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Ringworm in Sheep and Goats in Egypt, with Special Reference to Experimental Infection and Immunization in Sheep

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Summary

Out of 7181 sheep and 803 goats, 498 (6.93 %) and 9 (1.12 %), respectively, showed ringworm infection. From 507 cases examined mycologically, *Trichophyton verrucosum* was isolated 348 times and *T. mentagrophytes* 3 times. The infection was common in young animals. Experimental infection in two sheep with freshly isolated *T. verrucosum* was successful. After complete healing the sheep showed no resistance to re-infection. *T. verrucosum* antibodies could be detected by precipitation and haemagglutination tests both in experimentally infected sheep as well as in sheep immunized with autoclaved *T. verrucosum* whole mycelial antigen.

Introduction

Ringworm in sheep has been described in different countries (CATANEI, 1939; LINDQUIST, 1960; KIELSTEIN and WELLER, 1965; VANBREUSEGHEM, 1967; and GUPTA et al., 1970). Ringworm in goats was reported by KIELSTEIN and WELLER (1965) and BESE et al. (1965). In all these cases the causative dermatophyte was identified as *Trichophyton verrucosum*.

The isolation of *T. verrucosum* from sheep in Egypt has been reported by NASSER (1969) and REFAI et al. (1976). In the present work a detailed study on the incidence of ringworm in sheep and goat has been carried out. In addition to mycological examination of infected animals, experimental infection and immunization of sheep were studied.

Material and methods

A total of 7181 sheep and 803 goats found in different farms of 5 provinces in Egypt (Cairo, Giza, Al-Sharkia, Al-Gharbia, Al-Kaliobia) as well as from the Clinic of the Faculty were examined clinically for ringworm. Skin scrapings, wool and hairs were collected from the infected animals and examined mycologically.

Two apparently healthy adult sheep were experimentally infected by a

freshly isolated strain of *T. verrucosum*. The inoculum was rubbed on different sites previously scarified by sand-glass paper.

Two other sheep were immunized by whole mycelial killed antigen of 4 weeks old culture of *T. verrucosum* grown on fluid medium (maltose 12.0, neopeptone 3.0, yeast extract 0.15, thiamine 0.003, inositol 0.15 g. in 300 ml. water). Each animal received 5 doses of 0.5 % suspension (0.25, 0.5, 1.0, 2.0, and 4.0 ml.).

Serum samples were collected from naturally infected, experimentally infected and immunized sheep and were examined serologically by means of agar gel diffusion, and haemagglutination tests.

Results

1. Incidence of ringworm in sheep and goats

Typical lesions of ringworm were observed in 498 sheep (6.93 %) and 9 goats (1.12 %). The lesions were seen mostly on the head, especially on the nose, cheeks, around the eyes, forehead, ears and chin. The woolly part of the sheep was found to be infected also, especially at the neck region. Generalized infection was observed in 3 cases. The lesions varied in size from 3—10 cm in diameter, mostly circular, and only few

hairs remained in the lesions found on the face, ears and nose. On the woolly parts, the infected wool was easily detachable. In goats the lesions were localised on the head and were irregular and ill-defined (Fig. 1 and 2).

More than 50 % of the infected sheep were six months to two years old. Under 6 months and above 2 years the percentage of infection did not exceed 11 % and 17 % respectively.

2. Mycological examination

The direct microscopic examination of the infected hair and wool revealed the presence of fungal spores in 415 out of 507 cases examined (Fig. 3).

The cultural examination of the 507 samples was positive in 324 (78.07 %) samples of those that had showed fungal elements microscopically and in 27 (29.53 %) of samples negative microscopically. The isolated dermatophytes were mostly *Trichophyton verrucosum* (368); only 3 isolates were *T. mentagrophytes*. Most of the strains of *T.*



Fig. 1: Ringworm in sheep



Fig. 2: Ringworm in goat

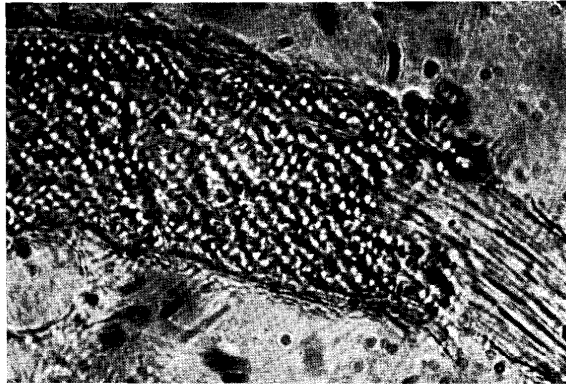


Fig. 3: *Trichophyton verrucosum* infection of wool in sheep

verrucosum were *T. verrucosum* var. *album*. 20 strains acquired violet colour in the primary cultures which was lost on subculturing.



Fig. 4: *Trichophyton verrucosum* isolated from goat

3. Experimental infection

Grayish white scaly crusts were recognized in all sites of infection on the 7th to 10th day after infection. Lesions, then increased in size and the crusts become compact. Complete clinical healing occurred in a period of 60—75 days without treatment. *T. verrucosum* could be re-isolated from the lesions at any time during the experiment and 3 weeks after clinical healing. Sheep recovered from the experimental infection were

again susceptible to re-infection with the same fungus, however, the infection took a rapid course and lesions developed on both newly infected sites as well as on the previously infected ones. Healing took place in a period of 25—30 days.

4. Immunological studies

Precipitins against *T. verrucosum* were detected in experimentally infected sheep 10 days from the appearance of the lesions and up to 45 days. In immunized sheep precipitins were demonstrated one week after the first injection and continued to be detected up to 10 weeks. The naturally infected and control sheep were negative.

Using the passive haemagglutination test, antibodies were demonstrated in sera from naturally and experimentally



Fig. 5: 10 days after experimental infection of sheep with *Trichophyton verrucosum*



Fig. 6: 35 days after experimental infection of sheep with *Trichophyton verrucosum*

infected sheep as well as from sheep immunized with *T. verrucosum*. Naturally infected sheep showed titres up to 1:64 (control 1:16). Experimentally infected sheep showed antibody titre of 1:128 up to the 9th week after the appearance of the lesions, then the antibodies began to decline. In the immunized sheep antibodies were detected one week after the first dose with gradual increase in the titre to 1:256—1:512 after 4 and up to 10 weeks. Then the titre declined slowly.

Discussion

Ringworm in sheep is not frequently reported. In the available literature there are few reports dealing with the disease in sheep and rarely in goats. These reports are concerned mostly with clinical studies of the disease and isolation of the causative fungi. The most commonly isolated dermatophyte from cases of ringworm in sheep is *Trichophyton verrucosum* (CATANEI, 1939; LINDQVIST, 1960; BESE et al., 1965; KIELSTEIN and WELLER, 1965; VANBREUSEGHEM, 1967).

The second common cause of ringworm in sheep has been reported to be *Trichophyton mentagrophytes* (GUILHON et al., 1965; PEPIN and AUSTWICK, 1968).

AINSWORTH and AUSTWICK in their book "Fungal Diseases on Animals" (1973) listed the dermatophytes isolated from sheep as *T. verrucosum*, *T. mentagrophytes*, *T. quickeanum*, *T. pruinatum*, and *Microsporum canis*.

In the present work *T. verrucosum* with its three varieties (*ochraceum*, *discoideum*, *album*) was the commonly isolated dermatophytes in cases of ringworm in sheep in Egypt and *T. mentagrophytes* was recovered only from 3 cases.

The isolation of *T. verrucosum* in 99.1% of the cases substantiate the results obtained by NASSER (1969) and REFAI et al. (1976). However, both authors could isolate only *T. verrucosum* from sheep. The three cases of *T. mentagrophytes* reported in this work might have been contracted either from infected cattle or from the soil. ABDALLAH et al. (1971) reported the isolation of *T. mentagrophytes* from cases of cattle ringworm in a farm in Assiut.

With regard to the pathogenicity of *T. verrucosum* to sheep there are no

reports in the available literature covering this point, therefore, the results obtained in this work are important as two sheep could be experimentally infected with *T. verrucosum* and typical lesions of ringworm developed and persisted for up to two months.

On the other hand, the pathogenicity of *T. verrucosum* had been studied only in laboratory animals as G. pigs (MARTIN and KIELSTEIN, 1966) and rabbits (COX and MOORE, 1968).

The re-infection in sheep was characterized by a rapid course both in newly as well as previously infected sites. Similar observations were reported by DELAMATER and BENHAM (1938) and REISS and LEONARD (1955) in dogs, cats and rabbits.

In the available literatures no data could be found dealing with immunology of the dermatophytes in sheep. In the present work antibodies could be detected in sera of sheep experimentally infected or immunized by autoclaved whole mycelial antigen of *T. verrucosum*; both by agar gel precipitation and haemagglutination tests. However, the detection of circulating antibodies had no correlation with the development of immunity and the sheep acquired no resistance to re-infection.

Zusammenfassung

Von 7181 Schafen zeigten deren 498 (= 6,93%) Zeichen von Dermatomykose, von 803 Ziegen waren es 9 (= 1,12%). 507 Fälle wurden mykologisch untersucht. 348mal wurde *T. verrucosum* identifiziert, 3mal *T. mentagrophytes*. Die Infektion betraf im allgemeinen junge Tiere.

Eine experimentelle Infektion mit frisch isoliertem *T. verrucosum* gelang bei 2 Schafen. Nach vollständiger Heilung zeigten die Schafe jedoch keine Resistenz gegenüber einer Reinfektion. Antikörper gegen *T. verrucosum* konnten mit Präzipitations- und Hämagglutinationstest sowohl bei den experimentell infizierten wie auch bei den mit Myzel-Vollantigen immunisierten Schafen nachgewiesen werden.

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