Sarcoptes Scabiei

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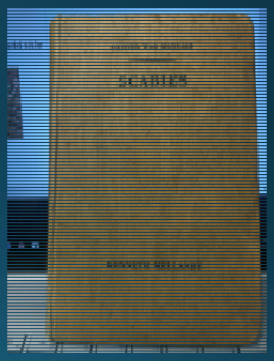
What is Scabies?

Scabies is an itchy skin condition caused by the microscopic mite *Sarcoptes scabiei*. This is common all over the world and can affect any age and socio-economical status.

Kenneth Mellanby

- The best research tome on scabies was by Kenneth Mellanby, Oxford University Press in 1943.
- Mellanby was the Sorby Research Fellow of the Royal Society of London and the Honorary Lecturer in Zoology in the University of Sheffield.
- Successful combat of this disease depends on accurate diagnosis and accurate diagnosis depends on full knowledge of the Sarcoptes which causes the disease.
- Mellanby's investigation was done with 19 human volunteers, all pacifists, and their service was given over a period of many months. Thirty-five others suffered infection for shorter period.



Incubation Period

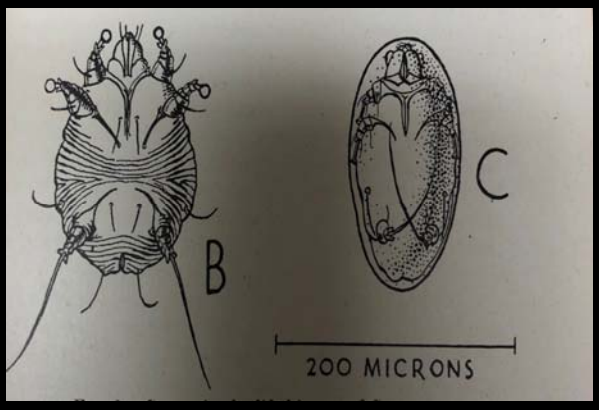
- If this parasite infests the skin and establishes itself, symptoms of scabies will occur.
- There is an incubation period in which the mite is imbedded but no disease is evident.
- This symptomless incubation period may extend for several weeks.

Sarcoptes Scabiei in Animals

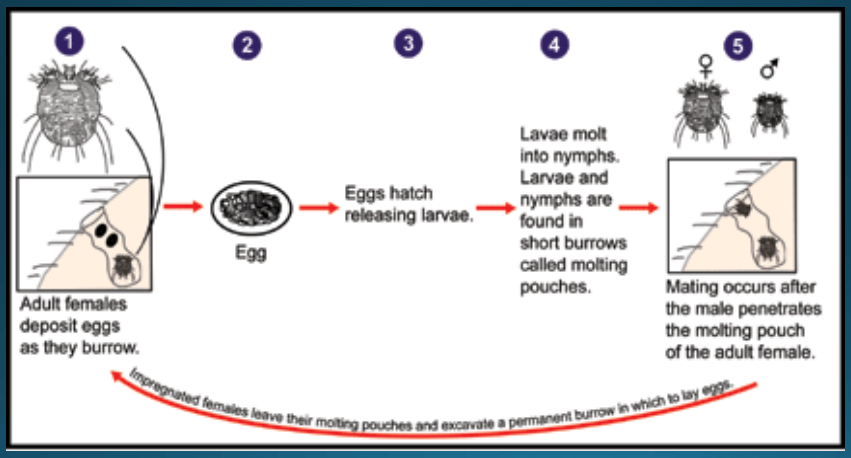
- The Sarcoptes scabiei attacks many different mammals ie, dogs, cattle, pigs, sheep, goats, camel, rabbits and horses.
- No definite morphological distinctions have been described between the mite that attacks humans but they do show physiological distinctions and these mites cannot attack and perpetuate disease in humans. So, sarcoptic mange in dogs is unlike human scabies.

Egg, Larvae & Nymph

- The egg in this drawing is relatively enormous when compared with the size of the adult. This egg contains a fully developed larva.
- A larva has only three pairs of legs. The larva moults and gives rise to the nymph with four pairs of legs.
- The nymph molts once more and then gives rise to either the adult male or the immature female. The transformation from the immature to the ovigerous female probably occurs after fertilization when the ovary swells up and distends the body of the animal.
- The ovary of the female is responsible for more than half of the internal body contents. The successful infection of a new victim by Sarcoptes is usually accomplished by a newly fertilized female.
- The mite is able to move rapidly on the warm surface of the skin, traversing as much as 1 inch in a minute.



Life Cycle of Scabies Mite

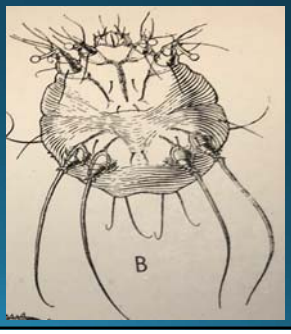


Adult Mite

- The adult ovigarous female mite is almost twice the size of the male. Before she is fertilized the discrepancy in size is negligible.
- When the mite is pregnant her size increases by a factor of two, and most of that is due to eggs maturing in her.

Other Body Parts

- Four pairs of legs, two pairs situated toward the anterior end and two towards the posterior end.
- At the end of legs are "suckers". The whole body is covered with characteristic grooves and on the top of the body are grooves and spines.
- The anus is situated terminally. Eggs are laid through a slit called the tocostome which is at about the middle of the ventral surface.



The Adult Female Mite

- The adult female is the form most commonly seen and the most easy to isolate from a patient.
- The animal is oval, flat below and convex above—it measures about 1/60th of an inch. A very striking series of bristles are reminiscent of those of a hedgehog.
- No distinct head, but mouth parts which consist of the chelicerae and palps protrude beyond the anterior end of the body and are erroneously called the head.

Ovigerous Female Egg Laying

- Within a few hours of starting her burrow the ovigerous female begins egg-laying.
- Two or three eggs are laid each day, and this process may go on for nearly two months.
- The eggs may be seen stuck to the floor of the burrow.
- The female mite is visible at the anterior end with the eggs all along the burrow behind her.

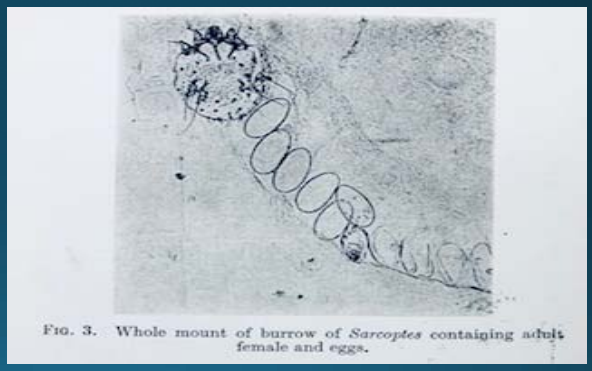


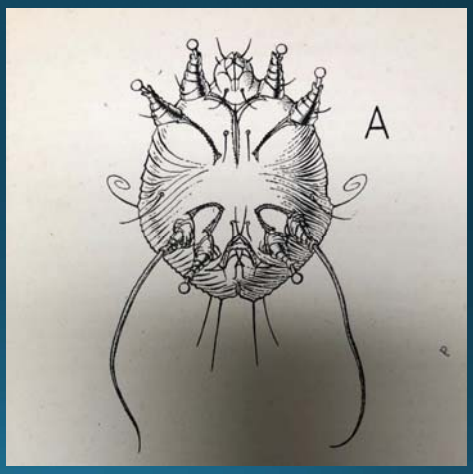
FIG. 3. Whole mount of burrow of *Sarcoptes* containing adult female and eggs.

Female Mite

- The female mite usually remains in her burrow for the rest of her life.
- Occasionally a newly burrowed mite might leave her place in the epidermis, may wander over the surface, until she has found a more suitable spot and has been fertilized.
- Once a mite has started a burrow ***properly,*** she never leaves it of her own accord.
- Mites are frequently scratched out by the finger nails of their victims. When this occurs, many are killed, but a substantial proportion survive and burrow in again.

Adult Male

- The adult male is only about half as long as the female, but the difference in size is due to the distended part in the female, (enormous ovaries) compared to hard parts of the male (epimeres). Otherwise the two sexes are much the same size.
- The male differs from the female in its characteristic external genital apparatus and because instead of having long bristles on the fourth pair of legs there are appendage changes called suckers.



Male Sarcoptes

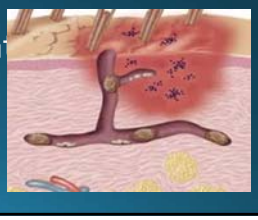
- The male Sarcoptes is found in a short burrow, less than a millimeter in length. He probably remains in his burrow only a short time.
- Adult males are not commonly found, and are undoubtedly much less common than the females. Adult males do not live as long as females. It probably remains inside this burrow for a short time only and spends a considerable portion of its life on the skin surface in search of the unfertilized female.
- The unfertilized female likewise makes only a very small burrow, in which she may remain for a day or two only.
- The whole period of the life from egg to ovigerous female may be as short as 10 days but 14 days is more normal.
- Well under 10% of eggs ever give rise to adult mites.

Mating

- Mating occurs after the active male penetrates the molting pouch of the adult female.
- It takes place only once and leaves the female fertile for the rest of her life.
- Impregnated females leave their molting pouches and wander on the surface of the skin until they find a suitable site for a permanent burrow.

From Sarcoptes Egg to Skin

- The eggs take 3 or 4 days to hatch. It is possible to find one or two larvae inside a burrow, but these have recently hatched for they always leave the burrows to continue their development.
- Larvae are able to move on the skin almost as rapidly as an adult, but they soon find shelter; by entering the hair follicles. Both larvae and nymphs are to be found in hair follicles.
- The transformation from nymph to adult male or immat female is in 4-6 days after hatching of the eggs



From Sarcoptes Egg to Skin (2)

- Two or three eggs are laid each day and this may go on for nearly two months.
- The eggs may be seen stuck to the floor of the burrow.
- The reddish, brick-shaped feces are the other contents of the burrow.
- The gravid mite can traverse the burrow as much as 5 mm a day but at slower paces of only ½ mm a day.
- The speed at which the mite moves under the skin seems to have little influence on the rate of egg production.

Burrows

- The burrow is confined to the horny layer of the skin—the stratum corneum. The sites where the mites form burrows are not necessarily those in which the cuticle is thin; in fact, regions with a thick cuticle are often attacked.
- In a position where the horny layer is fairly thick the Sarcoptes forms its burrows within its depth; in the thinner skin, such as the penis the mite raises a tiny lump as it pushes aside the layers of the tissue.
- It is probable that the successful infection of a new victim is usually accomplished by a newly fertilized female.
- Within a few hours of starting her burrow the ovigerous female begins egg-laying.
- The mite is able to move rapidly on the warm surface of the skin traversing as much as 1 inch in an hour.
- The parasite exercises some selection in the part of the body into which it burrows, the majority fixing on one of the normal sites of election.

Single burrow site after knife abrasion of the surface

Burrows (2)

- The Sarcoptes takes about one hour to bury itself in the horny layer of the skin and never tunnels deeper than this.
- The legs and the mouth parts are used to make the burrow. The mite bites its way into the skin with its jaws and digs in with elbows.
- This is the cutting edge of the last joint before the stalk which bears the suckers. It is manipulated so as to tear through the layers of the epidermis.

Transmission

- Transmission is primarily by direct contact with an infected person, occasionally by fomites
- Incubation period may be up to 6 weeks because it is an immunologic reaction that causes the symptoms
- In tropical regions it can infest the majority of individuals in a community
- Asymptomatic infestation by scabies is not uncommon

Scabies Symptoms

- In symptomatic cases pruritus is severe, often worse at night or after a hot shower.
  - Rash & itching are caused by a hypersensitivity reaction to the mite, eggs and feces.
  - Until this sensitization occurs diagnosis is practically impossible.
- Secondary bacterial infection, usually Staph, is not uncommon due to the scratching and itching.

Clinical Findings

- Skin lesions are variable and include erythematous papules with scale-crust, small patches of eczema, excoriations, vesicles (especially acrally in infants), nodules and the classic burrow—a thread-like grayish-white, wavy, 1-10 mm linear structure that favors acral sites.

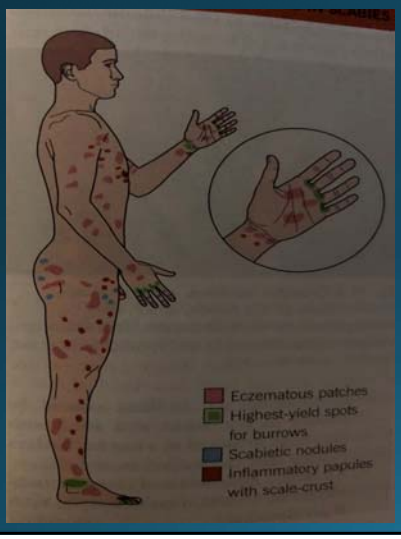
Clinical Findings (2)

- The discrepancy in population by area may be explained by the reaction pattern of the skin in different areas.
- The hands and wrists give comparatively little reaction as compared with the softer parts of the genitals and buttocks where the itching stimulates scratching and the scratching often destroys the signs by which scabies is identified.
- On the male genitalia there may be many excoriated papules but the scratching has annihilated the invading insects.
- On the penis, the mite raises a tiny lump as it pushes aside the layers of the tissue.
- In women, the nipples are one of the most frequently infected sites.
- On the buttocks, one usually will find excoriated macules and papules or bruises.

Infantile Presentation

- In babies, the distribution of the parasites has not been so fully investigated:
  - Burrows can occur on all parts of the body including the face, the palms and the soles.
  - The largest number of mites appear to occur on the feet in the first year if life.
  - It is probably not until about the fifth year that the hands come to bear the majority of the population.

Scabiei Rash



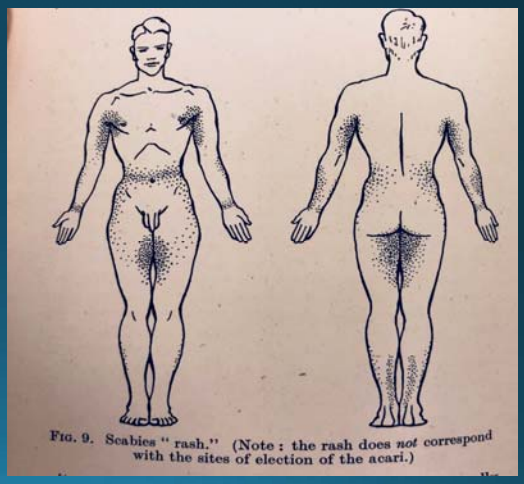


Fig. 9. Scabies "rash." (Note: the rash does *not* correspond with the sites of election of the acari.)

Parasite Density

- Hands and wrists 63%
- Extensor elbows, 10.9%
- Feet and genitals 95%
- Buttock 4%
- Remaining body surface 2 %
- 73% of patients could be diagnosed by exam of the upper extremities.
- In babies, the distribution of the parasites has not been so fully investigated:
  - Burrows can occur on all parts of the body including the face, the palms and the soles.
  - The largest number of mites appear to occur on the feet in the first year if life.

Sites of Adult Female Cases

- This is markedly different from what is found in Sarcoptes mange in animals, where many thousands of parasites may occur on a single host.
- Norwegian or crusted scabies in man would appear to simulate the condition found in animals.
- Intensity of itching experienced has no relationship to the parasitic rate.
- Of the roughly 900 volunteers in Mellanby's group 85% had one or more mites on the hands and wrists.

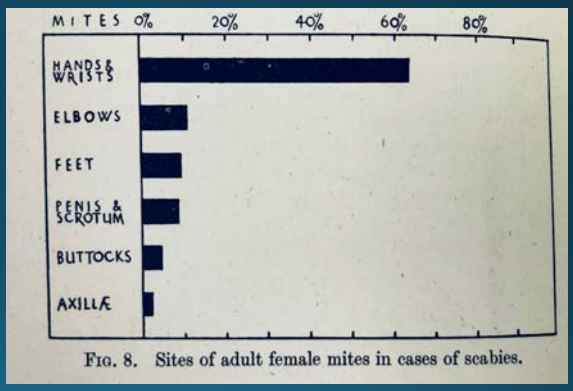


FIG. 8. Sites of adult female mites in cases of scabies.

Differential Diagnosis

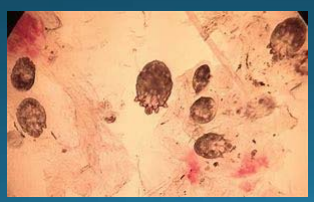
- Arthropod bites, bites from animal scabies, diseases associated with generalized pruritus such as atopic dermatitis.
- In infants, consider acropustulosis.

Finding a Parasite

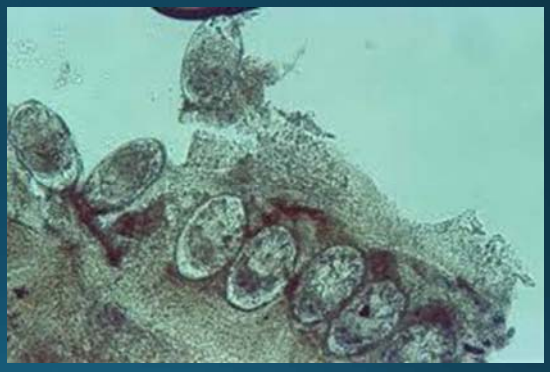
- Finding a parasite doesn't leave a shadow of a doubt as to the diagnosis, and in my opinion is the obligation of the treating physician.
- The first preliminary to finding the Sarcoptes is to discover an inhabited burrow and to observe the position of the animal.
- The mite is visible at the anterior end as a raised whitish oval with dark pigmentation at its front. This pigmentation is caused by the appearance of the epimeres connected with the mouth parts and anterior limbs. The biopsy is a thin slice of skin of the top of the burrow parallel to the body.
- It cannot be too strongly urged that the whole secret of finding the Sarcoptes is to know what to look for and not try to hunt blindly over the entire body surface
- Most patients are interested to see a living acarus under the microscope, and after such a demonstration it is easier to secure their wholehearted cooperation in insuring thorough treatment

Clinical Confirmation

- Clinical confirmation by MINERAL OIL SCRAPING OF a BURROW TO SHOW MITES, EGGS OR FECES.
- This is the only way to confirm the diagnosis



Microscopic Examination



Range Numbers of Parasites

- There are common misconceptions concerning the number of parasites found in patients suffering from scabies. It is generally believed that there are thousands of mites present in every case. This is false. The small number of parasites explains the difficulty which competent medical providers have in detecting any parasites. If you know where to look you can find parasites in almost every case.
- Only adult female Sarcoptes have been accurately enumerated but these probably bear a definite relation to the total mite population. The population of adult females is called the 'parasite rate'. The total number of other stages, including eggs, larvae, nymphs and immature females may possibly be twenty times as great as the parasite rate.

Range Numbers of Parasites (2)

- This chart gives the parasite rate found in nearly 900 adult male patients.
- The mean parasite rate was 11.3, more than half the patients had between 1 and 5 adult female Sarcoptes and only 3 percent had over 50.
- The greatest parasite rate was 511.

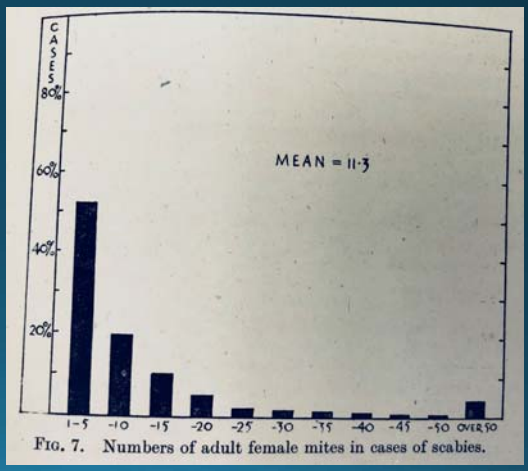


FIG. 7. Numbers of adult female mites in cases of scabies.

Parasite Rate of Increase

- One might expect that the rate of infestation would continue to rise. However, that is not the case. In Mellanby's studies in a dozen volunteers who went for nine months without treatment the parasite rate always increased during the first two or three months but at the end of that period the rate was between 20 and 400. After this the rate either decreased or did not increase—and some of the patients went on to spontaneous cure. In cases where it increased, it never went any higher than 10% of the potential increase which the egg production of the females would lead one to expect. There was always a wastage of at least 90 percent.

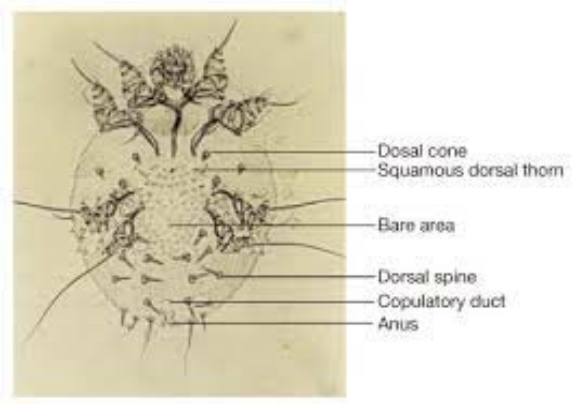
Treatment

- Permethrin topical 5% cream:
  - Two overnight applications, 1 week apart, to the entire body surface, from the neck to toes.
  - Infants, the elderly and the immunocompromised need to include the face and scalp
- Ivermectin oral:
  - (200-400) microg/kg given on days 1 and 8.
    - This is a way that is increasingly popular especially when large groups of individuals are affected, as in a nursing homes

Treatment (2)

- All clothing and bedding should be washed in hot water and dried with high heat
- All family members and close contacts should be treated simultaneously, even if asymptomatic.
- Cutaneous lesions often last 2-4 weeks after successful treatment but patients may feel relief within 3 days. I always warn patients that complete symptom relief may take 3 weeks.
- After treatment is underway, topical steroids may be used for relief of symptoms.

Return to Work or School



- Rigorous segregation of cases of scabies, including exclusion from schools and jobs is a step of doubtful usefulness.
- With modern treatment it should be possible for any cases detected at school or in the job to be treated the same day and they need not miss any further hours of school or work.
- After a single treatment with an efficient medicine any danger that did exist will be removed.