



# Research in Veterinary Science and Medicine



Dermatology Review Article

## Dermatomycoses in Animals in the Indian Subcontinent, the Middle East, Kenya and Brazil

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### ABSTRACT

Dermatomycoses are the most common of fungal infections in livestock, pet animals, and wild animals. The causative agents, dermatophytes, belong to three genera, namely, *Trichophyton*, *Microsporum*, and *Epidermophyton*. The dermatophytes known to have a sexual stage are placed in the family Arthrodermataceae in the Phylum Ascomycota of the Kingdom Fungi. Ecologically dermatophytes are classified as anthropophilic, zoophilic, and geophilic. Dermatophytic infections are the most common of fungal infections in animals. Human infections are frequently caused by some zoophilic dermatophytes but occasionally by geophilic dermatophytes. Predisposing factors for animal infections include contact with other infected animals and spores of the dermatophytes which can survive more than a year under humid and mild temperature conditions. This study presents an update on the occurrence of dermatomycoses caused by different species of dermatophytes in animals in countries in the Indian subcontinent, the Middle East, and in Kenya and Brazil. Therapy and prevention of infections are also discussed briefly.

**Keywords:** Animal dermatomycoses, Dermatophytes, Therapy, Prevention, An update

### INTRODUCTION

Dermatophytes are a specialized group of fungi that invade the keratinized layers of the skin and its appendages in humans and animals. They are often referred to as ringworm fungi due to the ring-shaped lesions that they form on the skin. Dermatophytes are the most common agents causing superficial fungus infections. Like most fungi, dermatophytes have two species names. One is that of the asexual form (anamorphic state) that infects the vertebrate hosts. The other is that of the sexual form or perfect stage (teleomorph) produced by mating between the anamorphs.<sup>[1]</sup> The dermatophytes known to have sexual states are placed in the family Arthrodermataceae in the Phylum Ascomycota of the Kingdom Fungi.<sup>[1]</sup> The dermatophytes that do not have a sexual state like other medically important fungi with no known sexual state are placed in the class Deuteromycetes (Fungi Imperfetti).<sup>[1]</sup>

From an ecological and epidemiological point of view, the dermatophytes are classified into three groups based on their mode of transmission; geophilic (found in soil and infecting both animals and humans), zoophilic (found on animals, but can be transmitted to humans), and anthropophilic (found on humans)<sup>[2-4]</sup> but can occasionally infect animals.<sup>[4]</sup> Zoophilic and anthropophilic dermatophytes evolved from a geophilic origin, with the anthropophilic dermatophytes being the most highly specialized group.<sup>[2,3]</sup> Zoophilic dermatophytes include *Trichophyton mentagrophytes*,

*Trichophyton simii*, *Microsporum canis*, *Microsporum gallinae*, *Microsporum nanum*, and *Microsporum persicolor*, but only some of them cause clinical infections in animals.<sup>[1,3]</sup> Occurrence of some zoophilic dermatophytes, namely, *T. simii*, *M. vanbrueseghemii*, *M. nanum*, and *M. persicolor* has also been demonstrated in soil.<sup>[2-5]</sup> It is noteworthy that *M. persicolor* was found to be widely spread in soils of central India.<sup>[6]</sup> Geophilic and zoophilic dermatophytes generally tend to form lesions that are more inflammatory than those produced by anthropophilic dermatophytes, and these lesions are also more likely to heal spontaneously.<sup>[4]</sup>

Predisposing factors for infections include contact with other infected animals and spores of the fungus; the poor immune response of the animal facilitates the spread of infection.<sup>[7]</sup> The lesions usually occur as red patches with a raised border. The skin portion on all regions of the animal body, scalp, nails, hooves, and horns may be infected. The nails may become distorted, cracked, and fall off.<sup>[7]</sup>

## METHODS

A thorough search of the literature was made in PubMed, MEDLINE, Biomed Lib, and Med Facts, using different sets of keywords, namely, Dermatophytes and Dermatomycoses in animals, Indian subcontinent, the Middle East, and South America.

## RESULTS

The prevalence of infection in animals caused by dermatophytes in different counties is shown in [Table 1].<sup>[7-38]</sup> The number of

publications on dermatomycosis in animals in India was 23 being the maximum from any country from India. As would be observed in the table, in some of the studies, no mycological study of lesions was done, nor was the clinical appearance of the lesions mentioned.

## DISCUSSION

This study provides an update on the prevalence of animal dermatophytic infections in countries in Indian subcontinent, the Middle East, in Kenya and Brazil. The maximum number of reports from India was from Delhi state-6 followed by Haryana-5. The maximum number of animals sampled-532 and found positive for infection-214 was in a single report from seven states of Nigeria.<sup>[38]</sup> A publication from Belgium<sup>[39]</sup> reported a clinical cure for 96.8% of the cats and 93.5% of the dogs with a 20-day daily dose (10 mg. kg/body weight) of oral ketoconazole; new hair growth was observed in 96.7% of the cats and 80.9% of the dogs. One report from India mentioned treatment of dermatophytic lesions with tincture iodine and miconazole in goat and its handler<sup>[20]</sup> and another one from Pakistan reported treatment of pet cats with oral griseofulvin, ketoconazole, and terbinafine.<sup>[33]</sup> The cost of medication for the treatment of herds of animals with antifungal drugs is very prohibitive. There is a need to explore novel saprophytic Streptomyces species to isolate antifungal drugs for economic use in animals. The Tulsi plant (*Ocimum sanctum*) found in several parts of India is known to have anti-dermatophytic activity.<sup>[40]</sup> Our veterinary scientists should also investigate the use of Tulsi and other local herbs including other species of *Ocimum* for the treatment of dermatomycoses in animals.

**Table 1:** Reports of infections in animals due to different species of dermatophytes in the Indian subcontinent, the Middle East, Africa and Brazil.

State (Locality)	Name(s) (species) of and number of animals infected	Mycological investigation of lesions	Lesions and sites affected	Reference
<b>India</b>				
<i>T. simii</i>				
Uttar Pradesh (Mathura)	Poultry ( <i>G. gallus domesticus</i> )-5, and Dog ( <i>C. lupus familiaris</i> )-1	Not mentioned	Not known	Stockdale <sup>[8]</sup>
Uttar Pradesh (Mathura)	Poultry-16 and Dogs ( <i>C. lupus familiaris</i> )-2	Not mentioned	Not known	Tewari <sup>[9]</sup>
Kerala (Trichur)	Many rabbits were infected	<i>Arthroderma simii</i> was recovered from scraping of lesions in several rabbits	Dermatitis (Details of lesions are not mentioned)	Rajan and Sivadas <sup>[10]</sup>
Delhi	Dog ( <i>C. lupus familiaris</i> )-2	Microscopic demonstration of hyphae in scrapings of the lesions and positive cultures	Circular erythematous lesions on the nose and upper lip	Mohapatra and Mahajan <sup>[12]</sup>
Delhi	Dog ( <i>C. lupus familiaris</i> )-4	Presence of hyphae in scrapings of the lesions and positive cultures	Scaly erythematous lesions on the body	Gugnani <sup>[13]</sup>

(Contd...)

**Table 1:** (Continued).

State (Locality)	Name(s) (species) of and number of animals infected	Mycological investigation of lesions	Lesions and sites affected	Reference
Delhi. Four privately owned poultry farms	Farm 1-Infection occurred as ongoing epizootic. 70 birds ( <i>G. gallus domesticus</i> ) (28%) out of 250 examined were infected. 7 birds in one additional, and one bird each in two other poultry farms were infected	Microscopic examination of scraping of lesions available from only 23 of the infected birds revealed many hyphae and arthrospores. <i>T. simii</i> was recovered in culture from all	The lesions were scaly, and erythematous on the comb, wattle, and basal portion of the flank feathers. In 8 birds only the entire comb was heavily infected.	Gugnani and Randhawa <sup>[14]</sup>
Haryana (Hisar) privately owned poultry far	Poultry ( <i>G. gallus domesticus</i> )-3	Presence of hyphae and arthrospores in scrapings from the lesions and positive cultures	Scaly and erythematous lesions on flank feathers	Gugnani and Randhawa <sup>[14]</sup>
Meerut (Uttar Pradesh) privately owned poultry farm	Poultry ( <i>G. gallus domesticus</i> )-3	Presence of hyphae and arthrospores in scrapings from the lesions and positive cultures	Scaly and erythematous lesions on flank feathers.	Gugnani and Randhawa <sup>[14]</sup>
Several unnamed localities Uttar Pradesh)	One out of 22 cattle examined was infected	Recovery of <i>T. simii</i> from the skin lesions	Not mentioned	Mitra et al. <sup>[15]</sup>
Tamil Nadu (Madras-now caed Chennai)	211 dogs including strictly house and stray dogs ( <i>C. lupus familiaris</i> ) cattle ( <i>B. taurus</i> ) were screened, Two (0.95%) were infected.	Two dogs (0.94%) were infected. <i>T. simii</i> was recovered in culture	Lesions were scaly, circinate, with a well-defined margin, and minimal crusts	Ranganathan et al. <sup>[41]</sup>
<i>T. mentagrophytes</i> var. <i>mentagrophytes</i>				
Delhi-Animal house of All India Inst. Med Sciences, New Delhi	Four guinea pigs ( <i>Cavia porcellus</i> ) and one rabbit ( <i>Lepus curpaeum</i> ).	Presence of septate hyphae in KOH mounts of skin scraping of the lesions and positive cultures for <i>Trichophyton verrucosum</i>	Scaly erythematous lesion	Mohapatra et al. <sup>[16]</sup>
Punjab (Ludhiana) Animals of Dairy farms of Punjab Agricultural University	Murrah Buffaloes ( <i>Bubalus bubalis</i> ) 71 (0.59%) out of 18099 animals, Cattle 27 (3.98%) out of 4923 animals were infected.	Mycological study identified <i>T. mentagrophytes</i> , <i>T. verrucosum</i> , and <i>M. gypseum</i> , as the causative agent The disease occurred throughout the year with a higher prevalence in winter.	Scaly erythematous lesion	Nooruddin and Singh <sup>[17]</sup>
Haryana (Hisar) Punjab Agricultural University farm Uttar Pradesh-Sheep farm	Pigs ( <i>Sus domesticus</i> )-20 Two out of 14 examined were infected	Eight of the pigs were infected.	Skin lesions (details not mentioned)	Gupta et al. <sup>[18]</sup>
Delhi, Animal house of National Centre for Disease Control (formerly called National Institute of Communicable Diseases 0, Delhi	Monkey ( <i>Macaca mulata</i> )-1 and Dogs ( <i>C. lupus familiaris</i> )-2. One of the attendants of monkeys got	Recovery of <i>T. mentagrophytes</i> from skin scrapings	Scaly erythematous lesions on the body of the monkey, and similar lesions on the flanks of dogs	Mitra et al. <sup>[15]</sup>
		Presence of fungal hyphae in skin scrapings of the lesions and positive culture		Gugnani 1971 <sup>[19]</sup>

(Contd...)

**Table 1:** (Continued).

<b>State (Locality)</b>	<b>Name(s) (species) of and number of animals infected</b>	<b>Mycological investigation of lesions</b>	<b>Lesions and sites affected</b>	<b>Reference</b>
Ludhiana (Punjab) Agricultural University dairy farm	infected with <i>T. mentagrophytes</i> from one of the monkeys. Two (0.16%) out of 1232 sheep examined were infected.	Positive cultures from scraping of the skin lesions of infected goats	Ringworm lesions (sites not known)	Thakur et al. <sup>[20]</sup> 1983
Tamil Nadu (Madras-now called Chennai)	211 house and stray dogs and 170 cattle ( <i>B. taurus</i> ) screened.	56 (26.6%) dogs and 17 (10.0%) were infected.	Occult scattered skin lesions	Ranganathan et al. <sup>[41]</sup>
Delhi-Privately owned dairy farm in West Delhi	71 indigenous cattle and 15 buffaloes	In 23 (30.26%) calves of these animals of different sex and age were infected. as demonstrated by direct microscopy of KOH mounts of skin scrapings and Culture positive in 19 calves	Raised, thick asbestos-like lesions were observed mostly on the head, near the eye, ears, nostrils, muzzle, and in mouth. In 2 calves, lesions were also present on the neck, abdomen, and thigh.	Pal 1987 <sup>[21]</sup>
Jaipur (Rajasthan)-120 dogs with ringworm lesions	22 (18.3%) were infected with <i>T. mentagrophytes</i>	Presence of hyphae in KOH mounts of scrapings of lesions and positive cultures	Skin lesions (Clinical features are described)	Gangil et al. <sup>[22]</sup>
Kolkatta (West Bengal)	253 (20.9% of 30 1200 dogs and 30 (28.9%) of 109 cats examined were infected.	Recovery of <i>T. mentagrophytes</i> from scrapings from the lesions in dogs and cats	Skin lesions (Details are not mentioned)	Debnath et al. <sup>[23]</sup>
Anand (Gujarat)-12 cattle with ringworm lesions	5 (41.7%) were infected with <i>T. mentagrophytes</i>			Parmar et al. <sup>[24]</sup> 2018
<i>T. verrucosum</i>				
Ludhiana (Punjab) Agricultural University dairy farm	Four (0.32%) out of 1232 sheep examined were infected.		Ringworm lesions (sites not mentioned)	Thakur et al. <sup>[25]</sup> 1983
Hissar (Haryana) Two privately owned cattle farms	Infection occurred as an enzootic among the calves. None of the milch cattle were infected	Microscopic demonstration of hyphae suggestive of <i>T. verrucosum</i> in KOH mounts of scrapings from the lesions and positive cultures	Ringworm lesions (sites not mentioned)	Gugnani <sup>[26]</sup> 1972
Haryana (Hisar) Teaching Veterinary Clinical Services Complex, College of Veterinary Sciences, CSS Haryana Agricultural University, Four organized cattle farms	58 (1.4%) infected out of 4136 cattle calves examined	Demonstration of hyphae indicative of <i>T. verrucosum</i> in KOH mounts of skin scrapings from the lesions and its recovery in culture on SDA	Lesions were grayish white, crusted, raised, circular, thick and circumscribed on the head, around the eyes, neck, and forelegs. In a few calves, lesions were spread all over the body.	Kumar and Khurana <sup>[27]</sup> 2005
Kuch, (Rajasthan) Organized farm	Two (11.1%) out of 18 cattle of both sexes infected, aged 9 and 12 months respectively were infected		Crusty lesions on different parts of the body, particularly the neck region	Choke et al. <sup>[28]</sup> 2006
<i>T. rubrum</i>				
Madras-now called Chennai (Tamil Nadu)	Five (2.37%) out of 211 strictly house dogs were infected	Positive culture of <i>T. rubrum</i> from scrapings of lesions.	Skin lesions (Details are not mentioned)	Ranganathan et al. <sup>[41]</sup>

(Contd...)

**Table 1:** (Continued).

<b>State (Locality)</b>	<b>Name(s) (species) of and number of animals infected</b>	<b>Mycological investigation of lesions</b>	<b>Lesions and sites affected</b>	<b>Reference</b>
<i>E. floccosum</i> Bikaner (Rajasthan) National Camel Research Centre	Many camels were infected in the herd of these animals. Infection occurred particularly during the period of high rainfall.	<i>E. floccosum</i> was recovered from skin lesions in many camels	Skin Details are not mentioned.	Tuteja <i>et al.</i> <sup>[29]</sup>
<i>M. canis</i> Haryana (Hisar) Punjab Agricultural University farm Gujarat (Anand) Gujarat Agricultural University	One dog was infected with <i>M. canis</i> One 7-years-old female goat and a 24-years-old goat handler were infected	Cultures of scraping of lesions positive Direct microscopy of scrapings from the lesions revealed hyphae and arthroconidia. Cultures on mycological media showed colonial and microscopical features typical of <i>M. canis</i>	Skin lesions (Details not mentioned) Two yellowish grey, irregular diffuse, alopecic patches on face and pinna. The goat handler had circular, erythematous lesions. The lesions in the goat and its handler resolved with tincture iodine and MCZ.	Gupta <i>et al.</i> <sup>[18]</sup> Pal <sup>[30]</sup> 2000
Kolkata (West Bengal) 1209 companion dogs and 292 companion cats were screened.	100 (8.27%) dwiogs and 100 cats (37.33%) (were infected). The predominant agents identified were <i>M. canis</i> , <i>T. mentagrophytes</i> , and <i>M. gypseum</i> .			Debnath <i>et al.</i> <sup>[23]</sup>
<i>M. gypseum</i> Ludhiana (Punjab) Agricultural University dairy farm Madras (now called Chennai)	One out of 1232 sheep examined was infected. Forty-two (19.9%) out of 211 strictly house and stray dogs, and 17 (10.0%) out of 170 cattle examined were infected	Positive culture of <i>M gypseum</i> from scrapings of lesions. Mycological investigation of lesions identified <i>M. gypseum</i> as the etiological agent.	Ringworm lesions (sites not known) Ringworm lesions (sites not known)	Thakur <i>et al.</i> <sup>[25]</sup> 1983 Ranganathan <i>et al.</i> <sup>[41]</sup> 1997
Kolkata (West Bengal) Bengal Veterinary College, Belgachia	Dog-1 Cow-2	Not mentioned	Dog-scaly, moist, itching, partially alopecic lesions on the buttocks and the trunk dorsal to the front legs Cows-The first one had small plaques raised and covered with scabs on the head, muzzle, and side of the nostril. The second had lesions all over the body.	Chakraborty <i>et al.</i> <sup>[31]</sup> 1954
Kolkata (West Bengal) 1209 companion dogs and 292 companion cats were screened.	100 (8.27%) dogs and 100 cats (37.33%) were infected. The predominant agents identified were <i>M. canis</i> , <i>T. mentagrophytes</i> , and <i>M. gypseum</i>	Fungi recovered by a sampling of the animals were identified by colonial and microscopical features	Animals without any lesions were studied for carriage of dermatophytes	Debnath <i>et al.</i> <sup>[23]</sup> 2015

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**Table 1:** (Continued).

<b>State (Locality)</b>	<b>Name(s) (species) of and number of animals infected</b>	<b>Mycological investigation of lesions</b>	<b>Lesions and sites affected</b>	<b>Reference</b>
Jaipur (Rajasthan)-120 dogs with ringworm lesions	67 (55.83%) were infected with <i>M. gypseum</i>	Presence of hyphae in KOH mounts of scrapings of lesions and positive cultures	Skin lesions (Clinical features are described)	Gangil <i>et al.</i> <sup>[22]</sup> 2012
<i>M. nanum</i> Haryana (Hisar) Punjab Agricultural University farm-12 pigs	All the pigs were infected.	Cultures of scraping of lesions positive	Skin lesions (Details not mentioned)	Gupta <i>et al.</i> <sup>[18]</sup>
<b>Pakistan</b>				
<i>M. canis</i> Lahore (Punjab) Thirty infected cats ( <i>Felis sylvestris catus</i> ) were randomly selected from pet Centre clinic in University of Veterinary and Animal Science	All (100%) were known to be infected.	Detection of typical lesions and green fluorescence on ultra-violet light exposure. <i>In vitro</i> antimycotic activity tested by DD was effective for ICZ 10 µg, FCZ 25 µg, KCZ 30 µg, CMZ 10 µg, MCZ µg	Typical ringworm lesions (Details are not mentioned)	Matloob <i>et al.</i> <sup>[32]</sup> 2019
Lahore (Punjab) 200 pet cats randomly selected from Pet Centre clinic	62 (31%) were infected	Fungal hyphae were demonstrated in chloral lactophenol blue mounts of skin scrapings, Microscopy of and cultures on mycobiotic agar demonstrated microconidia and macroconidia characteristic of <i>M. canis</i>	Round scaly lesions devoid of hair, small pustules, erythema, crusts, itching and alopecia on heel, ears, feet, tail, and whole body in some of the cats. 100 days treatment with oral GF and KCZ was successful in all the cats, and with TBF in 85% of the cats.	Saleem <i>et al.</i> <sup>[33]</sup> 2022
<b>Bangladesh</b>				
<i>T. mentagrophytes</i> Chittagong-Nine hospitalized rabbits (5 males and 4 females) with skin disease)	All rabbits were proven to be infected with <i>T. mentagrophytes</i>	Microscopic examination of KOH mounts of skin scraping revealed hyphae. Examination of cultures of the scrapings on SDA containing cycloheximide (0.02%) and depomycin (0.3%) showed colonial morphology and microscopical features typical of <i>T. mentagrophytes</i> .	Not mentioned	Syed <i>et al.</i> <sup>[34]</sup> 2016
<b>Iran</b>				
790 feather, hair, and skin specimens from a variety of animals with suspected dermatophytoses were studied	248 (31.4%) yielded dermatophytes. The most frequently isolated were <i>M. canis</i> (38.3%), <i>T. verrucosum</i> (31.8%), <i>T. mentagrophytes</i> (13.3%), and <i>M. gypseum</i> (7.7%).	Not mentioned	Ringworm lesions (Details are not mentioned).	Khosravi and Mahmoudi <sup>[35]</sup> 2003

(Contd...)

**Table 1:** (Continued).

State (Locality)	Name(s) (species) of and number of animals infected	Mycological investigation of lesions	Lesions and sites affected	Reference
!54 asymptomatic dogs examined in Adana	Four (2.6%) dogs were found to be carriers. 3 (75%) were carriers of <i>T. mentagrophytes</i> , and one (25%) of <i>M. gypseum</i>	<b>Turkey</b> Not mentioned	The animals did not have any lesions.	Ates <i>et al.</i> <sup>[36]</sup> 2008
Number of animals examined for different species of dermatophytes is not mentioned	Camels- <i>T. sarkisovii</i> , Cattel-Sheep and goats- <i>T. verrucosum</i> , <i>T. verrucosum</i> var. <i>autotrichicum</i> , Horses- <i>T. equinum</i>	<b>Kazakhstan</b> Not mentioned		Tokeyev <i>et al.</i> <sup>[37]</sup> 2010
538 different animals - 55 cows, 40 sheep, 40 pigs, 105 dogs, 77 cats, 130 goats, 25 horses, 18 rabbits, 66 chickens and 22 ducks from seven states namely, Enugu, Anambra, Ebonyi, Abia, Imo, Kogi and Delta were examined.	214 positive by microscopy and 180 animals positive for dermatophytes by both microscopy and culture. The percentage of species (based on 214) was <i>M. canis</i> -37.4, <i>T. mentagrophytes</i> -22.9, <i>T. verrucosum</i> -15.9, <i>T. equinum</i> -5.6, <i>M. gypseum</i> -7.0, <i>M. gallinae</i> -6. 1, <i>M. nanum</i> -3.1, <i>M. equinum</i> -1.0, and <i>M. persicolor</i> -0.5	<b>Nigeria</b> Demonstration of typical hyphae and arthroconidia in KOH mounts of skin scrapings in 214 animals and recovery of dermatophytes in culture on slants of Dermasel agar (Oxoid, UK), and by observation of colonial morphology and microscopical features typical of the species	Scaly lesions with crusts, pustules, annular plaques and hair loss were observed in majority of the animals	Nweze <sup>[38]</sup> 2011
Nairobi-20 dairy calves aged 3 months-1 year housed together affected with dermatophytosis (ringworm)	The calves were found to be infected with <i>T. verrucosum</i> . The infection also spread to 2 animal attendants working among the calves.	<b>Kenya</b> Not known	The lesions on the calves were extensive alopecia and/or circumscribed thick hairless skin patches affecting the head, neck, flanks, and limbs. Lesions persisted for more than 17 weeks and most of the calves did not respond to topical treatment for 9 weeks with various anti-fungal drugs.	Wabaccha <i>et al.</i> <sup>[42]</sup> 1998

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**Table 1:** (Continued).

<b>State (Locality)</b>	<b>Name(s) (species) of and number of animals infected</b>	<b>Mycological investigation of lesions</b>	<b>Lesions and sites affected</b>	<b>Reference</b>
Five cows, 16 goats, one monkey and one dog and one cat	The animals were found to be infected with <i>M. canis</i> and <i>M. gypseum</i>	<b>Brazil</b> Demonstration of hyphae and arthroconidia in 30% KOH mounts of scraping of lesions and study of colonial and microscopical features of the isolates recovered in culture on Sabouraud agar.	Infection occurred as six outbreaks First outbreak occurred in veterinary clinic. Lesions of dermatomycosis were observed in a female adult cat and its litter of five 6 weeks old. Similar lesions appeared in a 4 1/2 yrs old dog staying on the same site, finally in 2 adult employees and child contacts. In the 2nd outbreak, characteristic lesion appeared in the owner, an adult male and later in the cat of a relation. In the 3rd outbreak infection first occurred in two cats, and their owner, an adult female. In the 4th outbreak, a cat and two other adult animals showed characteristic dermatomycotic lesions, consequently affecting 4 children aged 5-12 yrs. In the 5th outbreak, an adult cat and its 2 cubs were first to be infected, followed by 2 children, and a gibbon monkey living in the same place. In the 6th outbreak, Lesions characteristic of dermatomycosis occurred in a female gestational bitch. Two puppies on delivery were affected passing the infection to 2 adults, 2 young persons, 3 children aged 10-12 yrs and a young man who came in contact in the residence. Regarding the characteristics of lesions, they were mostly uniform, mainly located on the upper limbs, vic-facial, thoracic and lumbar regions. In most cases, they were circular areas of alopecia, with erythematous edges, with presence of crusts in some cases and also with no itching, and sometime being dry in the central part being desquamative with varying degree of inflammation.	Costa <i>et al.</i> <sup>[43]</sup> 1994

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**Table 1:** (Continued).

State (Locality)	Name(s) (species) of and number of animals infected	Mycological investigation of lesions	Lesions and sites affected	Reference
<i>G. gallus domesticus</i> : <i>Gallus domesticus</i> , <i>C. lupus familiaris</i> : <i>Canis lupus familiaris</i> , <i>T. simii</i> : <i>Trichophyton simii</i> , <i>B. taurus</i> : <i>Bos taurus</i> , <i>T. mentagrophytes</i> : <i>Trichophyton mentagrophytes</i> , <i>T. verrucosum</i> : <i>Trichophyton verrucosum</i> , <i>T. rubrum</i> : <i>Trichophyton rubrum</i> , <i>E. floccosum</i> : <i>Epidermophyton floccosum</i> , <i>M. canis</i> : <i>Microsporum canis</i> , <i>M. gypseum</i> : <i>Microsporum gypseum</i> , <i>M. nanum</i> : <i>Microsporum nanum</i> , <i>T. mentagrophytes</i> : <i>Trichophyton mentagrophytes</i> , <i>T. sarkisovii</i> : <i>Trichophyton sarkisovii</i> , <i>T. equinum</i> : <i>Trichophyton equinum</i> , <i>M. gallinae</i> : <i>Microsporum gallinae</i>			An owner infection with <i>M. gypseum</i> had pruritus.	

For the prevention of clinical infections in animals, personal hygiene, awareness, proper diagnosis, and management of infection have been recommended.<sup>[3]</sup> It is possible that small occult lesions occurring in some pet dogs may not be noticed by the owners of these dogs. Therefore, periodic screening of all livestock and treatment of clinically infected animals is recommended as an important preventive measure, particularly from the public health point of view, as suggested in this study from South India.<sup>[41]</sup> It is encouraging to observe that in one study from South India, the reverse transmission of the anthropophilic dermatophyte and *Trichophyton rubrum* from owners of dogs.<sup>[41]</sup> Another study reported infection of a herd of camels with the anthropophilic dermatophytes and *Epidermophyton floccosum* in Bikaner (Rajasthan);<sup>[20]</sup> infection in the camels might have been possible acquired from attendants handling the camels. A noteworthy report is the infection of sheep with a primarily geophilic dermatophyte, *M. nanum*.<sup>[18]</sup> It may be mentioned here that despite an exhaustive search of literature, only two publications on animal dermatomycoses could be found in Africa, namely, one in Kenya and another one in Nigeria could be found. All the reports in other African countries dealt with parasitic or bacterial infections in animals.

## CONCLUSION

This study providing an update on dermatomycoses in animals in countries in the Indian subcontinent, the Middle East, and South America is the first of its kind in the world. The brief clinical feature of the lesions and treatment have been mentioned as far as available. Strategies for novel approaches to treatment including the use of herbal drugs and measures for prevention are also mentioned.

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## Declaration of patient consent

Patient consent is not required as there are no patients in this study.

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