



Experimental Transmission of Canine Scabies to Domestic Rabbits, *Oryctolagus cuniculus*

Sabiha Fazal,^{1,*} Kausar Jamal Cheema,¹ Farkhanda Manzoor¹ and Azhar Maqbool²

¹Department of Zoology, Lahore College for Women University, Lahore.

²Department of Parasitology, University of Veterinary and Animal Sciences, Lahore.

ABSTRACT

Sarcoptes scabiei infests a wide variety of mammals including domestic, farm and wild animals. Different varieties of *S. scabiei* are considered to be strictly host specific. However, some reports indicate that the parasite is not completely host specific. In the current study the dog strain (*S. scabiei* var. *canis*) was experimentally transmitted to domestic rabbit, *Oryctolagus cuniculus*. The back of the neck of experimental rabbits was shaved and scarified. The mites collected from skin scrapings of the infested dogs were applied on the prepared area on the rabbits. The progression of the disease was observed for 6 weeks and the quality of lesions was noted. The skin scrapings of the infested rabbits were checked on weekly basis to find the mites or their developmental stages. The presence of eggs and larvae proved that the parasites can also reproduce on non-normal host. The successful induction of infestation indicates that different varieties of *S. scabiei* are not strictly host specific.

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Authors' Contribution

SF Conceived and designed the study, statistically analyzed the data and wrote the article. FM and AM identified and isolated *Sarcoptes scabiei*. KJC supervised the study.

Key words

Sarcoptes scabiei, rabbit, hyperemia, pruritis, pyoderma.

INTRODUCTION

Sarcoptes scabiei, the itch mite causes a stubborn and debilitating skin disease called scabies in humans and mange in a number of wild and domestic mammals (Little *et al.*, 1998; Daszak *et al.*, 2000; Pence and Ueckermann, 2002; Bates, 2003; Fazal *et al.*, 2014). The mites collected from different hosts are morphologically similar but genetically and physiological distinct. On the basis of these differences they were considered as distinct species by some workers in the past. These researchers classified the Genus *Sarcoptes* into more than 30 species and 50 varieties (Blood *et al.*, 1979; Soulsby, 1982).

Fain (1978) as a result of an extensive study from 1962 to 1968 confirmed that although the described species show a great variability, yet this variability has no taxonomic importance. Fain identified the variability at 3 levels *i.e.*, hosts variability, individual variability and geographical variability. After comparing all the specimens from different host species Fain confirmed that Genus *Sarcoptes* has only one highly variable and extremely adaptable species and the mite collected from different host species are actually different varieties of a single species, *Sarcoptes scabiei*. These varieties are called after the name of the host from which they are derived, for example, *Sarcoptes scabiei* var. *canis* is the variety collected from infested dogs and *Sarcoptes scabiei* var. *homonis* is the variety of mite collected from infested humans.

The strains of *Sarcoptes scabiei*, derived from different mammalian species are largely host-specific. Experimental induction of infestation to unusual host shows confusing results. The transfer of canine strain to grazing animals, cat, rat and mice were unsuccessful while the same strain was successfully transferred to White New Zealand laboratory rabbits. (Arlian *et al.*, 1984; Arlian and Parish, 1988). The Goat strain of *Sarcoptes scabiei* was successfully transferred to Desert sheep by Ibrahim and Abu-Samra (1987) hence proving that mite can exhibit incomplete specificity and can show cross-infectivity. There are several reports indicating that humans living with an infested pet or farm animal occasionally get infested with animal strain of *Sarcoptes scabiei* (Smith, 1967; Thomsett, 1968; Fain, 1978; Witkowski and Vyszanski-Moher, 1978). The prevalence of acquired infestation is higher in those occupations where human – animal interaction is greater. Mumcuoglu and Ruffli (1979) discovered that dairy farmers occasionally get infested with cow strain of *Sarcoptes*. Warner (1984) reported the infestation of humans with dogs and cat strains of *Sarcoptes* working in pet clinics. Certain occupation related diseases such as Cavalryman's itch and Pig-handler's itch are the occupational diseases acquired by human-animal contact (Burgess, 1994).

Canine scabies has been reported in humans (Estes *et al.*, 1983). The infestation is normally self-limiting and disappears spontaneously within one or two weeks (Burroughs and Elston, 2003). But in certain cases it is reported to last for several months (Emde, 1961; Smith and Claypoole, 1967). The prolonged contact with the infested animal can result in high risk of getting permanent infestation (Walton *et al.*, 1999). The human

* Corresponding author: sabihafazal@hotmail.com

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strain can also infest animals. The mountain gorillas of low land forests living in close proximity to African human population are reported to get infested by *Sarcoptes scabiei* var. *hominis*, the human strain of mite (Graczyk *et al.*; 2001). The results from the previous studies mentioned above show conflicting results. Some studies have reported that variants of *S. scabiei* are non specific while others have reported high specificity. The current study was conducted as an attempt to find out the cross infestivity of canine variety of *S. scabiei*.

MATERIALS AND METHODS

Induction of infection to domestic rabbits

Naturally and heavily infested adult German Shepherd (*Canis lupus familiaris*) dogs were used as source of mites for the studies. Immediately before the start of the experiment, deep skin scrapings were collected from the selected heavily infested dogs with advanced lesions in clean sterilized Petri dishes. The scrapings collected from different animals were mixed thoroughly. A small portion of the pooled scrapings was examined under the stereoscopic microscope to check the intensity of the infection and to confirm the viability of the mite. The mites showing any external (legs or setae) or internal (esophageal) movement were considered to be alive. A suspension of scraped material in water was made to induce the infection to rabbits.

Study animals

Sixty healthy domestic rabbits (*Oryctolagus cuniculus*) aged 4-5 months, weighing 2.10–2.50 kg, without any sign of sarcoptic mange were selected for this experiment. The animals were caged under hygienic conditions and kept on nutritious diet. The animals were maintained under the protocol approved by University of Veterinary and Animal Sciences, Lahore. At the end of the study period all the infected rabbits were immediately treated for sarcoptic mange.

Experiment

Fifty rabbits were randomly selected to induce the infection. The back of the neck just behind the ears of each rabbit was shaved. The shaved area on the neck was then scarified with a sand paper till the appearance of hyperemia. On the prepared area the mite suspension was applied with the help of an applicator. After the induction of infection the rabbits were caged separately (Day zero). Ten rabbits were similarly shaved, scarified and treated with water only (without applying skin scrapings) on the prepared area and left as control (Day zero). After seven days the infected area of each rabbit was examined. The monitoring was carried out on weekly basis. The pathological changes in the infected area were observed

and recorded on day 7, 14, 21, 28, 35 and 42. Deep scrapings from the experimentally produced lesions were collected in 20% KOH solution and examined under microscope for the presence of mites and their developmental stages.

RESULTS

The outcome was studied in 50 rabbits. The results could not be followed in 3 rabbits due to mortality within the first three weeks of the study period. In the remaining 47 rabbits varying levels of infestation were observed during the study period. The criteria for grading the intensity of infestation is presented in Table I. Out of these 47 rabbits, 4 rabbits (8.5%) did not show any signs of infestation at all. Among the rabbits showing infestation, the majority of the rabbits (40.4%) showed mild degree of infestation. Light infestation was observed in 36.1% of rabbits. However, intense infestation as observed by high levels of pruritis, scaling and alopecia was noted only in 14.9% of the animals (Table I). All of the controls (n=10) failed to show any level of infestation. The scarified area in these animals regained its normal colour within one week and complete hair growth was evident at the end of the six week study period.

Table I.- Outcome of Induction of Infestation. (n=50).

Categories	No.	Percent	Symptoms
Not infested	4/47	8.5%	Slight hyperemia, recovered within 2 weeks (recovery just like control)
Light infestation	17/47	36.1%	Hyperemia, light pruritis and inflammation, of the prepared area only
Mild infestation	19/47	40.4%	Mild pruritis, inflammation, scab formation and alopecia of the prepared area only.
Intense infestation	7/47	14.9%	Intense pruritis, inflammation, alopecia beyond the prepared area, scaling, pyoderma due to secondary infections

Note: Outcome could not be studied in 3 cases due to mortality within the first 3 weeks of study

Progression of the disease in infested rabbits

At the day 7, only erythematous rash was observed on the infected area. Some swollen macules were visible under the magnifying glass. No significant change in the behavior of the infected rabbit was observed.

At the day 14, the skin at infected area became more erythematous and some raised papules were visible even with naked eye. A clear change in the behavior of the

infested animals was also observed. The rabbits became restless and they scratched the infected area with their nails. As gnawing was not possible due to the selection of the infected area, which was at the back of the neck just behind the ear, they rubbed the infected area with the walls of the cages. The microscopic examination of the skin scrapings from the infected area revealed a few adult mites and large number of eggs.

At the day 21, the infected area of the experimental animals appeared moist with serous exudates due to the rupture of the prominent vesicles and papules resulting from constant scratching. The infected rabbits became more restless due to severe pruritis and showed less interest in feeding. Microscopic examination of the skin scraping showed a few adult mites and large number of larvae and nymphs.

At the day 28, the yellowish scab appeared on the infected area and in some animals with severe pruritis, the lesions became hemorrhagic. The animals were found restless. The skin scrapings on observation under microscope showed a large number of adult mites.

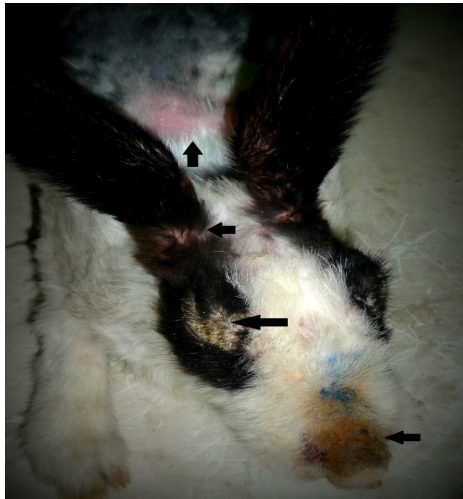


Fig. 1. Infested rabbit showing hyperemia and keratinization.

At the day 35, the signs of secondary infection and pyoderma were observed in the animals showing intense pruritis. The infested rabbits spent most of their time in scratching and showed the least interest towards eating. The microscopic examination of skin scrapings revealed a large number of adult mites. The signs of secondary infections were also evident in some heavily infested animals (Fig. 1).

At the day 42, due to the persistent excoriation and resultant serohemorrhagic exudation, the infected area on the animals became thick and crusty. The histopathological changes were seen in the skin of the

infected area. The necrosis and degeneration of the epidermis was evident. The animals exhibited persistent scratching and quite irritable behavior. The microscopic examination of skin scrapings showed large number of sarcoptic mites.

All of the control animals showed normal feeding and resting behavior throughout the study period. The scarified area of their neck regained its natural texture within 10 to 15 days and the normal hair growth was observed at the end of the study period. At the completion of the study the infested experimental rabbits were treated in the pet center of University of Veterinary and Animal Sciences, Lahore till complete recovery.

DISCUSSION

More than 40 hosts, belonging to 17 mammalian families and 7 mammalian orders are known to be parasitized by the itch mite, *Sarcoptes scabiei* (Fain, 1978). These mammals include a wide range of domestic mammals (both pets and livestock and dairy animals), wild animals and humans (Schlesinger *et al.*, 1994; Little *et al.*, 1998; Daszak *et al.*, 2000; Pence and Ueckermann, 2002; Bates, 2003).

In the current study canine scabies was successfully transferred from normal host to laboratory rabbits. 36.1% (17/47) of the rabbits showed light infection. 40.4% (19/47) showed mild infestation, while 14.9% (7/47) of the experimental rabbits showed intense infestation. 8.5% (4/47) of the experimental rabbits did not get infested while in 6% (3/50) of the rabbits the observation was not recorded due to the mortality of rabbits within the first 3 weeks of the study period. If various levels of the intensity of the infestation are ignored then the three categories *i.e.*, light, mild and intense infestation collectively constitute about 91.5% (43/47) of the total experimental animals (Table I).

The results clearly indicate that the *Sarcoptes scabiei* is not strictly host specific. Fain (1978), Howell *et al.* (1978) and Blood *et al.* (1979) also reported the cross- infestivity of different animal varieties. Ibrahim and Abu Samra (1987) experimentally transferred goat strain of *Sarcoptes scabiei* to desert sheep and proved that the infestation is not completely host specific.

It was also observed in the current study that the infestation was not self-limiting in most of the experimental animals. The infestation persisted up to 42 days of the study period and afterwards these animals were treated at the pet center of University of Veterinary and Animal Sciences Lahore.

Reports show that the cross species transmission can occur between humans, wild and domestic mammals. Humans occasionally get infested by animal strains of

Sarcoptes scabiei and the severity of infestation depends upon the degree of the human – animal contact (Walton *et al.*, 1999). Permanent contact may lead to prolonged infestation. In the aboriginal population of North Australia 25% adults show positive tests for antibodies against *Sarcoptes scabiei* var. *canis* due to permanent contact with domestic dogs (Normaznah *et al.*, 1996). The clinical manifestation of the animal strains is usually more severe (Burgess, 1994), but it is normally self-limiting (Burroughs and Elston, 2003). However some reports show that the symptoms may persist for more than one year and dissolve only after proper medication (Smith and Claypoole, 1967).

There is an ambiguity in literature about the cross-infective nature of different varieties of *S. scabiei*. The results from our study, however, show that canine scabies can successfully be induced to other domestic animals such as rabbits. This shows that *S. scabiei* does not show absolute host specificity. The partial or incomplete specificity is an important hurdle in controlling the disease in both animals and humans. *Sarcoptes scabiei* is the only obligatory parasitic mite species which infests such a large variety of hosts. This highly adaptive and variable species can infest and reproduce in non-normal host species. The interbreeding between different strains is advantageous for the parasitic mite from evolutionary point of view. Even if a non-normal parasitic variety is unable to reproduce in a remotely related host, it can transiently parasitize that host and can return to its normal host whenever possible. This may result in treatment failure and recurrence of infestation.

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