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Review Article

Mycotic infections in animals in India: An update

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ABSTRACT

This review traces the early records of mycotic infections in India, and presents an update of animal mycoses reported from several parts of India. The types of mycoses covered are the dermatophytosis (ringworm) in domestic animals due to well-known species of zoophilic dermatophytes, viz. *Trichophyton simii*, *T. mentagrophytes*, *T. verrucosum*, *Microsporum canis* and *M. nanum*, and the geophilic dermatophyte, *M. gypseum*, Aspergillus spp, *Cryptococcus* species and other yeast like fungi, histoplasma and blastomyces. The brief clinical and demographic features of infections in different animals are described. A particularly noteworthy finding in literature search is the report of clinical infections in one dog and two cows by an anthropophilic dermatophyte, *T. rubrum* from Belgachia, Kolkata, West Bengal in 1954. Veterinary scientists are urged to investigate the possible occurrence of infections in animals due to other pathogenic fungi including the dimorphic ones like Histoplasma and Blastomyces.

Keywords: Zoophilic dermatophytes, Mycoses in animals, India, Update

INTRODUCTION

The first record of animal mycotic infection confirmed by fungus culture in India was by Witkamp in 1924[1] when he isolated a fungus from ulcerated cutaneous lesions in horses and named it as *Hyphomyces destruens*. The organism was later named as *Pythium insidiosum*, and the disease called pythiosis by De Cock et al. in 1987.[2] No subsequent report of this disease in animals in India could be traced in the literature. The first authentic description of an animal mycosis with definite etiology in India was by Weldman in 1925[3] from a case of exfoliative dermatitis in the Indian Rhinoceros (*Rhinoceros unicornis*) by a yeast *Mallesezia* (*Pityrosporum*), the species involved was described to be a new species, *Mallesezia patchydermatitis*. *Malassezia* (*Pityrosporum*) species are lipophilic yeasts that are members of the normal mycobiota of the skin and mucosal sites of a variety of homeothermic animals. *Mallesezia* are yeasts in the fungal class Basidiomycetes, which also includes *Cryptococcus* spp, *Rhodotorula* spp and *Trichosporon* spp that can produce disease in man and animals; *Cryptococcus* spp are quite often involved in disseminated infections in immunosuppressed patients, and occasionally in animals. *Malassezia* yeasts are associated mainly with certain skin diseases and have been isolated from almost all domestic animals, wild animals, and also from wildlife.[4] *M. patchydermatitis* is of animal origin and zoonotic transfer of this species has been documented from dogs to neonates by healthcare workers who are owners of dogs.[5] Another yeast, *Candida pseudotropicalis* was found to cause abortion in mares.[6] The earliest record of animal ringworm in India was by Pinoy[7] of *Trichophyton* (*Epidermophyton*) *simii* in a monkey imported in France from India. The first record of epizootic lymphangitis in horses caused by *Histoplasma capsulatum* var. *farcinimosum* in India was by Kapur.[8] Later Mohan et al.[9]

reported an outbreak of enzootic lymphangitis in equines. Among the animal mycoses, dermatophytosis (ringworm) of several animals, viz. cattle, buffaloes, dogs, sheep, goats and poultry can be a potential source of infections in humans, sometimes causing widespread inflammatory lesions. An earlier review by Monga and Mohapatra[10] dealt with compilation of reports of mycoses in animals published up to 1980. This review presents an update of the fungal infections in animals in India reported so far. Salient clinical feature of infections caused by different species of fungi are described.

Search criteria

This review conducted an electronic (computerized) search of existing literature using the Google search engine and PubMed electronic database to identify and download relevant publications in different types of animal mycoses in India. The key words used were dermatophytosis, ringworm, aspergillosis, in livestock, domestic animals, and poultry The Boolean operator 'AND' was used to combine and narrow the searches. Additional information was obtained by searching the medical libraries for journals not listed in the database. The information relevant to the review was extracted from the available publications and incorporated in this review.

Literature review

Trichophyton species

The zoophilic *Trichophyton* species include *T. simii*, *T. mentagrophytes*, *T. verrucosum* and *T. interdigitale* as described by de Hoog et al.[11] *Trichophyton simii* is primarily a zoophilic dermatophyte that very frequently causes clinical infections in man and also occurs as a saprobe in soil. The first record of animal dermatophytosis (ringworm) due to *T. simii* in India was by Pinoy[7] in a monkey imported in France from India. Stockdale in 1965[12] identified 31 strains of an unidentified dermatophyte recovered from monkeys, poultry, a dog and a man sent from College of Veterinary Science and Animal Husbandry, Mathura (UP). *T. mentagrophytes* is primarily a zoophilic dermatophyte that frequently infects humans and may also survive in soil (https://www.sciencedirect/com. > topics > trichophyton - mentagrophytes). *T. mentagrophytes* infects number of wild and domestic animals, including baboons, buffaloes, cattle, sheep, goats, swine, dogs, cats, tigers, foxes guinea pigs, horses, chimpanzees, monkeys, chickens, rodents, mice and other laboratory animals, e.g., rabbits, rats.[13,14,15,16,17,18] According to Hubka,[19] *Trichophyton interdigitale* comprises human and zoophilic strains. Currently the predominant dermatophytes recovered from human ringworm lesions in India are *T. rubrum and T. interdigitale*.[20] Clinical infections in animals due to *T. interdigitale* are not yet recorded. The dermatophyte, *T. verrucosum* causes clinical infections in all ruminants, brief features of such infections in cattle and buffaloes in India are described in this review. Sometimes these animals may be asymptomatic carriers. *T. verrucosum* is the most common cause of ringworm in calves (https://www.sciencedirect/com. > topics > trichophyton-verrucosum). The brief clinical and demographic features of infections caused by the zoophilic *Trichophyton* species in India are described in Table 1. Diagnosis in all the cases was made by direct microscopy and recovery of the causative *Trichophyton* species in culture.

Table 1: Brief clinical and demographic features of animal infections caused by zoophilic Trichophyton species.

Reference	Location	No. of animals infected with clinical lesions	Lesions/Sites infected	Total (percent) positive
Trichophyton simii				
Stockdale et al. 1965[12]	Mathura (UP)	One monkey	Not known	Not applicable
Gugnani and Randhawa 1973[15]	Delhi	70 poultry birds infected with *T. simii* out of flock of 250 examined 7 birds in one additional and 2 birds in two other poultry farms	Comb, wattle and basal portion of the flank feathers. In 8 of the birds, entire combs were heavily infected, with scaly and erythematous lesion, appearing ragged	70/250(28)
Gugnani et al. 1973[17]	Hisar (Haryana)	3 poultry birds with *T. simii*	Scaly erythematous lesions on flank feathers	Could not be determined
Gugnani et al. 1973[17]	Meerut (Uttar Pradesh)	3 poultry birds with *T. simii*	Scaly erythematous lesions on flank feathers	Could not be determined
Gupta et al. 1969[21]	Hisar (Haryana)	1 dog with *T. simii*		Could not be determined

(*Continued*)

Table 1: (*Contd.*)

Reference	Location	No. of animals infected with clinical lesions	Lesions/Sites infected	Total (percent) positive
Mohapatra and Mahajan 1970[22]	Delhi	2 dogs with *T. simii*	Circular lesions on the nose and upper lip	Could not be determined
Ranganathan et al.[23]	Chennai/India	Two of 89 dogs with *T. simii*	?	211–2(0.95)
Mitra 1998[24]	Several locations in Uttar Pradesh	One of 22 cattle *T. simi-*	?	22–1(4.5)
Trichophyton mentagrophytes				
Mohapatra et al. 1964[25]	An animal house in AIIMS, New Delhi	Four guinea pigs and one rabbit	Scaly erythematous lesions on flanks	Could not be determined
Gupta et al. 1970[21]	Agriculture University campus, Hisar	Pigs 8	Not known	Could not be determined
Mitra 1998[23]	Uttar Pradesh	Cattle 1 of 22	Not known	Could not be determined
Debnath et al. 2016[26]	Companion animals in a private farm, Kolkata (W.B)	Dogs 49 out of 248 and cats 14 out of 103	Animals sampled were without lesions	49/248(19.76) 14/103(13.59)
Parmar et al. 2018[27]	Anand, Gujrat	Cattle 5 out of 52, Buffaloes 2 out of 52	Small raised, circumscribed. grayish-white crusted alopecic lesions on body	5/52(9.62) 2/52(3.85)
Trichophyton verrucosum				
Parmar et al. 2018[27]	Anand, Gujrat	Cattle 12 out of 52, Buffaloes 5 out of 22	Small raised, circumscribed. grayish-white crusted alopecic lesions on body	12/52(23.08) 5/22(22.73)
Trichophyton rubrum				
Chakraborty et al. 1954[28]	Bengal Veterinary College & Hospital, Belgachia, Kolkata (West Bengal)	Dog 1 Cows 2	Scaly, moist, partially alopecic, itching lesions on the buttocks and the trunk dorsal to the front legs. The first one had small raised plaques covered with scabs, on the head, on the muzzle and on the side of nostril. The second cow was covered with ringworm-like lesions all over the body.	? ?
Mitra 1998[23]	Uttar Pradesh	One out of 22 cattle	Not known	Could not be determined

Table 2: Brief clinical and demographic features of clinical infections in animals in India caused by ***Microsporum*** species.

Reference	Location	No. of animals infected with clinical lesions	Lesions/Sites infected	Total (percent) positive
Microsporum canis				
Pal 2001[32]	Anand, Gujarat	Goat-1, seven-year-old female	Dermatophytosis Irregular, diffuse, scaly , alopecic, yellowish-gray, crusted lesions on the face and pinna	NA
Debnath et al. 2015[33]	Companion animals in a private farm, Kolkata (W.B)	Dogs 108 out of 248, Cats 57 out of 103	Animals sampled were without lesions	108/248(43.55) 57/103(55.34)
Parmar et al. 2018[34]	Anand, Gujarat	Dogs 6	Lesions similar to that in cattle and buffalo	6/18(33.3)
Microsporum gypseum				
Debnath et al. 2015[33]	Companion animals in a private farm, Kolkata (W.B)	Dogs 91 out of 248, Cats 32 out of 103	Animals sampled were without lesions	91/248(36.9) 32/103(34.35)

Abbreviation: NA-Not applicable

Microsporum species

The zoophilic species of *Microsporum* commonly known to cause clinical infection in animals and humans are *Microsporum canis*, *M. gallinae*, and *M. nanum*[29]. *Microsporum gypseum* is a geophilic dermatophyte but it is potentially infectious and causes infection in animals and humans.[29,30] There is only one mention of its isolation from animals in India in the review by Mong and Mohapatra.[10] The brief clinical and demographic features of infections caused by these species in India are described in Table 2. Diagnosis in all the cases was made by direct microscopy and recovery of *M. canis* in culture

Aspergillus species

Species of Aspergillus are found world-wide in nature, and majority of them are saprophytic, found on a variety of substrates, viz soil, dust, forage organic debris and decomposing matter.[35] Only a limited number of Aspergillus cause disease in humans, animals and birds[34] causing localized infections to disseminated fatal diseases, as well as allergic diseases.[35] In birds and other animals, aspergillosis is primarily a respiratory infection, which may be disseminated with tissue predilection being highly variable among species of animals as described by Sayedmousavy et al.[36] It may be mentioned here that Sayedmousavy et al.[36] reported hypertrophic osteopathy associated with mycotic pneumonia in a Roe Deer (*Capreolus capreolus*). Sayedmousavy et al.[37] have given a very detailed account of Aspergillus infections in animals and humans. The brief clinical features of Aspergillus infection in birds reported from several parts of India are summarized in Table 3.

Table 3: Salient features of aspergillosis in birds in India.

Reference	Location	Bird species and no. of infected	Types of lesions	Diagnosis	Total (%) positive
Khan et al. 1977[37]	Zoological Park, Delhi	Imported Penguins - 7 out of 10	Persistent dullness, anorexia, and abnormal movements of the neck. Gross pathology showed enlarged liver with calcified nodules, greyish white nodules of varying size in the lungs; with thickening of serous membrane.	Histopathology and recovery of *Aspergillus fumigatus* from fibrino-caseous deposits	7/8(87.5)

(*Continued*)

Table 3: (*Contd.*)

Reference	Location	Bird species and no. of infected	Types of lesions	Diagnosis	Total (%) positive
Pal 1983[38]		A buffalo (*Bubalus bubalis*) calf	Keratomycosis	*A. fumigatus*	Could not be determined
Pal 1988[39]	Anand, Gujrat, College of Vet. Science	A 9-year-old buffalo (*Bubalus bubalis*) aborted at 7 months of gestation		Culture of *A. niger* from the liver, lung, lung and aborted fetus. The fungus and by demonstration of the fungus in KOH mounts of the placental tissues, skin, lung and liver	Could not be determined
Pal M 1992[40]	Anand Gujrat	A young pigeon (*Columbia livia*) kept by a bird fancier	Disseminated Aspergillosis	Demonstration of branched septate hyphae, characteristic of Aspergillus in tissue sections and *Aspergillus terreus* conidiophores in squeeze preparation of air sacs	Could not be determined
Singh 1994[41]	Ludhiana, Punjab Agricultural University	Japanese Quail. (*Coturnix japonica*). The bird died	Mycotic salpingitis. Necropsy revealed white to grayish 2–5 mm nodules on the setosal surface of the oviduct and the muscular wall of the oviduct.	Histopathology and culture of *Aspergillus flavus*	Could not be determined Could not be determined
Singh et al. 2009[42]	Jaipur, Rajasthan	Turkey poults. 85 of 120 brooding poults aged 3 days had ruffled feathers, gasping, nasal discharge and trembling. Mortality 65 (76.47)	Ruffled feathers, gasping, nasal discharge and trembling. Mortality 65(76.47)	Histopathology and culture of *A. fumigatus*	85/120(70.8)
Shukla 2012[43]	Mhow, Indore (M.P.) Local Emu farm	Emu (*Dromaius novahollandiae*) 11 out of 146 Emu chicks infected in an outbreak died	History of respiratory symptoms and mild nervous signs	Histopathology and recovery of *A. fumigatus* in culture	1/146(0.68)
Brathisdasan et al. 2013[44]	Izatnagar (U.P.)	Angioinvasive pulmonary aspergillosis in a Himalayan Griffin vulture (*Gyps Himalyensis*)	Weakness, emaciation, dyspnea, incoordination, and inability to fly, the bird, succumbing to the illness.	Gross pathological examination revealed several yellowish circumscribed, raised, miliary nodules on the surface of the lungs, air sac membranes, trachea, pericardium, aorta, pulmonary artery and kidneys. Diagnosis was based on histopathology and culture of *A. fumigatus* lungs and air sacs of the bird.	Could not be determined

(*Continued*)

Table 3: (*Contd.*)

Reference	Location	Bird species and no. of infected	Types of lesions	Diagnosis	Total (%) positive
Singh and Mahajan 2016[45]	Hisar, Bhivani, Jind, Sirsa and Fatehabad, Haryana	Four outbreaks in poultry of different age groups: 0–7 days old – 20 with 4.42% morbidity and 2–89% mortality, 8–14 days with 9.49% morbidity and 6–36% mortality 15–21-day old–13 with 7.4% morbidity and 5.29% mortality, > 21 days – 7 with 3.7% morbidity and 2.23% mortality	On gross pathology examination, pin-head sized yellowish nodules were observed on the lungs and air sac	Demonstration of characteristic septate hyphae in PAS- stained tissue sections of lungs, and recovery of *A. fumigatus* in culture.	
Ahmad DB et al. 2018[46]	Thanjavur, Tamil Nadu	Of the 200 desi chickens 40(20%) had systemic aspergillosis with symptoms of anorexia, whitish droppings, dullness, difficulty in respiration. 5(12.5%) died.			40/200(20%)

Abbreviation: NA-Not applicable

Cryptococcus species and other yeast-like fungi

Duncan in 2006[47] described *Cryptococcus gattii* in wildlife of Vancouver Island, British Columbia, Canada. Radoslite et al.[48] have dealt with in Candida infections in different animals in several countries. In India most of the reports of Candida and other yeast-like fungi from animals deal merely with its isolation from several sites without any lesions, a few of them name the lesions without any mention of the clinical features. Apart from Candida species, Mallesezia yeasts are also associated as commensals and opportunistic pathogens in animals and humans. *Malassezia pachydermatitis* is mainly found in dogs and cats, *Malassezia slooffiae* in pigs and cats, *Malassezia nana* in cats and horses, *Malassezia caprae* in goats, *Malassezia equina* in horses, *Malassezia cuniculi* in rabbits, *Malassezia brasiliensis* and *Malassezia psittaci* in parrots, and *Malassezia vespertiliones* in hibernating bats.[49] *Malassezia pachydermatitis* first isolated from exfoliative skin lesions of a captive Indian rhinoceros in 1925[3] was recognized as an important otic pathogen of dogs in 1950s by Guillot and Bond[50], Bond et al.[51] have described in detail the biology, diagnosis and treatment of Malassezia infection in dogs and cats. In a retrospective study, *Malassezia pachydermatis* was found to be associated with skin lesions in animals in 29.14% of the cases.[51] Singh et al.[52] in a study of 118 adult Indian healthy cats isolated *M. patchydermatitis* from 57(56.7%) of the female cats and 54(43.2%) of the male cats. There are only a few authentic reports of clinical infections due to Cryptococcus, and other yeast like fungi including *M. pachydermatis* from India, and these are covered in this review.

Table 4: Infections due to *Cryptococcus neoformans* and other yeast like fungi in different animals in India.

Reference	Location	Animal species and no infected	Types of infection/lesions	Diagnosis	Total (%) positive
Cryyptococcus neoformans					
Singh et al. 2007[54]	Bamboo thicket, Jabalpur (M.P.)	Bandicoot rat (*Bandicota indica*)-2 healthy male rats	Discrete, soft, confluent, elevated lesions in the lung, (some caseated) observed on dissection of the euthanized rats	Demonstration of encapsulated yeast cells in direct microscopy of lungs, liver, kidney and spleen and isolation of *C. neoformans* var, *grubii* from these organs	Not known

(*Continued*)

Table 4: (*Contd.*)

Reference	Location	Animal species and no infected	Types of infection/lesions	Diagnosis	Total (%) positive
Singh et al 2020[55]	Kolkata, West Bengal	An 8-month-old adopted stray bitch	Anorexia, depression, urinary incontinence, dysuria for 10 days, emaciated; was dehydrated and had sunken eyes, ocular and nasal discharge and had fever (103°F). Physical examination showed distended urinary bladder and abdominal pain. Blood profile revealed low hemoglobin, leucocytosis, neutrophilia, and lymphopenia.	Demonstration of budding yeast cells in urine and isolation of *C. neoformans* confirmed by sequencing the ITS region of rRNA	Not known
Candida species					
Sikdar et al. 1972[6]	Kolkata, West Bengal	Mares (13) in outbreak of abortion	Not described	Demonstration of yeast cells in placenta and fetal organs by histopathology and culture of *Candida pseudotropicalis*	Not known
Kumar and James 2012[56]	Nammakal, Kerala	Cattle, out of 21 samples of milk from suspected cases of mastitis, yielded I each of *Rhodotorula mucilaginosa*. *Torulopsis* sp, *Saccharomyces cerevisae*, *Candida guillermondii*, 2 of C. *parapsilosis*, 3 of *Trichospsoron cutaneum*, 4 of *Geotrichum candidum*, 7 of *Candida tropicalis*	Lesions not described	Isolation of causative agents from centrifuged deposits of mil samples	18/21 (85.7%)
Jadhav and Pal, 2013[57]		Out of 69 dogs, seven had clinical infection, 1 - otitis, stomatitis - 4, dermatitis - 2. Out of 21 buffaloes, 5 - otitis, 1 - stomatitis, 1 - mastitis	4 dogs and I buffalo with stomatitis had symptoms of salivation, halitosis and anorexia. Details of clinical features in cases of mastitis not mentioned.	Demonstration of Candida in. skin scrapings and pus swabs and isolation of *C. albicans* in culture in cases of stomatitis. In cases of mastitis, demonstration of Candida in centrifuged deposits of milk samples and recovery of *C. albicans*.	Dogs 7/69 (12.5%) Buffaloes 8/21 (38.0)
Weldman 1925[2]	Single horned India Rhinoceros (*Rhinoceros unicornis*)-1	Not known	Exfoliative dermatitis	Culture of *Mallesezia patchydermatitis*, (described as a new species) from skin lesions	Not known
Reddy and Kumari 2015[58]	Tirupati, Andhra Pradesh India	Recurrent pyoderma with *Malassezia* and hyperadrenocorticism in a dog.	Not known	Not known	Not known
Reddy and Sivajothi 215[59]	Tirupati, Andhra Pradesh India	An adult dog	Chronic discolored pruritic lesions with rancid odor on the ventral chin, neck, abdomen and inner surface of the legs	Demonstration of yeast cells of *M. patchydermatitis* in smears of the skin scrapings and hair from the lesions	Not known

(*Continued*)

Table 4: (*Contd*.)

Reference	Location	Animal species and no infected	Types of infection/lesions	Diagnosis	Total (%) positive
Rasamala and Kumar, 2018[60]	Kerala (India)	Dogs.- *P. patchydermatitis* associated with 6.6% of dogs with dermatitis, 4–4% of dogs with pyoderma, 2% of dogs with dermatophytosis. Pigs - 2%	Skin lesions, details of clinical features not known	Isolation of *P. patchydermatitis* from the skin scrapings of the lesions	Not known
Gangna *et al.* 2021[61]	Thrissur, Kerala (India)	Dogs 15 with dermatitis and 10 with otitis	Dogs with dermatitis showed primary and secondary scaly skin lesions with erythematous papules, alopecia, crusts, pruritis excoriations, and hyperkeratosis. The clinical signs in dogs with otitis were excessive discharge from ears with offensive odor.	Recovery of *M. patchydermatitis* from the ear swabs of cases of otitis, and skin scrapings of the lesions in cases of dermatitis.	

Histoplasma and Blastomyces species

Histoplasmosis, a non-contagious fungal disease caused by a thermally dimorphic, *histoplasma capsulatum* is found worldwide. Infection is acquired by inhalation of the hyphal elements and microconidia of the fungus from old avian excreta or bat guano, which reach the alveoli followed by rapid conversion to yeast form that can persist and spread in the body through the blood stream and lymphatics causing disseminated disease [Wheat et al. 2016,[62] Gugnani et al. 2018[63]]. Infection has been described in several species of small mammals including wild rats and opossum. The disease is uncommon or rarely detected in dogs and cats. Demonstration of histoplasmosis in the animals helps to establish the endemicity of the disease in a given area.[62] There is no report of *Histoplasma* from small mammals in India. Singh published his study of clinical cases in 1966[64] but the clinical details of the lesions are not available, nor were there in the report of equine mycotic respiratory disease by Ramachandran in 1995[65]; all attempts to locate clinical features of the cases described in the reports by an exhaustive search of the literature in different search engines were unsuccessful.

Blastomycosis, a serious fungal disease caused by a thermally dimorphic fungus, *Blatomyces* dermatidis, affects dogs, humans and occasionally other mammals with a restricted geographic distribution. It is primarily a canine disease with approximately 10 dogs for every human case (Schwartz, 2018).[66] Blastomycosis is acquired primarily through inhalation of airborne conidia of *Blastomyces* species that are liberated from the mold phase of the fungus, which is associated with moist, acidic, sandy soils enriched with decaying organic matter and animal droppings (Restrepo et al. 2000).[67] Dogs develop the disease more rapidly than humans. Most dogs get infected by inhaling spores of *B. dermatitiids* from soil and organic debris. Detection of blastomycosis in dogs is a sentinel of possible occurrence of human cases of this disease.[67] There is one reported case of canine blastomycosis from India in a Mongrel dog, found dead in Indian Veterinary Research Institute Campus, Izatnagar, Bareilly (Uttar Pradesh) by Iyer, 1982.[68] Infection was diagnosed by histopathological demonstration of thick-walled, broad-based yeast cells typical of *B. dermatitidis* in tissue sections of necropsied lung lesions.[68] Other animals including cats are very less commonly affected. No case of blastomycosis in cats or other animals in India could be traced in the literature search.

DISCUSSION

The present review of literature updates our knowledge on the different type of mycoses in domestic animals and poultry in India caused by zoophilic dermatophytes, *Aspergillus* species, and yeast-like fungi. The salient clinical and demographic features of infections in several parts of India caused by different species of fungi are aptly described. An unusual observation in the literature review was the report of *Trichophyton rubrum* infection in one dog and two cows from Belgachia, Kolkata, West Bengal,[26] this being the first record of animal infections due to *T. rubrum* in the world at that time. Also noteworthy is the report of cryptococcosis due to *C. neoformans* var. *grubii* in a bandicoot rat,[52] constituting the first record of this disease in a bandicoot rat. Another notable observation in our literature search is the detection

of a canine case of blastomycosis in Uttar Pradesh.[67] Surveillance for more canine cases in other parts of India may facilitate detection of endemic foci of *B. dermatitidis* in the country. It is worth mentioning here about a case of tinea faciens due to *Microsporum canis* in a goat handler reported by Pal in 2001.[31] Thus, it is suggested that dairy and veterinary scientists should investigate occurrence of fungal infections in animal handlers and their contacts in the livestock farms under their care.

CONCLUSION

This review of animal infections describes the early records of mycotic infections in India, and gives many insights updating our knowledge on this topic. Reports on the prevalence of *Trichophyton simii* infection in animals in different parts of India covered in this review establish the endemicity of this infection in animals in India. A noteworthy finding in literature search is the report of clinical infections in one dog and two cows by an anthropophilic dermatophyte, *T. rubrum* from Belgachia, Kolkata, West Bengal in 1954. By tracing many publications on dermatophytosis, aspergillosis, and infections due to yeast-like fungi in domestic animals and poultry, this review has given a true picture of the prevalence of these mycoses in different parts of India. Dairy and veterinary scientists should look for transmission of fungal infection from livestock to animal handlers and their contacts. Investigation of the possible occurrence of fungal infections due to other fungi including the dimorphic fungal pathogens e.g. *Histoplasma* and *Blastomyces* in animals in India is also suggested.

Declaration of patient consent

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

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Conflicts of interest

There are no conflicts of interest.

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