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Small but Mighty Enemies of the Skin: Scabies Mites and Bedbugs

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This review offers an overview of scabies and bedbug infestations, covering their characteristics, life cycles, symptoms, diagnosis, and treatment methods. These parasitic conditions are significant dermatological concerns caused by *Sarcoptes scabiei* and bedbug species such as *Cimex lectularius* and *Cimex hemipterus*, respectively. Scabies mites burrow into the skin, causing intense itching and various skin lesions, while bedbugs are nocturnal insects that feed on human blood, leading to itchy, red lesions. These infestations involve multiple stages, with scabies mites being active at temperatures above 20℃ and bedbugs capable of surviving for extended periods without feeding under optimal conditions. Diagnosis often relies on clinical examination, dermoscopy, microscopic analysis of the skin for mites, eggs, or feces in the case of scabies, and detailed inspections for bedbugs. Treatment for scabies involves applying permethrin cream, while bedbug bites generally resolve within a few weeks with symptomatic treatment to prevent secondary infections. The increasing incidence of these infestations calls for heightened awareness and understanding among healthcare providers and the public to effectively manage and control their spread.

Key Words: Bedbugs, *Cimex hemipterus*, *Cimex lectularius*, *Sarcoptes scabiei*, Scabies

INTRODUCTION

Infectious diseases, particularly scabies and bedbugs, have recently been resurgent in South Korea. This has become a social issue due to the skin problems caused by scabies mite infections. With the increase in the elderly population, more domestic scabies patients have been reported, especially in nursing and convalescent hospitals. In the early 1980s, scabies accounted for 10% of dermatology outpatients, but it gradually decreased to less than 1% in the 1990s. However, due to the increase in nursing facilities and lack of awareness about scabies, delayed diagnosis and transmission have led to a resurgence of scabies. According to the Health Insurance Review & Assessment Service data, in 2010, 51,331 cases of scabies were reported annually[1]. The Korea Disease Control and Prevention Agency has released a guide for preventing and managing scabies in response to the rising number of cases in the country. The guide is based on diagnostic, treatment, and prevention guidelines from the United States and Europe and aims to address the seriousness of the public health problem caused by scabies[2-4]. South Korea's Korean Dermatological Association published the national scabies treatment guidelines in the Journal of the Korean Dermatological Association as a critical project for scabies eradication in 2023[1,5].

In 2023, South Korea experienced a resurgence of bedbugs,

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which had not been seen in the country for 40 years. Bedbugs were reported in homes, exam study accommodations, dormitories, and saunas. People began to fear the tiny pests and hesitated to sit in subways. Understanding bedbugs and scabies mites accurately and educating people about preventing and dealing with infestations is essential.

WHAT ARE SCABIES AND BEDBUGS?

Scabies is a skin infection caused by a scabies mite (*Sarcoptes scabiei*). This mite belongs to the family *Sarcoptidae* and can cause diseases by burrowing into the skin of humans or animals. It can parasitize around 40 different species of animals, including humans. The mites that parasitize humans and those that parasitize animals are different. In Korea, three types of scabies mites have been identified: the human scabies mite (*Sarcoptes scabiei* var. *hominis*), the dog scabies mite (*S. scabiei* var. *canis*), and the pig scabies mite (*S. scabiei* var. *suis*). The human scabies mite is the one that causes disease in humans and is usually referred to as the scabies mite in clinical settings. The female mite is larger than the male, with a length of approximately 0.30~0.45 mm and a width of 0.25~0.35 mm, while the male is about half the size of the female and is difficult to see with the naked eye (Fig. 1A). The mite has a gnathosoma (mouthpart) and an undivided idiosoma (body), with larvae and adults having 8 short, disc-shaped, stubby legs. The mite does not have eyes or respiratory organs, but long bristles are on the third pair of legs[6].

Bedbugs are insects that feed on human blood and belong to the family *Cimicidae*, order *Hemiptera*, class *Insecta*, and phylum Arthropoda (Fig. 1B). They are nocturnal creatures commonly found in the crevices of bedding or mattresses, hence the name "bed bug". These pests feed on the blood of both humans and animals. There are over 110 known species across 24 genera globally, including the common bedbug (*Cimex lectularius*) found in temperate and subtropical regions and the tropical bedbug (*Cimex hemipterus*) found in subtropical and tropical areas. Both species are found in Korea and feed on human blood[7] (Table 1).

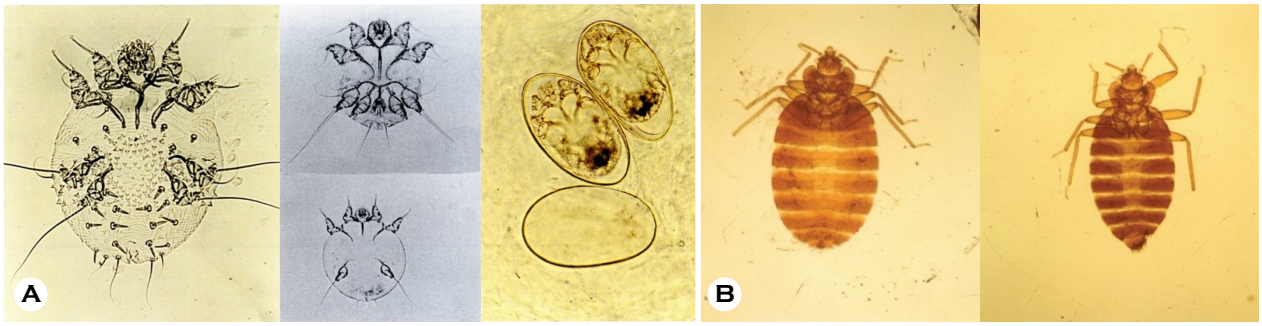

Fig. 1. (A) Photographs of a female (left panel) and a male (center panel, top), larva (center panel, bottom), and eggs (right panel) of a human scabies mite; Photo credit: Baik Kee Cho, used with permission; (B) A female (left panel) and male (right panel) bedbug; Photo credit: Baik Kee Cho, used with permission

Table 1. Classification and characteristics of *Sarcoptes scabiei* var. *hominins*, *Cimex hemipterus*, and *Cimex lectularius*

Species	Classification	Size	Life cycle	Habitat	Feeding	Development time
Sarcoptes scabiei	Arthropoda > Arachnida > Acari > *Sarcoptidae*	Approximately 0.3~0.4 mm	Egg, Larva, Nymph, Adult	Human skin	Feeds on materials in the skin	About 10~14 days from egg to adult
Cimex hemipterus, *Cimex lectularius*	Arthropoda > *Insecta* > *Hemiptera* > *Cimicidae*	Approximately 4~5 mm	Egg, Nymph, Adult	Bed frames, mattresses, furniture, behind wallpapers	Feeds on human blood	From 5 weeks to 4 months, depending on the condition

LIFE CYCLE AND HABITS

The human scabies mite goes through a life cycle of various stages, such as egg, larva, nymph, and adulthood. After mating once with a male on the skin's surface, the female adult burrows approximately 1~2 mm deep into the skin's keratin layer, while the male dies within 20 days post-mating. The female survives for 4~6 weeks and lays an average of 2~3 eggs daily, totaling approximately 35~50 eggs, within the burrow. The eggs hatch into larvae within 4~5 days, and after molting through the nymph stage, they mature into adults in approximately 10~14 days. On the skin's surface, they can move around 2.5 cm per minute and survive for 24~36 hours, up to a week, once off the host. The human scabies mite is particularly active at temperatures above 20℃[6].

Bedbugs don't have wings, so they can't fly or jump. Instead, they move quickly and can cover distances of up to 3~4 feet per minute. The bedbug life cycle consists of six stages, including the egg stage, four nymphal stages, and adulthood[8]. After mating, female bedbugs of *Cimex lectularius* lay up to 200 (and potentially up to 500) cream-colored eggs, each approximately 1 mm long. They deposit these eggs daily throughout their lifespan, resulting in 1~10 eggs daily. In contrast, the species *Cimex hemipterus*, commonly known as the tropical bedbug, can lay up to 50 eggs over its lifetime[9,10]. Bedbugs are parasites that primarily feed on human blood but can also feed on blood from other warm-blooded animals. The eggs of bedbugs hatch into nymphs within 9~12 days at a temperature of around 22℃ (72℉). To complete their life cycle, blood is essential for both male and female bedbugs in all nymphal and adult stages. Nymphs require at least one blood meal to progress to the next stage of development. They need to feed every 3~5 days for 3~5 minutes to achieve full engorgement before molting[9,10]. Bedbugs' life cycles are affected by temperature and humidity and usually last approximately 2 months at 22℃. Adult bedbugs can live for 6~12 months if they have access to food and can even survive for up to 24 months in cooler conditions without feeding. Bedbugs usually hide in the crevices of beds or wallpapers and emerge at night to feed, causing sleep disruptions. They tend to be more active in the early morning than evening. Bedbugs can consume blood up to 2.5~6 times their body weight during a feeding session. It's important to note that there is no known instance of bedbugs transmitting infectious agents to humans[11].

SYMPTOMS OF SCABIES AND BEDBUG INFESTATION

The clinical presentation of scabies can vary greatly depending on the patient's age, immune status, environment, coexisting conditions, and medications. However, itching is typically the most characteristic symptom and worsens at night (Fig. 2A). The scabies mite burrow into the skin's stratum corneum to lay eggs and move around, using keratin as a

Fig. 2. (A) Clinical photographs depicting papules and burrows on various body sites of patients diagnosed with scabies; Affected areas include the wrist (A1), interdigital spaces (A2), a child's ankle (A3), and scrotum and penis (A4) Photo credit: Baik Kee Cho, used with permission; (B) Multiple papules resulting from bedbug bites; Photo credit: Baik Kee Cho, used with permission

Table 2. Comparison of clinical manifestations of scabies and bedbugs bites

Condition	Characteristic symptoms	Clinical presentations	Commonly affected areas	Secondary complications
Scabies	Intense itching, especially at night; characteristic tunnels/burrows observed in the skin	Linear lesions about 1 cm in length, referred to as tunnels/burrows, with fine scaling on the surface and possibly ending in a slightly darker or raised area, are common in areas where the skin folds.	Areas where the skin folds, between the fingers, on the wrists, around the navel, male genitalia, and underarms	There are various clinical manifestations, such as infantile scabies, crusted scabies, nodular scabies, incognito scabies, and vesicular scabies.
Bedbugs	Painless bites occur on exposed body parts during sleep, and upon waking, itching, small bumps, and red lesions occur.	Itching, small bumps, and red lesions ranging 2~5 mm in diameter can expand to as much as 2 cm. Bites often occur in lines or clusters.	Arms, hands, neck, legs	Secondary infections include impetigo, eczema, folliculitis, cellulitis, or lymphangitis from scratching, and rare systemic reactions, such as hives, asthma, and anaphylaxis.

nutrient source. Clinically, this is observed as linear lesions on the skin, approximately 1 cm in length, referred to as tunnels /burrows. These tunnels/burrows can be observed in areas where the skin folds, such as between the fingers, on the wrists, around the navel, and in the male genitalia and underarms. Upon closer examination, these tunnels/burrows can be seen to have fine scaling on the surface and may end in a slightly darker or raised area[2,4]. Certain areas of the human body, such as those with a thin stratum corneum and no hair, are more favorable for burrow formation, which leads to various clinical manifestations of scabies such as infantile scabies, crusted scabies, nodular scabies, incognito scabies, and vesicular scabies.

Bedbug bites are usually painless at first and are commonly found on the exposed parts of the body while sleeping, such as the arms, hands, neck, and legs (Fig. 2B)[7]. The skin lesions may become noticeable upon awakening but can also appear a day later. The typical clinical features of these lesions include itching, small bumps, and redness. They usually range from 2~5 mm in diameter, but they can expand to as much as 2 cm[12]. Sometimes, bedbug bites may develop blisters and lumps and can often be difficult to distinguish from other insect bites. However, bedbug bites tend to occur in lines or clusters[13]. Although rare, multiple bites can cause hives, asthma, and anaphylaxis. Scratching itchy spots may lead to infections such as impetigo, eczema, folliculitis, cellulitis, or lymphangitis[7] (Table 2).

DIAGNOSIS OF SCABIES AND BEDBUG INFESTATION

It's essential to diagnose scabies, mites, eggs, or feces in the skin through microscopic examination or dermoscopy. However, specialized dermatology departments must conduct the necessary tests to confirm the diagnosis. The positivity rate may be low even when experienced dermatologists perform these tests. As a result, treatment for scabies often starts solely based on clinical findings. The recently published scabies treatment algorithm in the Journal of the Korean Dermatological Association could be helpful in this context[5].

Diagnosing bedbug bites can be challenging due to the non-specific nature of clinical symptoms. An accurate diagnosis requires confirmation of bedbugs[8]. If bedbugs have bitten an individual, several important factors must be considered. Bedbug bites may be associated with recent travel to areas with known infestations, suboptimal living conditions, residing in a facility with a known bedbug infestation, the use of second-hand furniture, or concurrent infestations among residents. Clinical indicators of bedbug bites include tiny bleeding points, itchy redness, and grouped or linearly arranged bumps and welts on exposed areas. Detailed examination of beds, mattresses, clothing, window frames, bookshelves, and floors is crucial to detecting bedbugs. Professional expertise is often necessary to identify elusive bedbugs and differentiate their remnants or droppings. There have been proposals for using tests to check for antibodies against bedbug saliva proteins to confirm bedbug bites, although further investigation is required to validate their effectiveness[8] (Table 3).

Table 3. Diagnosis and treatment of scabies and bedbug infestations

Aspect	Scabies	Bedbugs
Diagnosis	Identification of mites, eggs, or feces through microscopic examination or dermoscopy; Diagnosis may start based on clinical findings due to the low positivity rate of tests.	Diagnosis challenges due to non-specific symptoms, with detailed examination of living spaces required. The use of tests for antibodies against bedbug saliva proteins is proposed but needs further research.
Treatment	Treatment with permethrin cream for confirmed, clinical, and suspected scabies patients	Antihistamines, topical glucocorticoids, and possibly oral steroids provide symptomatic relief. Topical and oral antibiotics are also used for secondary infections. Systemic reactions may require intramuscular epinephrine and oral steroids.

TREATMENT OF SCABIES AND BEDBUG INFESTATION

If someone has been in contact with someone who has scabies and develops symptoms such as itching or skin rashes, a microscopic examination or dermoscopy should be conducted to confirm the presence of scabies mites. Scabies are diagnosed when the scabies mite, feces, or eggs are visually identified. Even if a test cannot be performed or shows a negative result, if typical skin lesions such as burrows are observed or characteristic clinical signs are present in common areas, the individual is classified as a clinical scabies patient. If there is a history of contact with a patient with scabies and itching is present, the patient is considered a suspected scabies patient, even without characteristic burrows or clinical signs. Confirmed scabies, clinical scabies, and suspected scabies patients should be treated with permethrin cream, a scabicidal agent. Other treatments, such as ivermectin, lindane, and sulfur, can also manage scabies[5].

Most skin symptoms caused by bedbug bites will naturally improve within 1~2 weeks. It is essential to cleanse the affected area with soap or disinfectant and avoid scratching the bites to prevent secondary infections. For intense itching, antihistamines and topical glucocorticoids can provide relief. In severe cases or if blisters form, oral steroids may be necessary. If a secondary infection occurs, topical antibiotics are recommended. Oral antibiotics may be prescribed as needed[12]. In systemic reactions, anaphylaxis, intramuscular epinephrine, oral antihistamines, and oral steroids should be prescribed (Table 3).

CONCLUSIONS

Assuming that scientific and hygienic advances have put us beyond the reach of a resurgence in scabies, mites, and bedbugs could lead us into a false sense of security. Reduced awareness among doctors and patients regarding scabies, mites, and bedbugs could result in delayed diagnosis, leading to a broader infestation spread. However, with a thorough understanding of their life cycle and clinical manifestations, we can diagnose them promptly and prevent their reemergence. As the saying goes, "Know thy enemy and know thyself, and you shall win a hundred battles". This applies to preventing and controlling the spread of these ectoparasitic infestations.

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CONFLICT OF INTEREST

In relation to this article, we declare that there is no conflict of interest.

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PATIENT CONSENT STATEMENT

The patient provided written informed consent for the publication and the use of his or her images.

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