

# Unusual Microscopic

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## UNUSUAL MICROSCOPIC APPEARANCE OF SARCOPTES SCABIEI FROM SKIN SCRAPPING SAMPLE AND ITS EPIDEMIOLOGY

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### Abstract

Scabies is still a major problem, especially to those who live in close contact to each other in a long time. Its causative agent is *Sarcoptes scabiei*, an arthropods which live in the host by burrowing and making tunnel in the skin. The patient usually complaint suffer from nocturnal itching, beside the skin derangement of the affected areas. Here we reported an unusual appearance of *S. scabiei* from a skin scrapping sample sent to the laboratory of Parasitology and also discuss its epidemiology.

Keywords: scabies, burrow, nocturnal itching, 10% potassium hydroxide, arthropod, parasite

### Introduction

Scabies is still a global health problem.<sup>1</sup> Its reported incidence actually resemble an iceberg phenomenon.<sup>2-3</sup> The causative agent, *Sarcoptes scabiei* or the itch mite, is an insect parasite from phylum arthropod that burrows deep into the skin of their host.<sup>1-4</sup> It causes a communicable disease called scabies, a neglected parasitic global problem among people living in close contact for a long time.<sup>7,8</sup> Major complain of the patient mostly unbearable pruritus, mainly at night.<sup>9</sup> Due to this symptom, the host continuously suffer from severe

itching and constantly want to scratch the affected area.<sup>10</sup> Excoriation or scratching wound sometimes found in the affected area which also mixed with the crusted appearance.<sup>11</sup>

Beside the dermal complaint, the host also usually was unable to sleep well due to pruritus, and some other consequences that follows were mostly sleep related disturbances, from sleepy, lack of attention or even to reduced performance in school or in workplace.<sup>12,13</sup> From community medicine point of view, this disease related with poor practice of hygiene, low level social economy and or people living in relative close contact for a long time with poor access to hygiene best practice, e.g refugees in temporary shelter, orphand in orphanage, elderly living in the nursing home or people living in untreated dormitory.<sup>1,4,7,8,13</sup>

The affected area can cover any part of the body, but commonly found in the interdigits, palms, wrist, axilla/armpit, gluteal/buttocks, scalp and maybe genital; usually it happened bilaterally.<sup>9-11</sup> In severe cases, scabies can affect all part of the body, called Norwegian scabies.<sup>14,15</sup> The clinical manifestation of scabies varies, marked by simple fine to rough crusting, burrows of the skin, which sometimes markedly seen by naked eye or even in severe condition, hyperkeratotic that can be mixed in appearance with rough crusting and to even scaly plaques; all caused by direct enormous infection and heavy infestation of the parasite, *Sarcoptes scabiei* mites. Involvement of other family member or room mates, especially those who have continuous close contact with the patient, must always be traced.<sup>16</sup>

Considering that the adult stage of *S. scabiei* arthropods usually leaving their eggs in the tunnel they formed, these eggs in time will hatch and young stage of *S. scabiei* are ready to make new burrow under the skin of their host.<sup>11,14</sup> Without early diagnosis and prompt treatment, usually the course of the disease likely to become chronic in origin.<sup>10,11,14</sup>

Educating the patients and their family is a must, in order to prevent further transmission and making sure that the patient follow the instruction for medication.<sup>5,6,14</sup>

Here we report an unusual microscopic appearance of *Sarcoptes scabiei* from a skin scrapping sample sent to our lab for laboratory confirmation and its epidemiology on our laboratory.

### **Case Report**

We received a sample of skin scrapping that put inside a closed petri dish (patient of Dr. Syahfori Widiyani from dept. of Dermatovenereology, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta Indonesia).

A potassium hydroxide mount of skin scrapings from various part of scrapping revealed numerous live and dead mites, eggs, and scybala, thus confirming our diagnosis of scabies. But after a more thorough and careful observation, we notice that our positive case of scabies showed an unusual appearance under the microscope.

Using 400× magnification (maximal magnification that can revealed its whole body inside one full ocular aspect field of view) there is a very interesting object inside the body of this adult stage, female mite. That object was a smaller *S. scabiei* with the size about one fifth or one sixth of its parent. This smaller *S. scabiei* in general also has the same morphology as common *S. scabiei*, but the difference is only in the size. The arrow inside the ocular lens was set to pointed at the impresion of an object resembles egg shell which seems has been split in half.



Fig. 1. The impression of small size mite inside the body of adult *S. scabiei* (using 400× magnification, light microscope Olympus CX21™)

At first, we were thinking about the possibilities of pregnancy, instead of producing eggs, considering the size and the position to each other. Although then to us, it became something that was considered as a theory that could not be accepted, because we did some literature searching in the internet about this possibilities and could not find any prove to support that idea. So this theory soon being removed.

We did further checking under the microscope on this image, switch the objective lens for the larger magnification so that we got a more bigger view.. After a careful inspection, we notice the shape that resemble of hatching egg shell, an image that was not intact anymore. but if carefully observed, the clear colorless, curved shaped resembling only half part of an egg shell; and it can be seen still covered the upper part head of the smaller organism (arrow). We also believed that the smaller one is another mite that was still in larvae stage, because if we

closely examined the body we can find three pairs of legs (the location of the legs are as follows: one pair in front, and two pairs at the dorsal part of the body).

The description of regular adult stage of *S. scabiei* mites usually as follows. It sized 0.2-0.5 mm in length, in general, the colour is pale whitish to clear transparent, its geometry shaped is spherical in general appearance, have no eyes at all and also have distinctive four pairs of legs, where two pairs located in front part of the body and two pairs located behind. The sucker bearing pairs of legs have unjointed pedicles, a specific characteristics for this mite; leg pairs no. 1 and no. 2 usually extended beyond the body margin. Leg pairs no. 3 and no. 4 are only visible from ventral view. They are easy to recognize by their classic descriptive appearance: oval, ventrally flattened and dorsally convex tortoise-like bodies with multiple cuticular spines. It has short rounded shape mouthparts. The dorsal surface covered with transverse ridges and bears numerous triangular chitinous scales and some spiny setae. Morphological distinction of host-based specific varieties are possible.

This mite undergoes four stages in its life cycle: egg, larvae, nymph and adult. Upon infesting a human host, the adult female burrows into the stratum corneum (outermost layer of skin) where she deposits two or three eggs per day. The eggs are oval in shape, sized 0.1-0.15mm long; and during incubation time (in three to four days), it may hatch as larvae. A study stated that 90% of hatched egg mites produced larvae will die. A female can lay up to 30 eggs, then dies at the end of a burrow.

Living larvae (has 3 pairs of legs) migrate to the skin surface and burrow into the intact stratum corneum to make short burrows, called molting pouches within 3-4 days. Larvae then molt into nymphs (which already has 4 pairs of legs) which then molt once again into a bigger nymphs before it turn to be adult mite. Mating takes place once and the female is become fertile for the rest of her life; while the male mites soon dies after mating.

The female mites make a serpentine burrow using proteolytic enzymes to dissolve the stratum corneum of the epidermis; then laying their eggs during the process and while doing so she also extending the <sup>2</sup> burrow and again lay eggs for the rest of her life with survival time is about 30-60 days.

Transmission of impregnated female mites occurred from human to human due to direct or indirect skin contact. Indirect skin contact is possible due to shared use of toiletries e.g solid bathing soap, comb, towel and sharing bed and or clothes. Direct skin contact made possible especially when the vulnerable hosts have difficulties on conducting self- personal hygiene, e.g elderly with comorbidities, retarded people or refugee.

Below are the photograph of regular appearance of adult stage *S. scabiei*, collection of dept. of Parasitology, Faculty of medicine, Universitas Kristen Indonesia, Jakarta Indonesia.

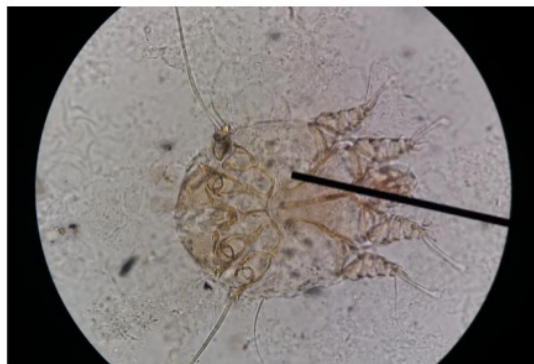


Fig. 2 the regular appearance of *S. scabiei*. Notice the 4 pairs of legs located in opposite direction from each other. This parasite shown is different case as shown in fig. 1 (using 100× magnification, light microscope Olympus CX21™)

In our department, we did a Parasitology laboratory examination service to patients that come from our university hospital, Rumah Sakit UKI, and also patients or sample that being sent to us from clinic or hospitals outside our hospitals. Our lab is open from Monday to Saturday in office hours. In general, we categorize our examination into three types: (1) Mycology

examination which comprise mostly skin scrapping, sent to us mostly on working diagnosis fungus or Parasite infection to be confirmed in our lab, (2) Stool examination for suspected parasite as causative agent, (3) blood examination for confirmation of suspected clinical Malaria or Filaria.

In case of suspected case of scabies, we did a skin scrapping in the affected area. We scrapped all crusted skin that technically able to be removed and quite big in size using blunt part of the scalpel, collected in a clean petri dish, then using 10% KOH (Potassium Hydroxyde), we examined the skin scrapping under light microscope, firstly using small magnification (100×) and if we found something suspicious, we use the higher magnification to check it more carefully (400×). Below is the summary of total examination conducted in our lab during 2014 until 2019.

Table 1. The amount of Parasitology examination conducted in our lab, from 2014-2019

Year	Mycology examination (mostly skin scrapping)	Stool examination	Blood examination (Malaria)	Total sample (myco+stool+blood)
2014	166	146	26	338
2015	110	104	27	241
2016	147	154	24	325
2017	178	177	35	390
2018	181	89	24	294
2019	187	43	14	244
total	969	713	150	1832

The total number of confirmed diagnosis of scabies made in our lab in six years, from January 2014 to December 2019, are 32 cases. So its prevalence among all Mycology examination in our lab was 3 ‰ (32 divided with total number of 969 Mycology examination), and if we continue further, scabies prevalence among all Parasitology lab examination in our department was 17 ‰ (32/1832)



## Discussion

Humans actually are not the only host of this mite, because isolation of *S. scabiei* from various infected animals also being reported elsewhere, e.g such as domesticated dogs-cats and other mammals which live in close contact to the human host, especially when the dogs or cats have the access to outside world besides where their live.<sup>15,16</sup> Data on genetic diversity of populations of this mite in humans is strongly supporting this idea, because according to Andriantsoantnirina *et al*,<sup>17</sup> the mites *S. scabiei* in humans do not denote only to a similar and homogeneous population. Further Studies must be conducted to reveal whether different clinical forms produced during scabies infection are associated with distinctive haplotypes or clades inside this species.

Beside that, Clinical appearance of scabies in general presents in three forms: classic, nodular, or a contagious crusted variant also called Norwegian scabies which can be further described in table 2.

Table 2. Various clinical form of Scabies, in brief<sup>15,18-20</sup> with modification

Characterization	classic	nodular	Contagious crusted (Norwegian scabies)
Population of mites	10-15 organism	The amount is more in number than that found in the classic form	Up to millions in 1 single host
Method of transmission	Skin to skin contact/direct human to human contact, or fomite transmission via clothing or bed sheet/ in-direct human-material-human contact		
Estimated time from contact until	Direct human to human contact: at least 10 minutes <sup>18</sup> In-direct contact: usually need longer time, more intense shared use of		

infection occurs	personal belongings, e.g towel, linens, clothing, blanket/bed sheet, carpets(?) or shared public facility, e.g childcare settings which is not maintained its cleanliness
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**Clinical  
apperance**

Diffuse and or  
localized  
Hyperkeratotic  
plaques

Erythematous  
nodule\*

2  
Marked thickening and  
crusting of the skin.  
Lesions are often  
hyperker<sup>2</sup>otic and  
crusted. Marked scaling is  
common, and pruritus  
may even be minimal or  
absen

<b>Affected area</b>	Palms, soles, underneath finger nail/nail bed	Axilla, groin	Cover large areas of the body, in fact it can affect the whole body
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**Underlying  
condition**

Poor hygiene  
practice

Poor hygiene  
practice

Poor hygiene practice +  
immunocompromised (due  
to immunosuppressive  
therapy, diabetes, human  
immunodeficiency virus  
(HIV), or disability related  
condition or elderly

\* The nodules are pruritic and considered to be a hypersensitivity reaction to the female mite

The zoonotic transmission of mange mite from domesticated dog or cat to humans is also common and being reported from many places in the world. The infestation and its route of transmission has a great implication to public health importance, because it still can be transmitted even only after a transient contact with the diseased animal to human; but human to human transmission happened through a closed contact with someone who are already infested with this mite.<sup>3,5,6</sup> Vulnerable people such as elderly, refugee or people living in abandoned dormitory are very prone to get infected; and once infection occurred, transmission is happened slowly but surely, only in just the matter of time.<sup>7,8</sup>

In the case of animal which infected, further public health implication of scabies is that there are certain groups that also at high risk, e.g occupational related such as veterinarians, kennel workers, pet owners, and also their children/relatives which is likely to also have close contact with the infected animals.<sup>16,21,22</sup> These people frequently come in very close contact during their occupation and hobby with the poor infested cats, kitten, dogs and puppies.<sup>21</sup> Proper interventional measures should be carefully adopted in order to prevent, control and eradicate the infestation and further breaking the chain of transmission.<sup>16</sup>

There are also specialized group member of the general population which more vulnerable to get infected with scabies, and these conditions in part are immune related.<sup>23</sup> Infection in this group can develop into a more severe condition. Patients with underlying diseases such as leprosy, immune deficiency disorders, malnutrition, HIV and malignancy, as well as the elderly and those with Down's syndrome and mental retardation, are more vulnerable to develop Norwegian scabies.<sup>11,23</sup>

In the context of making the correct diagnosis of Scabies, a Parasitology laboratory examination must be conducted. Actually, direct microscopic examination using 10% potassium hydroxide (10% KOH) considered as the gold standard for diagnosing scabies.<sup>24</sup> To date, it is still a simple, most widely used, trustworthy but <sup>1</sup>valuable technique to apply in the diagnosis of scabies.<sup>24,25</sup>

As an alternative for direct skin scrapping using 10% potassium hydroxide (10% KOH) that we usually conducted in our lab, there is also an alternative method named the indian ink burrow test.<sup>26</sup> The test conducted by putting certain amount of ink to the affected region; it must be <sup>1</sup>applied over suspected skin areas where it is absorbed slowly into where mite burrows exist under the skin. Wiping away superficial ink reveals the remaining ink that has

already penetrated the burrows or tunnel. According to Amanda *et al*,<sup>26</sup> that conducted comparison between this ink test vs 10% potassium hydroxide, the ink method have good conformity, simple, faster and painless. The problem with this technique is that it can caused inconvenience for the patient due to the ink that has to be apply to the skin in the affected areas. Additionally, although the test appears to be a valid diagnostic tool, a prolonged careful search is occasionally needed in order to find the parasite and confirmed the positive lesion, even in patients in whom scabies is strongly fathomed clinically.<sup>27</sup> Because this possible prolonged visual examination called verification bias, may be impractical in the busy laboratory setting, this method rarely used in public laboratory.<sup>25</sup>

Other alternative techniques for Diagnosing Scabies also available. This simple approach also use light microscope to identify the parasite. Identification of living or dead mites, its eggs, and the fecal pellets/scibala can be fulfilled by pre-examination treatment of the skin scrapping sample by suspending the skin scrapings in mineral oil for some time. The mites, when it is available, will contact and adhere to the oil, while skin scales/scrapping will mix with the oil. One of the benefit is that the refractility differences will be greater between the mite and the oil. Other benefits of this method is that the oil used to suspend the clinical materials will not dissolve any fecal pellets (unlike 10% KOH) and this will not interfere the area of examination.<sup>28</sup> Thereby mineral oil can clarify the visual identification of the morphology of the mites, *Sarcoptes scabiei*. For this reason, de Caprariis<sup>28</sup> suggested mineral oil is being recommended, rather than a 10% potassium hydroxide (10% KOH) technique.

Even though to our experience, considering the climatic condition of Jakarta, Indonesia, we think 10% potassium hydroxide (10% KOH) is still the best solution to lysis the skin scrapping and when it happened, it will slowly revealed the image of the parasite whenever it is available. We never experienced any derangement of visualization, throughout our

experience in confirming the diagnosis of scabies based on skin scrapping. Carefully burning or wagging a few times over the blazing bunsen might also helps 10% KOH to lysis the skin faster with the aid of heating. Beside that, pressing gently the cover glass that contain skin scrapping which already soaked with 1-2 drops of 10% KOH also mechanically helps to fasten the lysis. Both of these methods (heating and mechanical) are routinely done in our department.

Making the correct diagnosis is needed, as soon as possible, so that medication can be given sooner and hope that the patient responds well to therapy. But epidemiologically, tracing the source of infection in case of scabies, in order to prevent Ping pong transmission, is very difficult.<sup>11,29</sup> All person who has history of close contact with patients should also be encouraged to see the doctor, being examined and if confirmed positive by laboratory, he/she should be treated.<sup>4</sup> Without this approach being conducted, actually it is pointless to treat the patient.<sup>29</sup>

Epidemiologically in our lab, the incidence of scabies is very low. This is probably due to the very wide type of examination under the skin scrapping group. Most of our received sample were sent for confirmation using Mycology examination. Suspected cases of scabies were rarely sent to our lab for confirmation. This is perhaps because this disease often misdiagnosed and leads to mistreated/mistreatment and in the end can developed into full blown crusted scabies. This is a very good of an ice berg phenomenon, not because there is no cases of scabies in our surrounding environment but because the number of suspected cases sent to us to be confirmed is very minimal.

Furthermore, due to the tiered health service system, patients complaint that resemble scabies usually come to the primary health care (PUSKESMAS) rather than goes directly to

secondary or tertiary health care, like our hospital. Very busy doctors in the primary health care might not have time to wait for the results of laboratory tests or perhaps there is no lab service available; so usually they bypassing microscopic examination and go straight-forward for direct <sup>1</sup> empiric treatment of scabies for patients with major complaint pruritus, typical lesions, and a history of nocturnal itching following close contacts with scabies patient. That is also the reason why the number of suspected cases sent to our lab is also limited.

Scabies as an entity of disease is also known as “the great imitator”, because it can caused various clinical appearance that often misleading. Sometimes, laboratory service, especially the specific one like Parasitology, is not available in the primary health care. Without laboratory examination and confirmation, doctor rely only on the data of history/anamnesis and clinical appearance, combined with his/her empirical experience. Educating general lab tech with 10% potassium hydroxide (10% KOH) technique can improve the diagnostic of scabies and in turn will help doctors to improve the treatment success.

## **Conclusion**

*Sarcoptes scabiei* and scabies continues to become a parasitic problem. Its appearance underneath microscopic examination is very typical. Epidemiologically, Poor practice of hygiene, inappropriate sanitary set-ups and to some extent the immunocompromised condition may predispose the infection to become severe. Early diagnosis and prompt treatment with proper education to the patients and his/her family are pre-requisite in order to cut off the chain of transmission.

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### **Conflicts of interest**

There are no conflicts of interest.

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