were very efficient in decreasing mite survival. Administering 5% tea tree oil, 100 g/g ivermectin (Emulsifying Ointment), 2.1% terpinen-4-ol, as well as 5% permethrin allowed researchers to identify mite viability. *M. alternifolia*, a surface biocide, is the source of tea tree oil. According to the studies, acaricide is a highly effective topical medication. Tea tree oil is a helpful natural and conventional remedy for skin disorders, bruising, and insect bites [35, 36].

### ***Aloe barbadensis Miller***

Aloe vera's scientific name is *Aloe barbadensis* Miller. It is a pea-green, perennial, xerophytic plant belonging to the family Liliaceae that is succulent, with small shrubs, or arborescent in shape. The drier parts of Africa, Asia, Europe, and North America are where it is most frequently found. It can be cultivated in the Indian states of Rajasthan, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu, among others. Amino acids, enzymes, vitamins, minerals, lignin, saponins, salicylic acids, and saponins are some of the other aloe vera's 75 theoretically active components. Aloe vera, a medical plant, has been known and utilized for its health, beauty, therapeutic, and skincare characteristics for generations. Aloe vera is mostly constituted of water and polysaccharides

(pectin, cellulose, hemicellulose, glucomannan, acemannan, and mannose derivatives), with a long chain of acetylated mannose [37].

In an open, non-comparative study carried out between August and December 2002 at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria, 5 patients with scabies were successfully treated with crude gel of Aloe vera; thereafter, the efficacy of the extract was compared with that of benzoate lotion among 30 patients. Sixteen patients were treated with Aloe vera and 14 patients had benzyl benzoate lotion. The itching was still present in 3 patients in the benzyl benzoate group and 2 patients in the Aloe vera group after 2 courses of treatment. The scabietic lesions virtually disappeared in all of them. None of these patients had any noticeable side effects. It is concluded that Aloe vera gel is as effective as benzyl benzoate in the treatment of scabies [38].

### ***Azadirachta Indica***

Herbal shampoo made with *A. indica* seed extract effectively eliminates pathogens. *A. indica* has been tested in Egypt towards *S. scabiei*-affected canines. Ten naturally infected canines from various regions of the Nile delta were gathered. Skin irritation, lesions, and hair loss were noted as indicators of infiltration, and their prevalence was confirmed by the discovery of mature parasites and their growth stages in infected areas. For 14 days straight, appropriate shampoo was given externally to the affected areas. To complete the healing process, evaluations of scraping were also used. On the seventh day after application, four canines were mite-free, and it was also demonstrated that the mites' developmental stages had vanished. The six remaining dogs showed a significant decrease in the number of mites. Eight dogs were treated after 14 days of treatment, as evidenced by lower mite counts and improved clinical symptoms; just a small proportion of mites were identified in two dogs [39].

Neem oil contains an anti-parasite component called azadirachtin. The triterpene azadirachtin is responsible for the majority of the pesticide activity. This substance disrupts parasites' hormonal cycles, inhibits mite growth and development, turns eggs sterile, and has an antifeedant effect. Neem oil does not kill scabies mites directly, but it does stop them from reproducing and multiplying, resulting in a decrease in the parasite population over time. This is why; the cream should be applied daily. Neem oil at a concentration of 5 percent was said to be effective against scabies, with a 20–21 day recovery period [40].

*Sarcoptes scabiei* var. *cuniculi* were highly susceptible to the powerful acaricidal effects of Octadecanoic acid-3,4-tetrahydrofuran diester, isolated from neem (*Azadirachta indica*) oil. Depending on histopathological and enzyme functions, the acaricidal strategy of octadecanoic acid-3,4-tetrahydrofuran diester towards

*Sarcoptes scabiei* var. *cuniculi* has been assessed in this article. The outcomes demonstrated that mite lesions were noticeable under transmission electron microscopy following compound therapy for 24 hours at a dose of 20 mg/mL. The lesions included spinal problems that had disappeared, lysis of dermal cellular membrane as well as nuclear membranes, aberrant mitochondrial morphology, and vacuolization of the mitochondria. Octadecanoic acid-3,4-tetrahydrofuran diester treatment significantly altered the activities of superoxide dismutase (SOD), peroxidase (POD), glutathione-s-transferases (GSTs), as well as Ca (2+)-ATPase in mites compared to a control group. SOD, POD, and Ca (2+)-ATPase functions were all reduced significantly, but GST activity was enhanced. These findings suggested that the mechanism of octadecanoic acid-3,4-tetrahydrofuran diester's acaricidal activity was mostly achieved by interfering with mites' mitochondrial respiration, leading to insect mortality [41, 42].

Another study suggests that the acaricidal activity of *Azadirachta indica* (neem) aqueous fruit extracts was evaluated against *Sarcoptes scabiei* var. *suis* (mange mites) in an on-farm trial using grower pigs. Aqueous neem fruit extracts of three concentrations of 5%, 10%, and 25% w/v, and a commercial acaricide, 12.5% amitraz-based Triatix spray (positive control), were compared with pigs that received no treatment (negative control). Thirty grower pigs of the Daland breed were allocated to the five treatments in a completely randomized experiment. Each experimental animal was sprayed on day 0 and again on day 7. Counts of mange mites, scoring of lesion index, and calculation of rubbing index were done weekly. The topical application of 25% aqueous neem fruit extract had a higher efficacy ratio ( $p < 0.05$ ) than the other fruit extract concentrations, and performed similarly to an amitraz-based acaricide, suggesting a dose-dependent response. Amitraz (positive control) cured clinical mange on grower pigs after 5 weeks and 25% aqueous neem fruit extract 6 weeks post-treatment. The results indicated that aqueous neem fruit extracts have acaricidal effects against mange mites and can provide a cheaper, safer, and more eco-friendly alternative for the control of *Sarcoptes mange* in pigs [43].

### **'*Rosmarinus Officinalis*'**

Globally, *R. officinalis* was utilized as a therapeutic herb. That plant includes significant active ingredients like camphor and 8-cineole. It possesses astringent, antibacterial, and anti-inflammatory properties that aid in the treatment of scabies illness. While rosemary oil helps to dry out wounds and quickly heal bruises, it is not recommended for internal usage [44, 45]. Rosemary oil also kills mites.

### ***Capsicum Annuum***

Capsaicin, a molecule that lessens pain perception when employed correctly, is a component of cayenne [46]. Capsaicin can help reduce itching because it makes skin neurons less sensitive. However, according to one study, 30% of patients who apply capsaicin topically experience burning [47]. Studies have also demonstrated that rubbing *C. annuum* into the skin will kill scabies mites. In a boiling water bath with cayenne administered, the patient waits until the water cools before washing their bodies. Cayenne burns the eyes, so be able to keep yours away from any contact with it. One or two drops of water can also be used to create the cayenne paste. The paste is rubbed onto visible warrens under the top layer of the skin [48].

### ***Cinnamomum Camphor***

For several years, that tree has been used successfully to treat scabies. *C. camphor* is an analgesic and aromatic herb with a pleasant scent. This tree's insecticidal properties may have therapeutic benefits. For the management of muscular discomfort, it works well. This tree's oil will completely cure the scabies infection if used consistently for ten days. In the repellent assay, the highest repellent rate was found in the seed essential oil at the concentration of 20  $\mu\text{L/mL}$  after 24 h of treatment. Linalool was found to be a significant contributor to insecticidal and repellent activities [49].

### ***Eupatorium Adenophorum***

The possible acaricidal activity of *Eupatorium adenophorum* was analyzed using extracts created by water decocting, ethanol thermal circumfluence, and steam distillation. The toxic effect of each extract was tested against *Psoroptes cuniculi* and *Sarcoptes scabiei* *in vitro*. Ethanol, thermal circumfluence extract, had strong toxicity against mites, killing all *Sarcoptes scabiei* at 0.5 and 1.0 g/ml (w/v) concentration, while 1g/ml extract was also found to kill all *P. cuniculi* within a 4-h period. Similarly, 0.25, 0.5 and 1.0 g/ml concentrations of extract had strong toxicity against *S. scabiei*, with median lethal time (LT (50)) values at 0.866, 0.785 and 0.517 h, respectively. 0.5 g/ml and 1g/ml showed strong acaricidal action against *P. cuniculi*; the LT (50) values were 0.93 h and 1.29 h, respectively. The median lethal concentration (LC (50) values were 0.22 g/ml for Scabies mite and 0.64 g/ml for *P. cuniculi* in 1h. The results indicated that *E. adenophorum* contains potent acaricidal ingredients; as a first step in the potential development of novel drugs, it may provide new acaricidal compounds for the effective control of animal acariasis [50].

### ***Ailanthus Altissima***

*Psoroptes cuniculi* and *Sarcoptes scabiei* var. *cuniculi*, the two most common taxa of animal ectoparasitic mites, are being used as in-vitro test subjects to determine the possible acaricidal effects of an *Ailanthus altissima* stem bark. *A. altissima* bark extract was made using ethanol thermal circumfluence and evaluated against rabbit mites at four different concentrations (1.0, 0.5, 0.25, and 0.125 g/ml). The bark of *A. altissima* displayed considerable acaricidal capabilities for both mite species treated in comparison to the fenvalerate-treated group. Only 1.0 and 0.5 g/ml of extract killed all treated *P. cuniculi*, although doses of 1.0, 0.5, and 0.25 g/ml killed all tested *Sarcoptes scabiei* in 7 hours. *Sarcoptes scabiei* median lethal time (LT<sub>50</sub>) values at 1, 0.5, and 0.25 g/ml were 0.60, 0.78, and 1.48 h and *P. cuniculi* were 0.74, 1.29, and 3.33 h. At 4 hours, *P. cuniculi* median lethal concentration (LC50) was almost 1.6 times higher than that of *Sarcoptes scabiei* var. *cuniculi*. *Sarcoptes scabiei* was more sensitive to the extract's toxicity than *P. cuniculi*. The acaricidal effect of *A. altissima* crude extracts is time- and dose-dependent, as evidenced by the fact that mortality rates rose with increasing extract concentration supplied, even with increasing time post-treatment. The acaricidal activity of *A. altissima* against *P. cuniculi* and *Sarcoptes scabiei* var. *cuniculi* has never been documented before. It suggests that *A. altissima* may contain substances that have acaricidal properties. The development of possibly novel chemicals from *A. altissima* for the efficient control of mites in livestock is underway with the help of our investigation [51].

### ***Cymbopogon Citratus***

Tropical and subtropical areas frequently cultivate the plant *Cymbopogon citratus*. Lemongrass oil is an essential oil derived from the *C. citratus* genus, with citral as the main component. The essential oil of *Cymbopogon* species is in high demand around the world. Lemongrass essential oil is derived from dried or fresh leaves using steam distillation. Essential oils, as well as hydrosols or aromatic fluids, are produced by steam distillation and are frequently used to treat inflammatory illnesses and microbiological infections. Lemongrass oil has a number of pharmacological characteristics, including antiparasitic, antioxidant, antibacterial, and anti-inflammatory qualities. Lemongrass oil has been shown to have a miticidal impact on a plant pathogen (*Tetranycchus urticae*) as well as domestic dust mites [52].

Essential oils may represent an alternative strategy for controlling scabies, a neglected tropical disease caused by the infestation of mites from the species *Sarcoptes scabiei*. Lemongrass (*Cymbopogon citratus*) oil is reported to possess pharmacological properties, including antiparasitic, antioxidant, antimicrobial,

and anti-inflammatory. The present study aimed to assess the potential efficacy of lemongrass oil against the mites and eggs of *Sarcoptes scabiei*. Mass spectrometry analysis confirmed that the main component presented in lemongrass oil was citral. Lemongrass oil at concentrations of 10% and 5% killed all *Sarcoptes* mites within 10 and 25 min, respectively. The median lethal concentration value was 1.37%, 1.08%, 0.91%, 0.64%, and 0.48% at 1, 3, 6, 12, and 24 h, respectively. Lemongrass oil at all concentrations (10%, 5%, 1%, 0.5%, 0.1%) was able to significantly decrease the hatching rate of *Sarcoptes* eggs. Lemongrass oil should be considered a promising miticidal and ovicidal agent for scabies control [53].

### ***Eucalyptus Globulus***

In Egypt, *Scarcoptes scabiei* is the most prevalent mites of medical importance infesting man. This is true in overcrowded and poorly hygienic areas. Many effective acaricidal regimens are available, but being compounds used as insecticides. With the success of camphor oil in treating human demodicidosis, it was applied to treating human scabies. Camphor oil with or without glycerol dilutions gave a complete cure, with concentrations (100%, 75%, and 50%) within five to ten days [54].

### ***Curcuma Longa***

In the Ayurvedha and Sidha systems of medicine (Indian system of medicine), *Azadirachta indica* ADR ('Neem') and *Curcuma longa* ('Turmeric') have been used for healing chronic ulcers and scabies. 'Neem' and 'Turmeric' were used as a paste for the treatment of scabies in 814 people. In 97% of cases, a cure was obtained within 3 to 15 days of treatment. We find that this is a very cheap, easily available, effective, and acceptable mode of treatment for villagers in developing countries. We have noticed no toxic or adverse reactions so far. However, further research is needed [55].

### ***Syzygium Aromaticum Oil***

*Syzygium aromaticum*, commonly known as clove oil, is a traditional spice that has been used for food preservation and possesses various pharmacological activities. *S. aromaticum* is rich in many phytochemicals, as follows: sesquiterpenes, monoterpenes, hydrocarbon, and phenolic compounds. Eugenyl acetate, eugenol, and  $\beta$ -caryophyllene are the most significant phytochemicals in clove oil. Anti-microbial, anti-oxidant, and anaesthetic activities, can boost the inclination to heal. Pests can also be killed by it. Numerous other oils, including lavender, thyme, lemongrass, orange, and mint, are also used to treat scabies [56].

Additionally, it works well when combined with coconut oil. It seems to have narcotic effects. Rashes and blisters can also be treated with it [57].

### ***Melaleuca Alternifolia (tea Tree) Oil***

Scabies affects approximately more than 130 million individuals worldwide. In the industrialised world, outbreaks in healthcare facilities and vulnerable areas have a substantial financial impact. In addition to its successful usage as a topical adjuvant agent for the treatment of crusted scabies, particularly in instances that did not answer to traditional treatments, tea tree oil has also shown potential acaricidal actions against scabies mites *in vitro*. The effectiveness of the currently prescribed gold standard treatments for scabies (oral ivermectin and topical permethrin) in the prospective is threatened by the emergence of acaricide resistance. It's unlikely that any new chemical entities will emerge anytime soon. Tea tree oil's combined acaricidal, antibacterial, antipruritic, anti-inflammatory, and wound-healing properties may have the power to significantly lessen the incidence of scabies infection and the bacterial problems that go along with it. This review provides an overview of the most recent research on the use of tea tree oil in the treatment of scabies. Larger-scale, randomised controlled clinical investigations are called for depending on the merits of the available findings for tea tree oil [58, 59].

The 5% *Melaleuca alternifolia* oil and active component terpinen-4-ol were highly effective in reducing mite survival times. Statistically significant differences in mite survival curves were observed for 5% Tea tree oil, 2.1% terpinen-4-ol, 5% permethrin, and ivermectin (100 micro/g of Emulsifying Ointment British Pharmacopoeia 88). Tea tree oil is a membrane-active biocide extracted from the tree *M alternifolia*. It is a principal antimicrobial in a wide range of pharmaceuticals sold in Australia, with the main active component being oxygenated terpenoids. The results suggest that *Melaleuca alternifolia* oil has a potential role as a new topical acaricide and confirms terpinen-4-ol as the primary active component [60, 61].

### ***Heliotropium Indicum***

An assessment of Siddha herbal preparation *Thelkodukku Chooranam* (*Heliotropium indicum*), a total number of 50 patients with scabies were treated with *Thelkodukku Chooranam* orally at the dose of 500 mg twice a day with milk after food and for external use; the fresh leaf paste was applied over the affected area twice a day for one month. Clinical assessment of scabies lesions based on clinical grading score; itching intensity was assessed at weekly intervals for four weeks. From the result, it was observed that oral and topical administration of *Thelkodukku Chooranam* significantly reduced all the signs and symptoms after

one month of treatment. As compared to baseline, *Thelkodukku Chooranam* treatment significantly reduced clinical grading score and itching grading score from  $3.02 \pm 0.08$  and  $2.04 \pm 0.099$  to  $0.08 \pm 0.03$  and  $0.04 \pm 0.03$  respectively ( $P < 0.001$ ). The complete disappearance of scabies lesions was observed in all patients. No adverse effect has been noticed during the study period. Hence it is concluded that *Thelkodukku Chooranam* exhibits scabicial activity and is a promising Siddha herbal preparation that has an effective and safe anti-scabies agent [62].

### ***Crinum Asiaticum***

Scabies is an enervating parasitic infestation of the skin caused by *Sarcoptes scabiei*, affecting 130 million people at any time. Globally, this neglected tropical disease is amenable to 0.07% of the total burden of disease. *Crinum asiaticum* Linn. (Amaryllidaceae) plant parts are used in traditional medicines used for the treatment and management of various ailments, including insecticidal properties. Studies evaluate the anti-scabies and mosquito-repellent activity of ethanol and aqueous extracts of *Crinum asiaticum* leaves. Ethanol extract of *C. asiaticum* showed  $100.00 \pm 0.00\%$  mortality of *Sarcoptes scabiei* at 10% concentration within 80 min. of contact and also at its 10% concentration; it provided  $97.00 \pm 0.42\%$  protection effect and  $78.25 \pm 0.53\%$  after 6 h treatment comparable to DEET. This present study revealed that the ethanol extract of *C. asiaticum* exhibited excellent scabicial activity against adult *Sarcoptes scabiei* mites and mosquito-repellent activity against mosquito vector *A. stephensi* [63].

### ***Lippia Multiflora Moldenke***

*Lippia multiflora* Moldenke, a perennial aromatic plant found primarily in tropical West Africa, yields lippia oil. Bush tea, Gambian tea bush, and healer herb are all names for it. Several studies have shown that the components of this plant have antihypertensive, anti-inflammatory, anti-analgesic, anti-pyretic, anti-malaria, anti-oxidant, anti-microbial, muscle relaxant, pedicucidal, and scabicial qualities. Linalool,  $\alpha$ -pinene,  $\beta$ -pinene, geraniol, limonene,  $\beta$ -cymene, thymol, terpineol, and citronellyl acetate are among the essential oils extracted from leaves. Body and head lice are known to be resistant to terpineol with  $\alpha$ -pinene, while  $\beta$ -pinene with  $\alpha$ -pinene is an efficient insecticide [64]. A 20 percent v/v dilution of lippia oil in mild liquid paraffin BP (British Pharmacopoeia) preparation of lippia oil applied to scabietic patients for 5 consecutive days resulted in 100% cure, compared to 87.5 percent cure for the same concentration of benzyl benzoate preparation. Lippia oil had fewer side effects and was more tolerable. Researchers and producers may be able to replace crude ingredients with lippia oil because it is an economically underutilised resource [65]. Another study found that *L.*

*multiflora* oil is a better and more efficient scabicide than benzyl benzoate. In a randomised, double-blind, and group parallel investigation, the researchers compared two topical emulsion formulations (Lippia oil emulsions A and B), each containing 20 percent weight-for-weight essential oil of Lippia multiflora (Lippia oil), to benzyl benzoate emulsion BP. On application for 3, 5, and 7 days, the percentage cure attained for the Lippia oil emulsions (A and B) was around 50 percent, 80 percent, and 80 percent, respectively, compared to 30 percent, 60 percent, and 70% for much the same therapy using the benzyl benzoate emulsion BP at a time [66].

### ***Nicotiana Tobacum***

*Sarcoptic scabies*-infested rabbits were treated with *Nicotiana tabacum* decoctions ad-lib at weekly intervals on 3, 2, and 1 occasions required for severely, moderately, and mildly infested rabbits, respectively, for complete healing of lesions and disappearance of different stages of *Sarcoptic scabiei*. Both macroscopic and microscopic examination of lesions was done throughout the period. Reinfestation was not observed even after 1 and a half months of treatment. Thus, tobacco decoction was highly effective in controlling *Sarcoptes scabiei* infestation in rabbits with no side effects. In addition, the decoction is convenient and simple to prepare, economical, costing only 1/10<sup>th</sup> of the cost involved in using acaricide [67].

### ***Tinospora Cordifolia***

The current study evaluated the clinical efficacy and safety of *Tinospora cordifolia* lotion, including its cure rate and clearance time compared with permethrin lotion. A single-blind, randomized, controlled, pilot clinical study was performed in three government institutions to investigate the clinical efficacy of *T. cordifolia* lotion in sixty-six clinically diagnosed scabies-infected patients. The patients were treated with *T. cordifolia* or permethrin lotions for three consecutive days for two weeks and a clinical assessment of each patient was performed for five weeks. *T. cordifolia* lotion and permethrin significantly reduced the mean global evaluation score after four weeks of treatment. The two lotions showed comparable effects as an anti-scabies agent. Moreover, the clearance time (days) and cure rate using the two lotions did not differ. Clinical improvement, mean clearance time and cure rate of *T. cordifolia* lotion are comparable with permethrin. *Tinospora cordifolia* lotion exhibits anti-scabies activity comparable with permethrin. Its incorporation as a therapeutic reagent in *Sarcoptes scabiei* infections is highly recommended [68].

### ***Denis Elliptica***

Rotenone was originally extracted from derris root (*Denis elliptica*) of which it constitutes 5-9 percent., and now from *Lonchocarpus nicou* (South American cuberoot), which has a content of about 7 percent. It is widely used in veterinary medicine for demodectic mange and as a constituent of flea powders. It is colorless, crystalline, and insoluble in water but readily soluble in alcohol, ether, acetone, chloroform, benzene, or carbon tetrachloride. Though toxic by mouth, it is not absorbed by the skin. For the trial in scabies cases, 1 gm of rotenone was dissolved in 3 cc. chloroform, and added, with vigorous shaking, to a mucilage of quince seed and Irish moss to make a 1-2 percent, lotion; 0.1 percent, sodium benzoate is added as a preservative [69].

### ***Allium Sativum***

Garlic is an alternative therapy for various parasites, therefore, the assumption that it might help with scabies infestations is convincing [70]. Garlic has a long history of use as a preventive and therapeutic medicinal plant in various cultures. Throughout antiquity, garlic has played important dietary and therapeutic roles. Garlic possesses hundreds of phytochemicals, including sulfur-containing compounds such as ajoenes (E & Z), allicin, sulphides (diallyl disulfide - DADS, diallyl trisulfide - DATS), and others, which make up 82% sulfur content. Enzymes like alliinase, sulfur-containing substances like alliin, and enzymatically generated compounds like allicin are among their constituents. The four garlic formulations are aged garlic extract (AGE), dried garlic powder (DGP), heated garlic juice (HGJ), and raw garlic juice (RGJ). Different types of garlic formulations have different pharmacological characteristics, and among the four garlic preparations, AGE is the most efficacious preparation. S-allyl cysteine, Allin, S-methyl-L-cysteine, cycloalliin, S-ethylcysteine, S-1-propionyl-L-cysteine, S-allylmercapto-L-cysteine, fructosyl-arginine, and beta-chlorogenin are some of the components of AGE [71]. Some of the medicinal plants and their active metabolites with significant scabicial activities are described in Table.(7) [72 - 93].

### **CLINICAL AND PRECLINICAL STUDIES**

Herbal products have become an important and indispensable part of public healthcare around the world [94]. Plant-based agents have been used in indigenous medicine for several years and are now entering clinical trials. However, to further widen their forum of acceptance, clinical trials of these herbal products should be encouraged. To prove the efficacy of clinical trials, it is advised to use single and consistent batches of formulations [95]. Direct and network meta-analyses were applied to 13 antiscabietic agents on 3 outcomes

(cure, persistent itching, and adverse events). Their probability of having the highest efficacy and safety was estimated and ranked. A network meta-analysis of 52 trials, including 9917 patients, indicated that permethrin (the reference treatment) had a significantly higher cure rate than sulfur, malathion, lindane, crotamiton, and benzyl benzoate. Combination permethrin plus oral ivermectin had a nonsignificantly higher cure rate than permethrin. Combination permethrin plus oral ivermectin was ranked highest in terms of cure, topical ivermectin in terms of persistent itching, and synergized pyrethrins in terms of adverse events. Based on clustered ranking, permethrin, oral ivermectin, and synergized pyrethrins seemed to retain a balance between cure and adverse events [96, 97].

**Table 7. Common traditional medicinal plants for the treatment and management of scabies.**

Vernacular Name	Botanical Name	Family	Parts Used	Active Metabolites	Pharmacological Significance	Refs.
Arrow-poison-tree	<i>Acokanthera schimperi</i>	Apocynaceae	Leaves	Triterpenoids, including lupeol, ursolic aldehyde	It is used to treat convulsion, oedema, warts, wounds, amnesia, syphilis, rheumatic pain, scabies, leprosy, elephantiasis, headaches, and amnesia.	72
Falling stars	<i>Calamagrostis aurea</i>	Fabaceae	Leaves	Not Known	Is used for elephantiasis, syphilis, scabies, intestinal parasites, tinea capitis, diarrhoea, leishmaniasis, as well as respiratory disease.	72, 73
Lippia	<i>Lippia adoensis</i>	Verbenaceae	Leaves	1,8-cineole, camphor and <i>para</i> -cymene, carvacrol	used for eczema and cutaneous fungal infections	74
Amargna	<i>Olinia rochetiana</i>	Oliniaceae	Leaves	.....	In eczema, scabies, and acne.	72
Black cohosh	<i>Actaea racemosa</i>	Euphorbiaceae	Roots and leaves	Triterpene glycosides, Actein, 27-deoxyactein, cimicifugoside M and cimicifugoside	It is used for scabies	75
Small taro	<i>Canna esculenta</i>	Araceae	Leaves and rhizome	$\Gamma$ -eudesmol, $\delta$ -cadinol, $\gamma$ -selinene, luciferin	It is used for skin diseases	76

Vernacular Name	Botanical Name	Family	Parts Used	Active Metabolites	Pharmacological Significance	Refs.
Smooth crotalaria	<i>Crotalaria pallida</i>	Fabaceae	Leaves, roots, and bark	Cyclopentylene, crotilidene, octacosane hydroxydihydrobovalide,	It is used for skin diseases	77
Caesar weed or Congo jute	<i>Urena lobata</i>	Malvaceae	Leaves	Alkaloids, cardiac glycoside, tannins, terpenoid	It is used in itching and scabies	78
Tall pine barren milkwort	<i>Polygala cymosa</i>	Urticaceae	Leaves	Apigenin, quercetin	In skin disorders	79
Rough Mexican clover	<i>Richardia scabra</i>	Rubiaceae	Leaves	Isopsoralen, Oleic acid	In skin disorders, pruritis, and scabies	80
Hard pear tree	<i>Graptopetalum pentandrum</i>	Santalaceae	Bark	Not known	In itching as well as eczema	81
Sannale gida	<i>Euphorbia heyneana</i>	Euphorbiaceae	Leaves and bark	Flavonoids, naringenin, quercetin	In skin Disorders	82
Spiny pigwee	<i>Amaranthus spinosus</i>	Amaranthaceae	Whole plant	Diglycoside flavonoids hesperidin, rutin, phenolic acid (E)-ferulic acid	In gonorrhea, piles, dermatitis and STD	80, 83
Licorice weed	<i>Scoparia dulcis</i>	Plantaginaceae	Leaves and flower	Benzoxazinone, phenylethanoid, flavone, and lignan	It is used for toothache and itching	80
Jersey cudweed	<i>Gnaphalium luteoalbum</i>	Asteraceae	Whole plant	5, 7, 3, 4 tetrahydroxy flavone; 5, 3, 4 trihydroxy flavonol	Use It is applied against dermatitis, arthritis, and tumours.	80
Papaya	<i>Carica papaya</i>	Caricaceae	Whole plant	Tannins, alkaloids, flavonoids, terpenes, anthraquinone, saponins, phenolics,	It treats hyperglycemia, dermatitis, hepatitis, constipation, scabies, rheumatoid arthritis.	84
Wild cabbage	<i>Brassica oleracea</i>	Cruciferae	Leaves and fruits	Indole-3-carbinole (I3C), sulforaphane and indoles	It treats a variety of skin conditions, including eczema, cancer, and gynaecological issues.	85

Vernacular Name	Botanical Name	Family	Parts Used	Active Metabolites	Pharmacological Significance	Refs.
Himalayan cedar	<i>Cedrus deodara</i>	Pinaceae	Leaves and bark	Wikstromal, matairesinol, dibenzylbutyrolactol	It is used for psoriasis, gastritis, hemorrhoids, and sexual difficulties.	86
Zebra cactus	<i>Haworthia aristata</i>	Asphodelaceae	Whole plant	Berberine, oxyberberine, berbamine, aromoline	It treats coughs and scabies.	83, 72
Common vervain	<i>Verbena officinalis</i>	Verbenaceae	Whole plant	Iridoids, phenylpropanoids, flavonoids, luteolin and terpenoids	It treats eczema, leukemia, TB, and helminthiasis.	77
Dwarf bulrush	<i>Typha minima</i>	Typhaceae	Whole plant	Trianthemine	It helps treat dermatitis, wounds, and other disorders that cause cutaneous itching.	76
African senna	<i>Senna didymobotrya</i>	Fabaceae	Whole plant	Alkaloids, flavonoids, saponins, steroids, tannins, terpenoids	It helps treat dermatitis, sores, and other conditions that cause skin irritation.	87
Fig-mulberry	<i>Ficus sycomorus</i>	Moraceae	Fruit juice	Tannins, flavonoids, saponins, glycosides and alkaloids	It treats scabies as well as boils.	88
Vernonia	<i>Vernonia lasiopus</i>	Asteraceae	Leaves	Alkaloids, phenols and flavonoids	It treats scabies, acne, and dermatitis.	88
Arrowhead	<i>Sagittaria secundifoli</i>	Aloaceae	Leaves	Tannin, saponins	It is applied to injuries, tumors, rashes, dermatitis, and acne.	88
Siam weed	<i>Chromolaena odorata</i>	Compositaeae	Leaf	Essential oil, flavonoids, oxalates, tannins, Antibiotic	Skin sepsis, scabies. Wound dressing	89
Thorny pigweed	<i>Amaranthus spinosus</i>	amaranthaceae	Whole plant	Tannins, saponins, hydrocyanic Acid anti-prostaglandin synthesis	Scabies, Eczema, Psoriasis, Burns & Sunburn, Insect bites, Scorpion stings, Cobra bites	90, 91,