

SCABIES IS A MICROSCOPIC PARASITE KNOWN AS THE HUMAN ITCH MITE: *SARCOPTES SCABIEI*

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DOI: <https://doi.org/10.5281/zenodo.20406831>

**How to cite this Article:** 1\*Prashant Mevada, 2Dr. Pruthviraj K. Chaudhary, 3Dr. Dhruvo Jyoti Sen and 4Harshil Satishbhai Chaudhari. (2026). Scabies is a Microscopic Parasite Known As The Human Itch Mite: *Sarcoptes Scabiei*. European Journal of Pharmaceutical and Medical Research, 13(5), 789-799.

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Article Received on 05/04/2026

Article Revised on 25/04/2026

Article Published on 01/05/2026

## ABSTRACT

The main cause of scabies is an infestation of the skin by the microscopic mite *Sarcoptes scabiei var. hominis*. These mites burrow into the upper layer of the skin, where they live, lay eggs, and cause an allergic reaction that results in intense itching and a rash. Scabies is not caused by a bacterium, virus, or fungus, but by a microscopic, burrowing **parasite** known as the human itch mite (*Sarcoptes scabiei var. hominis*). *Sarcoptes scabiei* (the human itch mite) is an obligate parasite that does not live or feed on chrysanthemums. However, chrysanthemum flowers are the natural source of pyrethrins, which are powerful insecticidal compounds used to make permethrin, the primary medicated cream prescribed to kill scabies mites and their eggs.

**KEYWORDS:** Mite, pyrethrin, chrysanthemum, eggs, stratum corneum, contagious.

## INTRODUCTION

Scabies is not an insect, but a parasitic infestation caused by the microscopic itch mite *Sarcoptes scabiei*. While scabies mites do not have flagella, their burrows under the skin often create a unique, wavy, "S-shaped" or thread-like track on the surface of the skin.

### Clarifying the Terms

- Not an Insect: Scabies mites are arachnids (part of the same family as ticks and spiders). They have eight legs as adults rather than the six found on insects.
- No Flagella: Flagella are whip-like structures used by microorganisms (like certain bacteria or protozoa) for movement. Scabies mites do not have or use flagella.

The "Thread-Like" Appearance: You might be confusing flagella with the visual appearance of a scabies burrow. The mature female mite burrows into the top layer of the skin (the stratum corneum) to live and lay eggs. This creates a fine, raised, grayish-white or skin-colored

"thread-like" track, which can look like a thin line or fiber on the skin.<sup>[1]</sup>



Figure 1: Chrysanthemum flower.

### Common Scabies Signs to Look For

Because the mites are only about 0.3 to 0.5 millimeters long, they are nearly impossible to see with the naked

eye. Instead of spotting the mite itself, healthcare providers look for the tracks they leave behind:

- **Burrows:** Serpentine or comma-shaped lines, often just a few millimeters to a centimeter long.
- **Predilection Sites:** These tracks and the accompanying rash are most commonly found in skin folds and areas with thin skin, such as between the fingers, on the wrists, inner elbows, armpits, and around the waist or genitals.
- **Intense Itching:** The severe, often sleep-disrupting itching is the hallmark of scabies. It is actually an allergic reaction to the mite's presence, movements, and waste products (feces) within the skin.

**Next Steps & Treatment:** If you suspect you have scabies, it is important to seek medical advice for an accurate diagnosis. Treatment typically involves the use of a prescription medicated cream or lotion (such as permethrin) applied from the neck down to kill the mites and their eggs. Under Scanning Electron Microscopy (SEM), the egg of the scabies mite (*Sarcoptes scabiei*) is an oval-shaped capsule, roughly 0.10 to 0.15 mm in length.

SEM imaging reveals distinct structural characteristics of the scabies egg:

- **Distinct Geometric Shell:** The outer layer of the eggshell (chorion) is covered in a highly organized pattern of minute, closely packed polygons (pentahedrons and hexahedrons).
- **Adhesive Glue:** The female mite glues the eggs to the floor of her skin burrow using a glycoprotein that replicates the exact geometric pattern of the eggshell, anchoring it securely.
- **Hatching Mechanism:** Observations under SEM show that developing larvae inside position themselves uniformly and use specialized hook-like

structures on their legs to crawl out from the eggshell. These eggs typically incubate in the skin for 3 to 4 days before hatching into larvae and migrating to the skin surface.

**The Chrysanthemum Connection:**

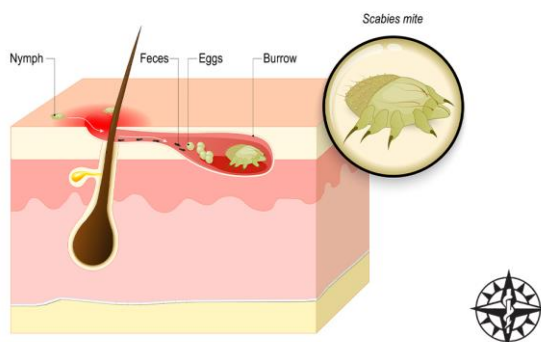
- **Pyrethrins:** The dried flower heads of the Dalmatian chrysanthemum (*Chrysanthemum cinerariifolium*) naturally produce pyrethrins, which attack the nervous systems of insects and mites.
- **Permethrin:** This is a synthetic, chemically stable version of natural pyrethrins. A 5% permethrin cream is the global standard of care for treating scabies.

### The Scabies Mite at a Glance

- **Type:** An obligate human ectoparasite (a tiny arthropod related to ticks and spiders).
- **Size:** Microscopic, measuring roughly 0.3 to 0.4 millimeters in length.
- **Behavior:** The female mite burrows into the upper layer of your skin, creating tunnels where she lays eggs and leaves waste.
- **Symptoms:** The intense itching, red bumps, and rashes are primarily an allergic reaction to the mites, their eggs, and their feces.<sup>[2]</sup>

### How It Spreads & Treatment

- **Transmission:** It spreads primarily through prolonged, direct, skin-to-skin contact.
- **Treatment:** Because it is a parasitic infestation, it requires prescription topical medications (such as permethrin cream) to kill the mites and their eggs.



**Figure 2: Mites in stratum corneum.**

- **Transmission Method:** Scabies is highly contagious and spreads primarily through direct, prolonged skin-to-skin contact with an infected person.
- **Secondary Transmission:** It can occasionally be transmitted by sharing clothing, bedding, or towels used by an infected person.

### The Mite's Action

The female mite burrows into the skin, lays eggs, and as the larvae hatch, they travel to the skin's surface, where they can spread to other areas of the body or to other people.

- **Not Related to Hygiene:** Scabies is not a sign of poor hygiene and can affect anyone, regardless of cleanliness.
- **Risk Factors:** The infestation spreads easily in crowded conditions, such as child care groups, schools, nursing homes, and prisons.

**Symptoms** usually appear 2–6 weeks after infestation, starting with intense itching that is often worse at night.

The mites are typically killed using prescription-strength lotions or oral medication.

Prescription topical creams and oral medications are the only reliable ways to kill scabies quickly. While the medications start killing mites immediately, the severe itching can take two to four weeks to fully subside.



**Figure 3: Infection on skin and scabies forming eggs.**

### Key Facts about the Cause of Scabies

#### Fast-Acting Treatments

- **5% Permethrin Cream:** The most common first-line treatment. It is applied from the neck down, left on for 8 to 14 hours (overnight), and washed off in the morning. A second treatment is usually required one week later to kill newly hatched mites.
- **Ivermectin:** An oral prescription pill. It is highly effective and often used if creams don't work or for

crusted scabies. It is typically taken as a single dose, followed by a second dose 7 days later.

- **Alternative Prescriptions:** Doctors may also prescribe 10–25% benzyl benzoate emulsion or 5–10% sulfur ointment.<sup>[3]</sup>



**Figure 4: Rash on skin due to scabies.**

### How to Stop Reinfection

Because scabies is highly contagious, you must take these steps simultaneously to prevent re-infestation.

1. **Treat the household:** All close contacts and household members must be treated at the same time, even if they have no symptoms.
2. **Decontaminate bedding and clothes:** On the first day of treatment, machine-wash all worn clothing,

towels, and bedding in hot water and dry on high heat (temperatures over for at least 10 minutes).

3. **Bag items you can't wash:** Any items that cannot be washed (like coats or shoes) should be sealed in a plastic bag and stored for at least 72 hours.

Yes, scabies is highly contagious and spreads easily through close, prolonged skin-to-skin contact. It is

caused by tiny *Sarcoptes scabiei* mites that burrow into the skin, causing severe itching and a red rash.

#### How it spreads

- **Skin-to-Skin Contact:** Transmission usually requires direct, lasting physical contact (like sleeping in the same bed, holding hands for a while, or sexual contact). Quick, casual contact (like a brief hug or handshake) is unlikely to spread the mites.
- **Shared Items:** While less common, mites can survive for 2 to 3 days off the human body. You can sometimes get it by sharing unwashed clothing, towels, or bedding used by an infected person.

#### Key Characteristics

- **Hidden Onset:** Symptoms can take up to 4 to 8 weeks to appear in a newly infected person, meaning you can unknowingly spread it to others during that time.
- **Not Related to Hygiene:** Anyone can get scabies; it has nothing to do with cleanliness or personal hygiene.
- **Outbreaks:** Because it spreads so rapidly, outbreaks are common in close-knit environments like households, schools, nursing homes, and daycare centers.

#### How to Stop the Spread

- **Treat the Household:** Everyone living with an infected person—as well as recent sexual partners—

must be treated at the same time, even if they show no symptoms.

- **Wash Everything:** On the first day of treatment, wash all bed linens, towels, and clothing in hot water (60°C or higher) and dry them on a hot cycle. Items that cannot be washed should be sealed in a plastic bag for at least 3 to 7 days. If you suspect you have scabies, it is best to consult a healthcare provider or dermatologist to confirm the diagnosis and receive prescription medicated creams.

**Primary symptoms** of scabies are an **intense, relentless itch** (which is usually worse at night) and a pimple-like or scaly rash.

- **Timeline:** If you have never had scabies before, symptoms can take **2 to 6 weeks** to appear. If you have had it before, symptoms often show up within **1 to 4 days**.
- **The Rash:** It often resembles small bug bites, hives, or tiny blisters. In infants, the rash can appear as tiny fluid-filled blisters anywhere on the body, including the palms and soles.
- **Mite Burrows:** You might notice tiny, raised, grayish-white or flesh-colored lines (often crooked) on your skin. These are the tunnels female mites dig to lay eggs.

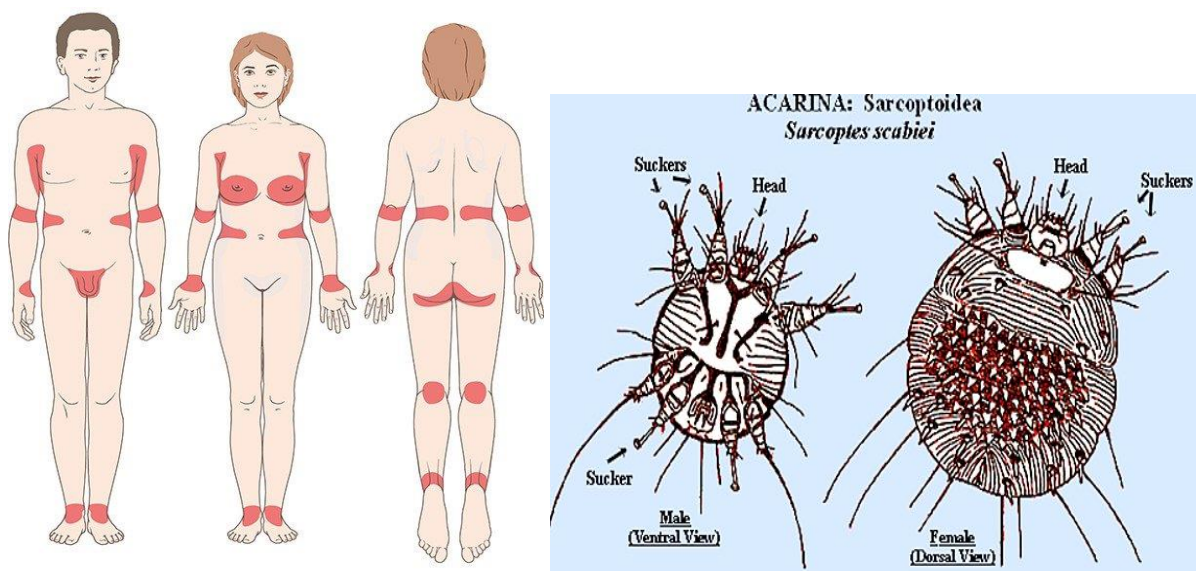


Figure 5: Action on both sex.

- **Common Locations:** Mites prefer skin folds and narrow cracks. Common areas include:
  - Between the fingers and toes
  - Wrists, elbows, and armpits
  - Around the waist, groin, and buttocks
  - Around the nipples, navel, and male genitals
  - The face, scalp, and neck (primarily in very young children)

#### Secondary Symptoms

- **Sores:** Intense scratching can break the skin, leading to painful sores and potentially bacterial infections like impetigo.

- **Crusted Scabies:** A severe, highly contagious form that primarily affects people with weakened immune systems. It features widespread, thick, crumbly crusts of skin. Surprisingly, this form may not cause the intense itching typical of standard scabies.<sup>[4]</sup>

Because scabies is highly contagious and easily spread through skin-to-skin contact, you should consult a healthcare provider for an accurate diagnosis and prescription treatment.

Scabies is a very common itchy skin condition caused by a tiny mite. Anyone of any age can get scabies; it is not caused by poor hygiene. Scabies can easily spread from person to person through skin-to-skin contact, including during sexual contact.

Scabies is treated primarily with **Permethrin (5% cream)**, the global first-line prescription medication. It is applied from the neck down, left on for 8 to 14 hours, and repeated in 7 days. Other prescription options include **Oral Ivermectin** or topical **Benzyl Benzoate**.

Because scabies is highly contagious, effective treatment requires a synchronized, multi-step approach.

### 1. Primary Medications

- **Permethrin 5% Cream:** The gold standard. Apply it to clean, dry skin from the neck down (including the soles of the feet and under fingernails). Leave it on overnight (8-14 hours) and wash it off. A second application is usually required 7 days later to kill any mites that hatched from eggs.
- **Oral Ivermectin:** An antiparasitic pill. It is highly effective but is typically reserved for severe (crusted) scabies or cases where creams fail. It requires two doses taken with food, 7 to 14 days apart, and should generally be avoided by pregnant women or children under 15 kg.
- **Alternatives:** Benzyl benzoate (10-25%) or Sulfur ointment (5-10%) are alternative topicals often used when permethrin is unavailable or poorly tolerated.

### 2. Symptom Management

- **Itchiness:** The itch can last for 2 to 4 weeks *after* the mites are dead. Over-the-counter antihistamines (like cetirizine) and cool compresses can provide relief.
- **Steroid creams:** A doctor may prescribe a mild topical steroid to reduce inflammation and redness, though it will not kill the mites.

### 3. Essential Prevention Steps

To prevent immediate reinfection, everyone in your household and any recent sexual partners must be treated simultaneously, even if they show no symptoms. On the day the first treatment begins, you must wash all bedding, towels, and clothing used in the last 3 days in hot water (at least 60°C or (140°F) and dry them on a

high heat cycle. Items that cannot be washed should be sealed in plastic bags for at least 72 hours.

**Sourcing & Medical Care:** Scabies requires prescription medication to cure; over-the-counter permethrin in lower doses (typically 1%) is only used for head lice, not scabies.

*Disclaimer: This information is for educational purposes. Always consult a healthcare provider or a verified Practo dermatologist to get a definitive diagnosis and the proper prescription dosage for your situation.*

Permethrin 5% cream is the standard, first-line medical treatment for scabies. It is a safe, topical medication that paralyzes and kills both the mites and their eggs. A single application is usually highly effective.<sup>[5]</sup>

### How to Apply the Cream

For the best results, follow this application process closely:

- **Coverage:** Apply a thin layer of the 5% cream over your entire body, starting from the neck down to the soles of your feet.
- **Target Areas:** Pay special attention to hidden areas where mites hide, such as between fingers and toes, under fingernails, armpits, wrists, and the groin.
- **Face & Scalp:** Only apply to the face and scalp if specifically directed by your doctor, particularly in infants and the elderly.
- **Duration:** Leave the cream on your skin for **8 to 14 hours**. It is highly recommended to apply it before bed and wash it off in the morning.
- **Removal:** After 8-14 hours have passed, take a bath or shower to thoroughly wash the cream off.

### What to Expect and When to Retreat

- **Itching:** Itching may persist for several weeks after the mites are dead because your skin is reacting to the dead mites and their waste. Do not re-apply the cream immediately just because of itching.
- **Retreatment:** While one application usually cures the infection, a second application 7 to 14 days later is sometimes necessary if you still see live mites or new burrows.

### Crucial Prevention Steps

Because scabies is highly contagious, treating yourself is not enough to stop reinfection.

- **Treat Contacts:** Everyone you live with and any close sexual partners must be treated at the same time, even if they do not have symptoms.
- **Wash Bedding:** On the day you begin treatment, wash all bed linens, towels, and recently worn clothing in hot water and dry them on high heat.
- **Non-Washable Items:** Place items that cannot be washed (like heavy coats or stuffed animals) into

sealed plastic bags and leave them sealed for at least 72 hours.

### Important Safety Information

- **Age:** Permethrin 5% cream is generally safe for adults and children over 2 months of age.
- **Allergies:** Consult a doctor before using if you are pregnant, breastfeeding, or have known allergies to chrysanthemums.
- **Product Formulations:** Ensure you purchase the **5% cream for scabies**. Do not confuse it with 1% permethrin, which is typically used for head lice.

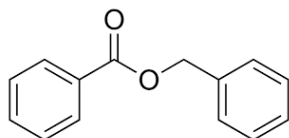


Figure 6: Benzyl benzoate.

To compare products or access clinical support, you can look up specific brands through 1mg Permethrin. If you need to review side effects or application instructions from an authoritative clinical source, you can consult the doctor.

Permethrin is a synthetic pyrethroid insecticide and antiparasitic medication used to treat scabies and lice, and as a repellent for ticks and mosquitoes. It acts on the nervous system of insects and mites, causing paralysis and death.

### Medicinal Uses (Topical)

- **Scabies:** Apply a 5% cream to the entire body (neck down), leave on for 8–12 hours, then wash off.

- **Head Lice:** Apply a 1% formulation to the scalp and hair, leave for 10 minutes, and rinse.
- **Safety & Side Effects:** It is generally safe for adults and children, but can cause mild skin irritation, redness, or a rash.

### Insect Repellent (Clothing & Gear)

- **Application:** Used as a 0.5% spray specifically for treating clothing, tents, and boots.
- **Mechanism:** It kills or repels mosquitoes and ticks that land on the fabric.
- **Safety:** **Never apply 0.5% clothing-grade permethrin directly to the skin**, as it metabolizes differently than medical-grade creams.

### Local Availability & Resources

**Pyrethrin I: Formula & Weight:** (C<sub>21</sub>H<sub>28</sub>O<sub>3</sub>); Molar mass: (328.45g/mol)

**Natural vs. Synthetic:** Pyrethrin I is one of the six active insecticidal esters collectively known as *pyrethrins*. While *pyrethrins* refer specifically to the natural botanical extracts, their chemical structures served as the blueprint for *pyrethroids*. Pyrethroids are human-made, synthetic analogs (like permethrin or cypermethrin) engineered to be chemically stable and longer-lasting in sunlight.

Table 1: Natural products.

Group	Pyrethrin I			Pyrethrin II		
	Pyrethrin I	Cinerin I	Jasmolin I	Pyrethrin II	Cinerin II	Jasmolin II
Chemical compound	Pyrethrin I	Cinerin I	Jasmolin I	Pyrethrin II	Cinerin II	Jasmolin II
Chemical structure						
Chemical formula	C <sub>21</sub> H <sub>28</sub> O <sub>3</sub>	C <sub>20</sub> H <sub>28</sub> O <sub>3</sub>	C <sub>21</sub> H <sub>30</sub> O <sub>3</sub>	C <sub>22</sub> H <sub>28</sub> O <sub>5</sub>	C <sub>21</sub> H <sub>28</sub> O <sub>5</sub>	C <sub>22</sub> H <sub>30</sub> O <sub>5</sub>
Molecular mass (g/mol)	328.4	316.4	330.5	372.5	360.4	374.5
Boiling point (°C)	170	137	162	200	183	195
Vapor pressure at 25 °C (mmHg)	2.03×10 <sup>-5</sup>	1.13×10 <sup>-6</sup>	2.56×10 <sup>-6</sup>	3.98×10 <sup>-7</sup>	4.59×10 <sup>-7</sup>	3.67×10 <sup>-6</sup>
Solubility in water (mg/L)	0.2	0.085	0.045	9.0	0.03	0.67

### Toxicity and Safety

**Mammals:** Pyrethrin I breaks down quickly in the presence of UV light and oxygen, making it relatively safe for humans and dogs when used properly. However, it is highly toxic to cats, fish, and aquatic invertebrates.

The pyrethrins are a class of organic compounds normally derived from *Chrysanthemum cinerariifolium* that have potent insecticidal. Pyrethrins are pesticides

found naturally in some chrysanthemum flowers. They are a mixture of six chemicals.<sup>[6]</sup>

### Pyrethrin I

**Structure:** It is an ester combining chrysanthemic acid with pyrethrolone.

**CAS Number:** 121-21-1, **Molecular Formula:**  $C_{21}H_{28}O_3$

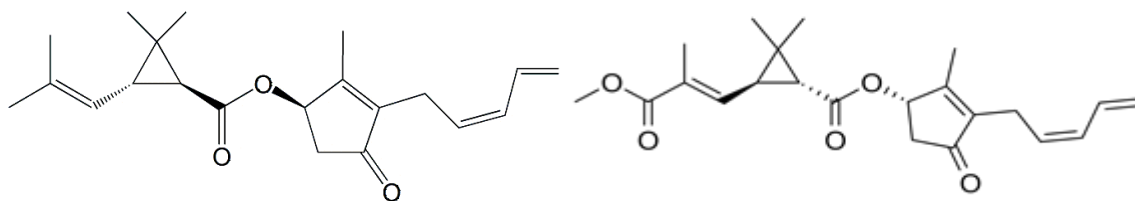


Figure 7: Pyrethrin I & Pyrethrin II.

**IUPAC Name:** (1S)-2-Methyl-4{-oxo-}3{-}(2Z){-penta-}2,4{-dien-1-yl}cyclopent-}2{-en-}1{-yl}(1R,3R){-2,2-dimethyl-}3{-(-2-methylprop-}1{-en-}1{-yl}cyclopropane-}1{-carboxylate}}

**Pyrethrin II: CAS Number:** 121-29-9, **Molecular Formula:**  $C_{22}H_{28}O_5$

**IUPAC Name:** {cis-}[1S]{-2-methyl-}4{-oxo-}3{-}[(2Z){-penta-}2,4{-dienyl}cyclopent-}2{-en-}1{-yl}[(1R,3R){-3-[(E){-3-methoxy-}2{-methyl-}3{-oxoprop-}1{-enyl}-2,2-dimethylcyclopropane-}1{-carboxylate}]}

- **Formula:** ( $C_{22}H_{28}O_5$ )
- **Molecular Weight:** (372.45g/mol)
- **Structure:** It is an ester consisting of a cyclopropane core combined with a pyrethrolone ring. It differs from

Pyrethrin I by having a methyl ester group instead of a standard methyl group.

- **Properties:** It is an oil-soluble liquid that degrades rapidly when exposed to air and light.

### Mechanism of Action & Uses

- **Neurotoxin:** It interferes with the sodium ion channels in the nerve axons of insects, causing continuous nerve impulses, which result in rapid knockdown and paralysis.
- **Commercial Applications:** Thousands of tons are produced annually to manage public health pests (such as mosquitoes and lice) and agricultural insects.

### Environmental & Safety Profile

- **Mammalian Safety:** It is generally considered safe for humans and pets because the mammalian body breaks it down rapidly, though high exposure can lead to mild neurological symptoms.
- **Botanical Extraction:** Pyrethrin II is one of six active components found in pyrethrum extract.

- Pyrethrin II  $C_{22}H_{28}O_5$ . Pyrethrin II is a natural organic compound also called pyrethrolone ester of chrysanthemum monocarboxylic acid.
- Pyrethrin I - The pyrethrins are a class of organic compounds normally derived from *Chrysanthemum cinerariifolium* that have potent insecticidal.
- Pyrethrin II - Pyrethrin II is an organic compound that is a potent insecticide.

Permethrin is a medication and an insecticide. As a medication, it is used to treat scabies and lice. It is applied to the skin as cream.



Figure 8: SEM of insect.

**Permethrin** is a medication and an insecticide. As a medication, it is used to treat scabies and lice. It is applied to the skin as a cream or lotion. As an insecticide, it can be sprayed onto outer clothing or mosquito nets to kill the insects that touch them. Side effects include rash and irritation where it is applied. Use during pregnancy appears to be safe, and it is approved for use on and around people over the age of two months in the United States. Permethrin is in the pyrethroid family of medications. It works by disrupting the function of the neurons of arthropods such as lice, mites, insects, and shrimp, making it highly toxic to these animals. It is also highly toxic to fish. It is of low toxicity to birds and mammals. However, cats are more sensitive to it than other mammals due to much slower metabolism.

Permethrin was discovered in 1972. In 2022, it was the 351st most commonly prescribed medication in the United States, with more than 40,000 prescriptions.<sup>[7]</sup>

Scabies is caused by the *Sarcoptes scabiei* mite, an eight-legged, microscopic parasite. It has a round, tortoise-like body that is ventrally flattened and dorsally convex. You

cannot see it with the naked eye, but under a microscope, its highly specialized anatomy becomes visible.



Figure 9: Permethrin & Benzyl benzoate.

#### Key anatomical features of the scabies mite include

- **Size & Shape:** The body is oval, eyeless, and covered with cuticular spines, scales, and bristles (setae). Females are slightly larger (0.3-0.45mm long) than males.
- **Legs:** Adults have four pairs of short, cylindrical, segmented legs. The front two pairs end in long, tubular processes known as suckers (pulvilli). The back pairs end in long bristles.
- **Note on gender:** In males, suckers are found on all legs except the third pair, which helps distinguish them from females.
- **Mouthparts (Capitulum):** The front of the body features a jaw-like structure. The mite uses these specialized mouthparts to secrete proteolytic enzymes that dissolve skin cells, allowing it to burrow into the stratum corneum (the top layer of the epidermis).

#### Life-Stage Differences

- **Larvae:** When eggs hatch, the young have only three pairs of legs.
- **Nymphs & Adults:** After molting, they develop four pairs of legs.

Benzyl benzoate is an organic compound that acts as an acaricide, scabicide, and pharmaceutical excipient. It is primarily used to treat scabies and head lice by destroying the parasites' nervous systems, and is also used in the fragrance and cosmetics industries as a solvent and fixative.

#### Medical Uses

- **Treatment:** It is applied topically as a lotion (typically in 10% to 25% concentrations) to treat scabies and lice.
- **Mechanism:** It acts by paralyzing and killing mites and lice, including their ova (eggs).
- **Application:** For scabies, it is generally applied to the entire body from the neck down, left on for 24 hours, and followed by a bath. A second application is often required.
- **Caution:** Because it can cause skin irritation, healthcare professionals may consider alternative treatments like permethrin or ivermectin, particularly for children or individuals with sensitive skin.<sup>[8]</sup>

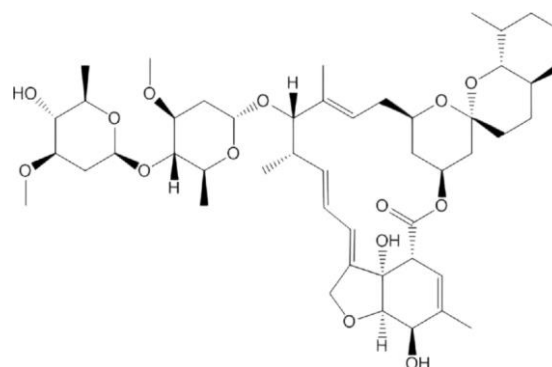


Figure-10: Ivermectin

#### Fragrance and Industrial Uses

- **Fixative:** It is a key ingredient in fine fragrances, helping to anchor base notes and extend the longevity and sillage (scent trail) of perfumes.

- **Solvent & Stabilizer:** It is utilized as a solvent to thin out viscous essential oils and as a stabilizing agent to blend volatile oils in creams, lotions, candles, and reed diffusers.
- **Excipient:** It serves as a preservative, solubilizing agent, and plasticizer in various pharmaceutical and cosmetic formulations.

#### Safety and Storage

- **Skin Sensitivity:** It can be highly irritating to delicate tissues (e.g., eyes and mucous membranes). It is intended strictly for external use only.
- **Storage:** To maintain its stability and shelf life, it should be stored in tight, light-resistant containers in a cool, dry place away from excessive heat (over 40°C).

Benzyl benzoate is an organic compound which is used as a medication and insect repellent. As a medication it is used to treat scabies. Benzyl benzoate is used to treat lice and scabies infestations. This medicine is believed to be absorbed by the lice. Scabies is a highly contagious skin condition caused by a microscopic mite that burrows into the skin, causing an intense, itchy rash. Symptoms typically take 4-6 weeks to develop after exposure, or just 1-4 days if you have been infected previously.

#### Key Symptoms

- **Intense Itching:** The most common symptom, which is typically much worse at night and can disrupt sleep.
- **Rash:** A pimple-like (papular) rash, small blisters, or scaly patches.
- **Burrow Tracks:** Tiny, raised, grayish-white or skin-colored wavy lines that look like pencil marks on the skin, indicating where the mite has tunneled.
- **Sores:** Resulting from severe scratching, which can sometimes lead to secondary bacterial skin infections.

#### Common Body Areas Affected

Mites prefer warm places on the body.

- **Adults and Older Children:** Between the fingers and toes, wrists, elbows, armpits, waist, buttocks, breasts, and genitals.
- **Infants and Young Children:** Often affects the face, scalp, neck, palms of the hands, and soles of the feet.

**Severe Form: Crusted Scabies:** Individuals with weakened immune systems may develop **crusted (or Norwegian) scabies**, a severe infestation characterized by thick, crusty, scaly skin. This form may not itch, but it spreads extremely easily. Scabies can spread through close, long-term person-to-person contact. This may be within a family, child care group, school class, or a place where people live together, such as a nursing home or prison. Because scabies spreads easily, healthcare

professionals often treat the whole family or any close contacts.

Scabies is easy to treat. Medicated skin creams or pills kill the mites that cause scabies and their eggs. But itching may go on for weeks after treatment.<sup>[9]</sup>

#### Symptoms

##### Scabies symptoms include

- Intense itching and often worse at night.
- Thin, wavy tunnels made up of tiny blisters or bumps on the skin.

Scabies is often in the skin folds. But scabies can appear on many parts of the body. In adults and older children, scabies is most often found:

- Between the fingers and toes and on the soles of the feet.
- Around the waist.
- On the insides of the wrists, in the armpits and on the inner elbows.
- On the chest and buttocks.
- Around the nipples and belly button.
- Around the genitals.

In infants and young children, scabies most often are on the:

- Fingers.
- Scalp and face.
- Palms of the hands.
- Soles of the feet.

If you've had scabies before, symptoms may start within a few days after getting the mites. If you've never had scabies, it can take up to six weeks for symptoms to start. You can still spread scabies even if you don't have symptoms yet. Many skin conditions, such as dermatitis or eczema, also cause itching and small bumps on the skin. Your healthcare professional can find the cause of your symptoms and prescribe the right treatment.

**Causes:** A tiny, eight-legged mite causes scabies. The female mite burrows just under the skin. It makes a tunnel where it lays eggs. The eggs hatch, and the mite larvae travel to the surface of the skin, where they become adults. These mites can then spread to other areas of the skin or to the skin of other people. The itching comes from the body's allergic reaction to the mites, their eggs and their waste. Close skin-to-skin contact and, less often, sharing clothing or bedding with a person who has scabies can spread the mites. Pets don't spread scabies to humans. The scabies mites that affect animals don't survive or reproduce in people.

**Complications:** A common complication of scabies is a bacterial infection. Scratching too much can break the skin and let in bacteria that cause the infection.

A worse type of scabies, called crusted scabies, may affect certain people including:

- Young children.
- People who live in a group setting.
- People with weakened immune systems, such as those with HIV or lymphoma, or people who have had organ transplants.
- Older people.

Crusted scabies makes the skin crusty and scaly. It affects large areas of the body. It spreads easily and can be hard to treat. People with crusted scabies need quick treatment with both a prescription pill and a skin cream.

People with crusted scabies have high numbers of mites. Crusted scabies might not itch, or itching may be mild.

**Prevention:** To prevent scabies from coming back and to keep the mites from spreading to other people, take these steps:

- **Wash all clothes and linens.** Heat kills the mites and their eggs. Use hot, soapy water to wash all clothing, towels and bedding used in the three days before beginning treatment. Dry with high heat. Dry-clean items you can't wash at home.



**Figure 11: Michael Elliott and Johann Zacherl [Permethrin inventor].**

- **Starve the mites.** Place items you can't wash in sealed plastic bags. Leave them in an out-of-the-way place for a week. Mites die after a few days without food.
- **Clean and vacuum.** It's a good idea to clean your home to prevent scabies from spreading. This is especially true for people with crusted scabies. Vacuum furniture, carpets and floors to remove scales and crusts that may have scabies mites.

Permethrin was invented in 1972 by a team of chemists led by **Michael Elliott; CBE, FRS, FRSC** [30 September 1924–17 October 2007] at the Rothamsted Experimental Station in England. It is a synthetic pyrethroid, chemically engineered to mimic the natural insecticidal compounds (pyrethrins) found in chrysanthemum flowers.

### History and Development

- **Natural Origins:** For centuries, extracts from chrysanthemum flowers (pyrethrum) were used as insecticides, but they were highly unstable in sunlight and broke down quickly.
- **The Breakthrough:** Elliott's team sought to create a synthetic alternative that retained the insect-killing properties but could withstand sunlight. They successfully synthesized permethrin in 1972.
- **Impact:** Permethrin became the first pyrethroid that was stable enough for large-scale agricultural and public health applications

Pyrethrins are not credited to a single inventor, as they are a naturally occurring group of insecticidal compounds extracted from the dried flower heads of the *Chrysanthemum cinerariifolium* daisy. However, the history of pyrethrins involves a few key pioneering figures:

**Johann Zacherl** (1814–1888): An Austrian industrialist who popularized the insecticide globally in the mid-19th century. Johann Zacherl (1814 – 30 June 1888) was an Austrian inventor, industrialist and manufacturer who made a fortune in the late 19th century selling dried flower heads of *Chrysanthemum cinerariifolium* as an insecticide. He learned of the powder's properties during travels in the Caucasus and launched the famous commercial product "Zacherlin".<sup>[10]</sup>

- **Hermann Staudinger and Lavoslav Ružička:** Two chemists who successfully determined the chemical structures of pyrethrins I and II in 1924, unlocking the door for man-made synthetic analogues.
- **First Synthetic Pyrethroid (Allethrin):** Discovered by researchers Milton S. Schechter and F. B. LaForge in 1949. This laid the groundwork for modern, synthetically modified versions used today.

Because natural pyrethrins are broken down by sunlight, scientists later developed more stable, man-made versions known as *pyrethroids* (such as permethrin). The history of pyrethroids and their impact on agriculture and health can be explored further.

Pyrethrins are a class of six naturally occurring organic compounds with potent insecticidal properties, extracted from the flowers of *Chrysanthemum cinerariifolium*. They are widely used as biodegradable, low-toxicity insecticides in households, agriculture, and public health due to their ability to rapidly paralyze insects on contact.

### Key Chemical Properties

- **Composition:** Pyrethrins consist of six active insecticidal esters, broadly divided into Category I (based on chrysanthemic acid) and Category II (based on pyrethric acid).
- **Mechanism of Action:** They target the insect's central and peripheral nervous systems by interacting with voltage-gated sodium channels,

causing repetitive nerve impulses, paralysis, and quick insect "knockdown".

- **Degradation:** Natural pyrethrins break down rapidly when exposed to sunlight, air, and moisture. Because of this instability, they are often paired with synergists like piperonyl butoxide (PBO) to prevent the insect from metabolizing the chemical, prolonging its effectiveness.

#### Uses and Applications

- **Agriculture & Gardening:** They are popular in organic farming and home gardens because they degrade quickly and leave no objectionable residues on food crops.
- **Household & Public Health:** Pyrethrins are highly effective for fogging and spraying to control mosquitoes, flies, bedbugs, and ants.
- **Medical & Veterinary:** Because of their low mammalian toxicity, they are utilized in pet shampoos, topical lice treatments, and certain FDA-regulated head lice formulas for humans.

#### Safety and Environmental Impact

- **Toxicity:** While natural pyrethrins are safe enough for direct human and pet application, they are highly toxic to aquatic life (fish, aquatic insects) and honey bees.
- **Synthetic Counterparts:** To address the rapid degradation of natural pyrethrins, scientists created synthetic versions called **pyrethroids**. While pyrethroids last much longer in the environment, they are more potent.

For scabies, **permethrin (a 5% cream)** is the recommended pyrethrin derivative. It kills the mites and their eggs on contact. Apply a single head-to-toe layer (neck down), leave it on for 8 to 14 hours overnight, then wash it off.

#### How it Works & Differences

- **Natural vs. Synthetic:** While natural pyrethrins (extracted from chrysanthemum flowers) are sometimes used for head or pubic lice, a synthetic form called **permethrin** is the clinical standard for scabies.
- **Mechanism:** It paralyzes the mites and their eggs by disrupting their nervous systems.

Scabies on skin is an intensely itchy skin condition caused by the tiny *Sarcoptes scabiei* mite. The mites burrow under your skin to live and lay eggs, triggering an allergic reaction that causes a rash of tiny, red bumps. It is highly contagious and spreads through prolonged skin-to-skin contact.

#### Common Symptoms

- **Severe Itching:** Often worsens dramatically at night.
- **Visible Tracks:** Short, wavy, silver-colored or threadlike lines (burrows) on the skin.

- **Rash:** Pimple-like bumps that can appear anywhere but are most commonly found in skin folds. Most Affected Areas Between the fingers and toes Wrists and elbows
- Armpits, waistline, and groin area
- Around the breasts and genitals

#### CONCLUSION

Scabies requires prescription medication to kill the mites and their eggs. Left untreated, it will not resolve on its own. Topical Creams: The most common treatment is permethrin cream, applied from the neck down and left on for 8 to 14 hours before washing off. Oral Medications: In severe cases or when creams are ineffective, doctors may prescribe a pill called ivermectin. Household Treatment: Anyone you have lived with or had close physical contact with must be treated at the same time to prevent infestation. Decontamination: Wash all clothing, bedding, and towels used in the last three days in hot water (above 50°C/122°F) and dry on high heat. Items that cannot be washed should be sealed in plastic bags for up to a week.

#### REFERENCE

1. L. Arlian. "Biology, host relations and epidemiology of *Sarcoptes scabiei*". Annual Review of Entomology, 1989; 34: 139–61.
2. Meyersburg D, Hoellwerth M, Brandlmaier M, Handisurya A, Kaiser A, Prodingler C, et al. "Comparison of topical permethrin 5% vs. benzyl benzoate 25% treatment in scabies: a double-blinded randomized controlled trial". The British Journal of Dermatology, 2024; 190(4): 486–491.
3. Boffetta P, Desai V. "Exposure to permethrin and cancer risk: a systematic review". Critical Reviews in Toxicology, 2018; 48(6): 433–442.
4. Elliott M, Farnham AW, Janes NF, Needham PH, Pulman DA, Stevenson JH. "A photostable pyrethroid". Nature, 1973; 246(5429): 169–170.
5. Dhana A, Yen H, Okhovat JP, Cho E, Keum N, Khumalo NP. "Ivermectin versus permethrin in the treatment of scabies: A systematic review and meta-analysis of randomized controlled trials". Journal of the American Academy of Dermatology, 2018; 78(1): 194–198.
6. Linnett PJ. "Permethrin toxicosis in cats". Australian Veterinary Journal, 2008; 86(1–2): 32–35.
7. Nakagawa LE, do Nascimento CM, Costa AR, Polatto R, Papini S. "Persistence of indoor permethrin and estimation of dermal and non-dietary exposure". Journal of Exposure Science & Environmental Epidemiology, 2020; 30(3): 547–553.
8. Richardson JA. "Permethrin spot-on toxicoses in cats". Journal of Veterinary Emergency and Critical Care, 2000; 10(2): 103–106.
9. Dymond NL, Swift IM. "Permethrin toxicity in cats: a retrospective study of 20 cases". Australian Veterinary Journal, 2008; 86(6): 219–223.
10. Berger-Preiess E, Preiess A, Sielaff K, Raabe M, Ilgen B, Levsen K. "The Behaviour of Pyrethroids Indoors: A Model Study". Indoor Air., 1997; 7(4): 248–262.