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An Over View of Ovine and Caprine Dermatophytosis

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Review Article

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ABSTRACT

Dermatophytosis is a superficial fungal infection of hair and keratinized layers of the epidermis and is caused by keratinophilic and keratinolytic genera such as *Microsporum*, *Trichophyton* and *Epidermophyton*. The animal age and trauma are important predisposing factors of disease. Show lambs are more susceptible to ringworm. *T. verrucosum* has been cited as a major agent encountered in cases of ovine and caprine ringworm. Lesions in lambs are most often noticed on the head while in goats lesions can occur beside head in pinnae, neck, and legs. The disease can be diagnosed by direct examination, fungal culture, skin biopsy and molecular diagnostic methods. This review will forecast more light on the different aspects of this disease.

Keywords: Dermatophytosis; ovine; caprine; clinical feature; diagnosis; treatment.

1. INTRODUCTION

Dermatophytosis is caused by fungi in the genera *Microsporum, Trichophyton* and Epidermophyton. There are three ecological groups of dermatophytes: anthropophilic (mostly associated with humans), zoophilic (associated with animals) and geophilic (found in the soil) [1].

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Dermatophytosis is particularly common in cold climates, where animals stabled for long periods. Young animals have affected most often and asymptomatic infections are common particularly in adult animals. The reaction to dermatophyte infection may range from mild to severe as a consequence of the host's reactions to the metabolic products of the fungus, the virulence of the infecting strain or species, the anatomic location of the infection and local environmental factors [2].

Ringworm infections in sheep are worldwide in occurrence, although the incidence may vary from country to country [3]. Outbreaks of sheep ringworm have also been reported from France [4] Germany [5] and South Africa [6]. Outbreaks of ringworm infection in sheep in Ireland and Russia were studied by [7,8] respectively, and observed that weight gain of the animal was less due to *Trichophyton. verrucosum.*

2. PREDISPOSING FACTORS

- Animals that have never had ringworm before.
- Animals with poor nutrition.
- Young animal.
- Animals that are kept in close contact with infected animals.
- Animals that are kept in warm, damp, and poorly ventilated areas.
- Animals that are washed too frequently.
- Animals that come into contact with infected flies [9].

3. EPIDEMIOLOGY

Ringworm infection depends on fungal species, host age, immunocompetence, condition of exposed skin surfaces, host grooming behaviour, and nutritional status [10]. The disease is more common in the winter and temperate climates [11]. Young animals are more susceptible than adults. Chronically cases may be a source of the infection among the herds. The incidence rate of ringworm seems lower in sheep and goat than in cattle, but it may be under diagnosing or has not been reported [12, 13]. Show lambs are more susceptible to ringworm due to the stress and preparation they go through getting ready to show. Frequent washing and clipping of sheep break down the lanolin which serves as a natural barrier to infectious organisms making the skin more susceptible to infections.

4. TRANSMISSION

The transmission of dermatophytosis is usually occurred by direct contact with infected animals or humans. The spores of ringworm fungi survive many months and in some cases years in the farm environment and may be transmitted either by fomites such as (brushes, gates, feed carts) or by a symptomatic carrier to susceptible hosts. [14-16].

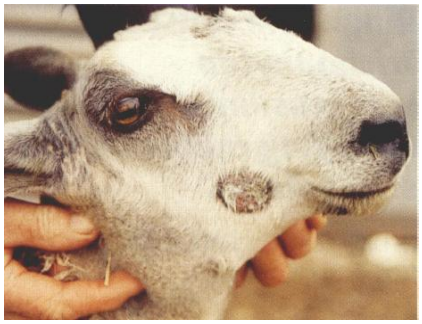

Fig. 1. Ringworm lesion on the face of sheep [13]

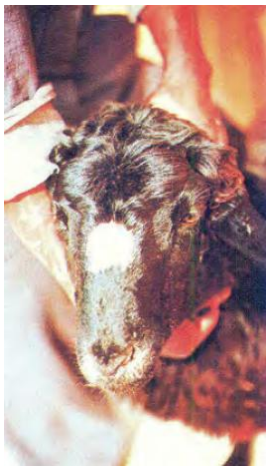

Fig. 2. Typical circumscribed area of alopecia on the dorsum of sheep nose [6]

5. CLINICAL FEATURES

In sheep, lesion starts with scaling patches of hair loss with grey-white crust formation some time it becomes thickly crusted with suppuration. Lesions in lambs are most often noticed on the head, multiple lesions can be in show lambs [17] (Fig. 1-7). In goat, lesions can occur at any position but are most common on the face, head, pinnae, neck, and legs. Annular to uneven to diffuse areas of alopecia, scaling, erythema, and

yellowish crusts are seen. Pain and pruritus are rare [18] (Fig. 8-12).

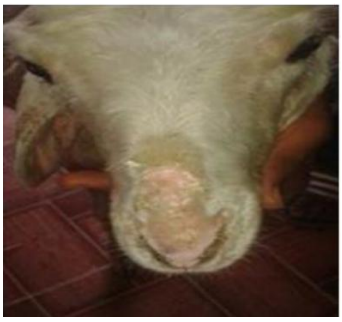

Fig. 3. Ringworm lesions in sheep showing alopecia and scaling [26]

6. AETIOLOGY

Sheep

T. verrucosum is the only species which were able to isolate in Germany and Britain respectively [19,20]. *T. verrucosum* latter was isolated from an outbreak in Karakul sheep by [6,13]. In addition to *T. verrucosum* isolated *Trichophyton mentagrophytes* from infected animals in a flock of sheep Gujlhon et al., 1955, Gujlhon et al., 1955 , Eissaa et al., 2013 [21-23], while Thakur et al., 1983 [24] isolated *Microsprum gypseum* . Nweze, 2011 [25] was able to isolate *Trichophyton equinium.* Haggag et al., 2017[26] isolated *Microsprum canis* from sheep in Egypt. El-Allawy et al., 1980 [27] isolated *Trichophyton terrestre* from an outbreak in Oseemy sheep in Egypt. While Biswas et al., 2015[28] isolated *Trichophyton rubrum*. *Arthroderma vanbreuseghemii* has been isolated by Laguna et al., 2017 [29].

Goats

T. verrucosum, T. mentagrophytes and *M. gypseum* have been isolated by Thakur et al., 1982 [30], while Biswas et al., 2015 [28] added *T. rubrum* to latter isolates. *M canis* reported by Pal, 2001 [31]. *T. equinium* was recorded by Nweze, 2011 [25]. *Trichophyton schoenleinii* by Chah et al., 2012 [32].

7. DIAGNOSIS

Dermatophytosis diagnosis is based on the clinical signs however to confirm the diagnosis culturing and direct microscopic examination of skin scrapings from the periphery of the lesions should be indicated.

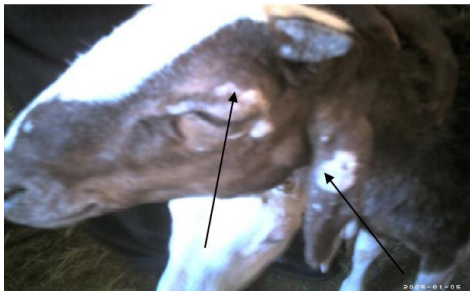

Fig. 4. Ringworm lesions on the ear and the eyelid of a Sudanese desert sheep (arrow).[52]

Fig. 5. Lesions which have progressed circularly from around the eyes to adjacent areas of the face [6]

Fig. 6. Dermatophytosis. Annular crusts on side of face [18]

8. COLLECTION OF SAMPLES

The affected skin should be cleaned with alcohol and the advancing border of the lesion should be scraped with the blunt edge of a sterile disposable scalpel. Hairs and scales can be plucked with sterile tweezers. Clean, dry and sterile paper envelopes should be used for transport of specimens [25].

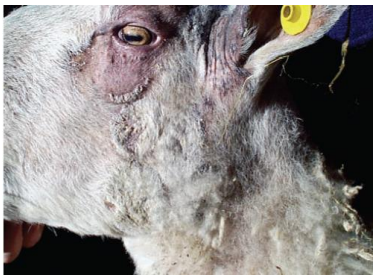

Fig. 7. Dermatophytosis. Annular crusts on face [18]

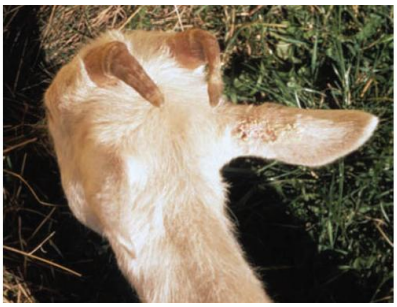

Fig. 8. Dermatophytosis. Annular area of alopecia and yellowish-grey crust on the right pinna [18]

Fig. 9. Dermatophytosis. Annular areas of thick, greyish crusts on the udder [18]

Fig. 10. Dermatophytosis.Well-circumscribed areas of alopecia, erythema, and scaling on face and pinna [18]

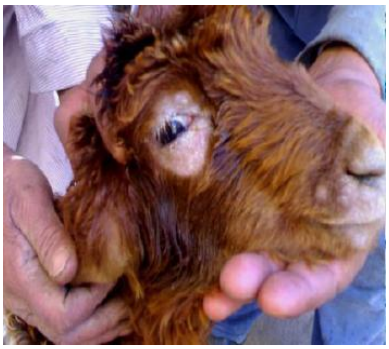

Fig. 11. Alopecia and scaling around the eye [53]

9. DIRECT EXAMINATION

Each sample from the infected cat was divided into two portions, one portion to be used for direct microscopic examination and the other for culture. Direct examination of hairs and scales looks for the presence of fungal hyphae and/or ectothrix spores. Hairs or hair fragments with hyphae and arthrospores are thicker, with a rough and irregular surface.

This procedure can be done with clearing agents such as Potassium Hydroxide (KOH) 10 or 20% [33-35]. Infected hairs can be readily identified at x4 or x10 magnification, appearing pale, wide and filamentous compared with normal hairs. On high magnification (x40) cuffs of arthrospores are visible (Figs.13, 14). The positivity values for the KOH direct test were considered predictive about positive cultures, which were considered as the gold standard. The use of mineral oil for direct examination has been reported [18] (Fig. 15).

10. FUNGAL CULTURE

Samples are usually collected by sterile toothbrush which is more preferred than the hair plucking technique. The samples are cultured on Sabouraud dextrose agar supplemented with chloramphenicol (0.05 mg/mL) and cycloheximide is added as a semi selective agent to reduce the growth of nondermatophytic fungi (0.5 mg/mL). Petri dishes were incubated at 25ºC for 5 weeks. The isolates were examined macroscopically and microscopically after staining with lactophenol cotton blue for wet mount technique [36,37] (Figs. 16-21). The slide culture was made simultaneously, for better visualization of typical structures of each fungi species. Dermatophytes test media (DTM) is recommended as the best media for isolation of

dermatophytes because the presence or absence of the red colour indicator is a useful aid in early identification of highly suspect cultures, and also later in sorting and evaluating plates before microscopic examination [38]. In addition to the mention above, pigment production on cornmeal agar, urease activity on urea agar base (Fig. 22), growth at 37ºC on SDA *in vitro* and hair perforation tests are used for identification of dermatophytes [39-41]. Biochemical tests were employed to differentiate *Trichophyton* spp. are enriched media with thiamine, histidine, nicotinic acid and inositol, the isolates are subcultured in this media [42].

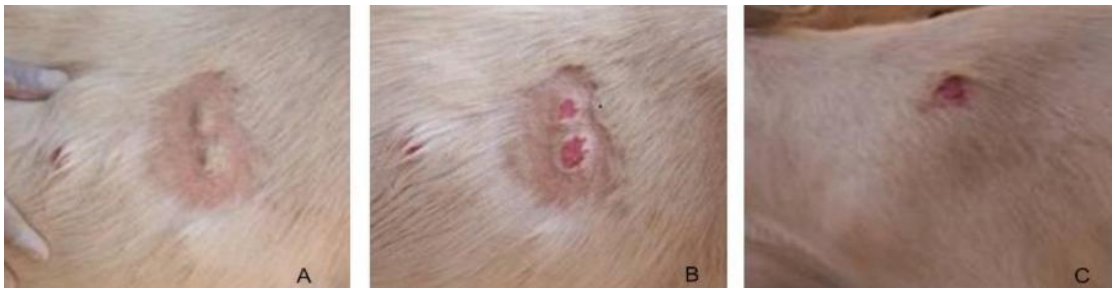

Fig. 12. Different size rounded , raised scaling and crusting skin lesions (A) lesions on the right thoracic wall with scabs on their tops - to expose the lesions, the hair around them was clipped out, (B) same lesions in-A showing scabs detachment after sampling, (C) Auto detachment of the scabs on the left scapular region.[54]

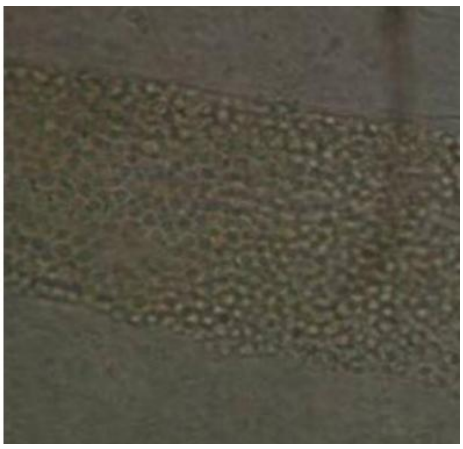

Fig. 13. Direct examination of skin scrapings in 20% KOH (400x) showing large numbers of endothrix spores [55]

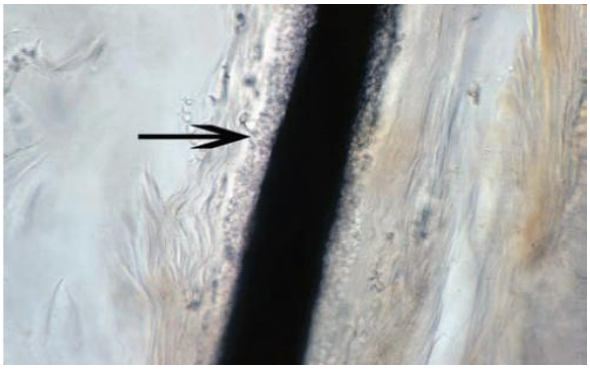

Fig. 14. Dermatophytosis. Numerous arthroconidia (arrow) on the surface of infected hair [18]

Fig. 15. Dermatophytosis. Plucked hairs in mineral oil. Note the thickened irregular appearance of infected hair (arrow) [18]

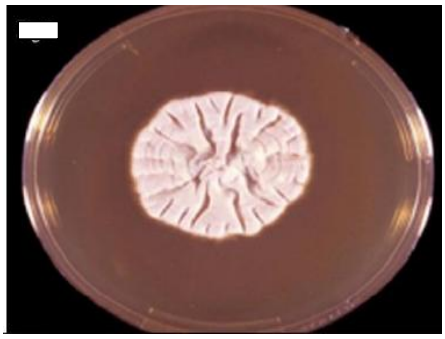

Fig. 16. *T. verrucosum* (growth on Sabouraud's, glucose agar, forming slightly folded, curled, heaped, glabrous, grey-white colonies). [23]

Fig. 17. Cultures of *T. mentagrophytes* characterized by buff to tan colour and radial folds [23]

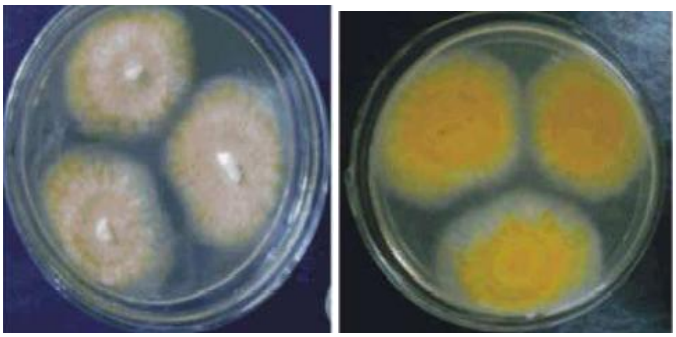

Fig. 18. Macroscopic morpholgy of three weeks old culture of *M.canis* on SDA

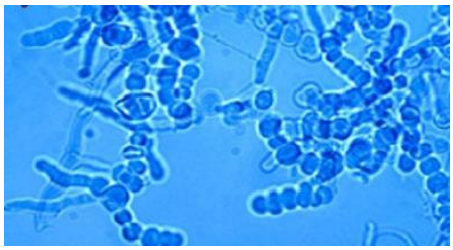

Fig. 19. lactophenol cotton blue, showed characteristic, septate hyphae with chlamydospores [23]

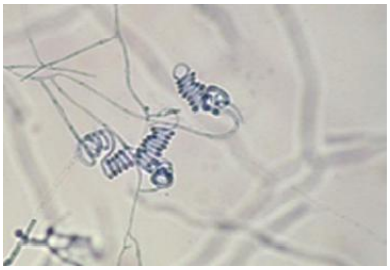

Fig. 20. Microscopic examination of *T. mentagrophytes* showed the presence of spiral shape mycelia [23]

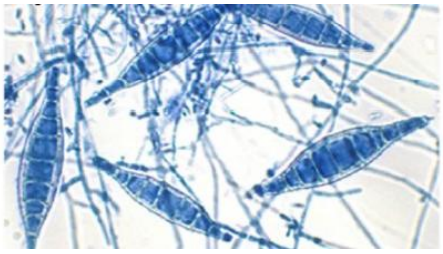

Fig. 21. Microscopic examination of *M. canis* showed the presence of numerous spindle-shaped with rough and thick wall macroconidia [23]

Fig. 22. Growth of *T.mentogrophytes* on urea agar after 4 days showing hydrolysis of the area [55]

11. SKIN BIOPSY

Specimens from infected skin should be taken and fixed in 10% formaline solutions then dehydrated, cleared and embedded in paraffin wax, sectioned at 4 µm thickness should be stained by haematoxylin and eosin for microscopical examination [43]. haematoxylin and eosin staining (H&E) may or may not identify dermatophytes and special stains such as periodic acid Schiff (PAS) and Grocott methenamine silver (GMS) are needed. Skin biopsy from two dairy goats from different flocks revealed a mixture of orthokeratotic and parakeratotic hyperkeratosis [44].

12. MOLECULAR IDENTIFICATION

Diagnosis with conventional methods is time-consuming because it might take up to 4 weeks or longer to give the final results [2]. Furthermore, morphological identification may be confusing due to the polymorphism of dermatophytes [45]. During the last decade, a wide variety of molecular techniques has become available as possible alternatives for routine identification of fungi in clinical microbiology laboratories [46,47]. Different molecular methods have been used for identification of dermatophytes isolated from animals.

13. TREATMENT

If your sheep gets wool fungus, the first thing you should do is remove the wool at least two inches around the infected area. Next, take a brush and soapy water to remove the scab down to the skin. You should also dispose of or thoroughly disinfect all brushes, wool, scabs, and clippers. Treating the area will not only shorten healing time, but it is also going to prevent the fungus from spreading to other animals and humans.

Topical treatment:

1- 3-ethylamino-1,2-benzisothiazole-hydrochloride (Ectimar) [6]
2- 3-benyl-5-carboxymethyltetrahydro-1 ,3,5-thiabiazin - 2- thion sodium(Defungit) [6]
3- Phenylmercuric acetate (Sporodyl). [6]
4- Micro-sulphur suspended in oil. [6]
5- tincture iodine [48]
6- Miconazole [31]

Systemic treatment:

1- Griseofulvin10 mg/kg body weight can be used for 7 days in mild infections; in severe cases 2–3 weeks [49].

2- Ivermectin at a dose 200 micrograms /Kg body weight by subcutaneous injection [50].

14. ENVIRONMENTAL DECONTAMINATION

Clinafarm can be used for disinfecting of the environment with spray or smoke generator [49].

15. VACCINATION

Live attenuated vaccine of *T. verrucosum* was used to control sheep and goat dermatophytosis [51].

16. CONCLUSION

Dermatophytoses are the most common fungal infections in sheep and goats. Studies were done considering different aspects of the disease (eg. epidemiology, clinical presentation and diagnosis, treatment, prevention, and control) but more studies are needed to be done in molecular and serological methods of identification. Infected sheep and goats with dermatphytes can be a source of infection to human this can lead to the public health problem.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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