World's Veterinary Journal
World Vet J, 5(4): 66-73, December 25, 2015
ISSN 2322-4568

Cross Sectional Study on Cutaneous Mycotic Infections of Dogs and Cats in Baghdad

Mohammad Mushgil Zenad[1], Naseir Mohammed Badawi[2*] and Abdul-Raheem Abdul-Jalil Wali[3]
[1,2]*Department of Internal and Preventive Veterinary Medicine, College of Veterinary Medicine, Baghdad University, Iraq.*
[3]*Baghdad Veterinary Hospital*
*Corresponding author's email: naseir.badawi78@gmail.com

ABSTRACT

The objective of the current study was to detect the species of fungi that infected dogs and cats. Sixty six dogs and twenty nine cats were presented to the Baghdad veterinary hospital, during the period from the beginning of December 2014 to the end of April 2015, showing signs of itching. Thorough clinical examinations were carried out, followed by exposing to the affected skin to UV light, followed by skin scraping, then, direct microscopical examination of the hair, with lactophenol cotton blue stain was used for the demonstration of spores and hyphae. Culturing of the scraped skin samples was done on sabouraud dextrose agar, incubated at 37 ° C for seven days. Identification of fungus was based on the morphological characters of cultures, three species were identified; the *Alternaria*, *Aspergillus* and *Geotrichum* species, the total infection rate of mycotic skin infection was 21.05%. A significantlly ($P< 0.05$) high rate of infection occurred by the *Alternaria* species (15%) and the significant rate of infection was lowered by the *Geotrichum* species (3%). A significant increase ($P\leq 0.05$) in the rate of *Alternaria* infection was observed on December and January, whereas a significant increase ($P\leq 0.05$) of the infection rate by *Aspergillus niger* occurred on March and April while, the *Geotrichum* species showed a significant increase ($P\leq 0.05$) on February. The clinical signs varied in severity, sever signs occurred in cats by the *Geotrichum* species. Conclusively the uncommon mycotic infection might have increased, according to seasonal variation; also unexpected severe signs may have resulted from allergic dermatitis reaction rather than mycotic infection. Furthermore, the wide prevalent of spores might have initiated a great risk to humans, as it causes bronchopulmonary allergy or/and pulmonary infection.

ORIGINAL ARTICLE
pii: S232245681500013-5
Received: 16 Oct 2015
Accepted: 17 Nov 2015

Key words: Fungal Species, Cutaneous Infections, Dog, Cat, Baghdad.

INTRODUCTION

Mycotic skin infections were common disease conditions in pet dogs and cats, they were classified according to etiological factors into primary and secondary infections (Bourguignon et al., 2013). The mycotic cutaneous infections were mostly chronic in character, and occurred in dogs aged from 6 months to 3 years old, besides that, spores and hyphae of fungi were considered potent allergens and may be responsible for seasonal allergy, similar to other non-infectious seasonal allergic reaction (Favrot et al., 2010).

Alternaria species causing skin infection in immunosuppressant animals, although the *Alternaria* species had a low infection rate (2.9%) of the total cutaneous disorders, but incidence may increase significantly in warm and humid climate (Jand and Gupta, 1989); the *Alternaria* spores are regarded as common airborne allergens, the wide prevalence of the *Alternaria* species in soil, water and contaminated other objects was recorded (Nowicki et al., 2012). In addition to causing dermatopathy lesions, their hyphae were considered as the common etiology of skin hypersensitivity reactions (Dedola et al., 2010). Furthermore *Alternaria* infections may be considered as a zoonotic disease, the risk of such infection increase as they induce allergic asthma in human beings, known as allergy bronchopulmonary alternariosis (O'Driscoll et al., 2005). The disease signs increased markedly in patients due to the presence of *Alternaria* spores in the home environment (Barnes et al., 2001). Moreover, the danger rises from difficulty in preparation of the specific extract from fungi, which complicates the control of such hypersensitivity (Horner et al., 1995).

Aspergillosis was a disease caused by *Aspergillus* species (Denning et al., 2013), the *Aspergillus* species included *Aspergillus fumigatus*, *Aspergillus flavus* and *Aspergillus niger* (Bennett, 2010). The *Aspergillus* species were present in the environment and grow on organic materials, however, the *Aspergillus* species were opportunistic fungi in human and animals, they might cause diseases in patients with concurrent immunosuppressive diseases (AIDS and diabetes mellitus) or those kept on prolonged use of antibiotics or corticosteroids therapy, the lesions of *Aspergillus* infection mostly occurred on the tail of cats and dogs without systemic signs, although it occurred less in cats than in dogs (Negoiţă1 and Negoiţă2, 2012; Kano et al., 2008). Fatal orbital aspergillosis was reported in a cat (Kano et al., 2008), also orbital

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

aspergillosis leads to other secondary fungal infection (Barachetti et al., 2009). The susceptible age to *Aspergillus* infection in dogs ranged from 3 months to 11 years (Mathews and Sharp, 2006).

Geotrichum was a common saprophyte fungi, it was present in soil and organic wastes of humans and animals, it can be isolated as a normal microflora or a pathogen (Ya-Jane et al., 2010), *Geotrichum* infection mostly occurred in immune-compromised patients particularly in those suffering from neoplasms, diabetes mellitus, leukosis and chronic renal diseases (Pal et al., 2013), the *Geotrichum* species infected several animal species including pet dogs and caused skin lesions (Figueredo et al., 2011), whereas *Geotrichum* infection in human caused chronic respiratory distress. The spores of the *Geotrichum* species were present on the infected hair shafts and epithelial cells. The symptoms appeared on the hairless area of face, ears and forelegs. Although signs were usually without pruritus lesions but some infected animals showed mild to severe pruritus particularly in adult animals with other uncommon signs such as folliculitis, dermatitis and acne were reported (ESCCAP, 2011).

MATRIAL AND METHODS

Animals and examinations

Ninety five animals (66 dogs and 29 cats) were taken to a small animal clinic in Baghdad veterinary hospital, during the period from the beginning of December 2014 to the end of April 2015. The owner's complains were mainly concentrated on itching and restlessness with hypersensitivity of some dogs. Thorough clinical examinations were performed and the symptoms were recorded.

Primary skin examination

The affected skin areas were exposed to ultra violet rays in the dark room, in order to confirm the presence of mycotic skin infection, based on the emitting bright green color from affected area (Sachin et al., 2006).

Skin scraping

Skin scraping was carried out (after applying vaseline ointment on the affected area to prevent spreading of hair) by using a blunt scalpel, hairs collected particularly from the peripheral lesions in Petri dishes (Kurtdede et al., 2014).

Direct microscopic examination

The scraped skin samples were treated with 10% KOH, heated gently then centrifuged at 3000 rpm/minute for five minutes, the supernatant was discarded and few drops from the sediment were examined under light microscope after using the cover slip on the glass slide, for detection of hyphae and spores of the fungi (Scott, 2007).

Culturing method

Samples were cultured on Sabouraud Dextrose Agar (SDA), by deeply implanting the hair and incubated at 37°C for seven days, identification of fungal species was based on the morphological characteristics, and by using few drops of lactophenol cotton blue stain placed on a clean slide with small piece of cultured colonies covered with the cover slip and examined under light microscope (10X) and (40X) (Ibrahim and Rahma, 2009), the fungal species were identified according to Cheesbrough (2000).

Statistical Analysis

Data were analyzed by using SPSS program version 20, chi-square test used for comparison at level significance of $P \leq 0.05$.

RESULTS

The clinical signs that were reported in the affected dogs and cats varied in severity according to the animal species and the species of the causative agents. The severe signs were associated with the *Alternaria* species infection and appeared in dogs only, whereas lesions of less severity occurred in cats due to the *Aspergillus* and *Geotrichum* species. The signs of *Alternaria* infection in dogs showed severe dermatitis manifested by severe itching on the tail, forelimbs, feet (Figure1) and around the eyes, rough coat, eructed and spares hair with a dirty appearance, cutaneous erythema of the affected area was more obvious than in other fungal infections, sometimes accompanied with patches of hair loss (Figure 2), scratching and blood oozing in the hand and tail areas reflect the severity of intensive infection, some animals showed signs of biting the affected area and some behavioral changes including; restlessness, excitement and hypersensitive towards their surroundings, mild cases were related to the *Aspergillus* and *Geotrichum* species infection were observed in cats.

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

The *Geotrichum* species infection was seen in cats only and characterized by crimp of hair coat and sometimes loss of hairs in some patches with cutaneous erythema. High infection rate was recorded in dogs (24%) in comparison with cats (13%). The most frequent infection was caused by the *Alternaria* species followed by the *Aspergillus* and *Geotrichum* species (Table 1 and Table 2).

Significant increase ($P \leq 0.05$) of the mycoytic infection rate occurred on December and January, particularly in dogs, whereas in cats the peak of infection rate occurred in March and April (Table 1 and Table 2). On the other hand, the *Alternaria* species infection increased significantly ($P \leq 0.05$) on December and January, the *Aspergillus* species infection increased significantly ($P \leq 0.05$) on March and April, whereas the *Geotrichum* species showed a significant increase ($P \leq 0.05$) on February and also high significant ($P \leq 0.05$) rate of infection occurred by the *Alternaria* species (15%) and low significant rate of infection was occurred by the *Geotrichum* species (3%) (Table 3).

The site of the infection by the pathogenic *Alternaria* species appeared on the tail and limbs, while the aspergillosis infections spread on: limbs, back, flank and around the eyes. Also, the *Geotrichum* species infection appeared on the back and flank.

Table 1. Mycotic skin infection rate for dogs in Baghdad from December 2014 to April 2015.

	Total	December	January	February	March	April
Total cases	66	9	10	14	16	17
Positive cases	16	4	5	2	4	1
Infection rate	24%	44%*	50%*	14%	25%	5%

* Horizontally mean significant differences at ($P \leq 0.05$).

Table 2. Mycotic skin infection rate for cats in Baghdad from December 2014 to April 2015

	Total	December	January	February	March	April
Total cases	29	8	5	3	2	6
Positive cases	4	-	-	-	2	2
Infection rate	13%	-	-	-	100%*	33%

*Horizontally mean significant differences at ($P \leq 0.05$).

Table 3. Mycotic skin infections rate for fungal species infected dogs and cats in Baghdad from December 2014 to April 2015

Agents	Total	December	January	February	March	April	Infection rate in dogs out of 66	Infection rate in cats out of 29
Alternaria spp.	10	4(40%)*	5(50%)*	-	1(10%)	-	10 (10.5%) ****	-
Aspergillus niger	8	-	-	-	5(62.5%) **	3(37.5%) **	4 (4.2%)	4(4.2%)
Geotrichum spp.	2	-	-	2(100%) ***	-	-	2 (2.1%)	-

*Horizontally *Alternaria spp*. significant increase ($P \leq 0.05$) in December and January; ** Horizontally *Aspergillus niger* significant increase ($P \leq 0.05$) in March and April; *** Horizontally *Geotrichum spp.* significant increase ($P \leq 0.05$) in February; **** Vertically *Alternaria spp.* significant increase ($P \leq 0.05$) compare to other species.

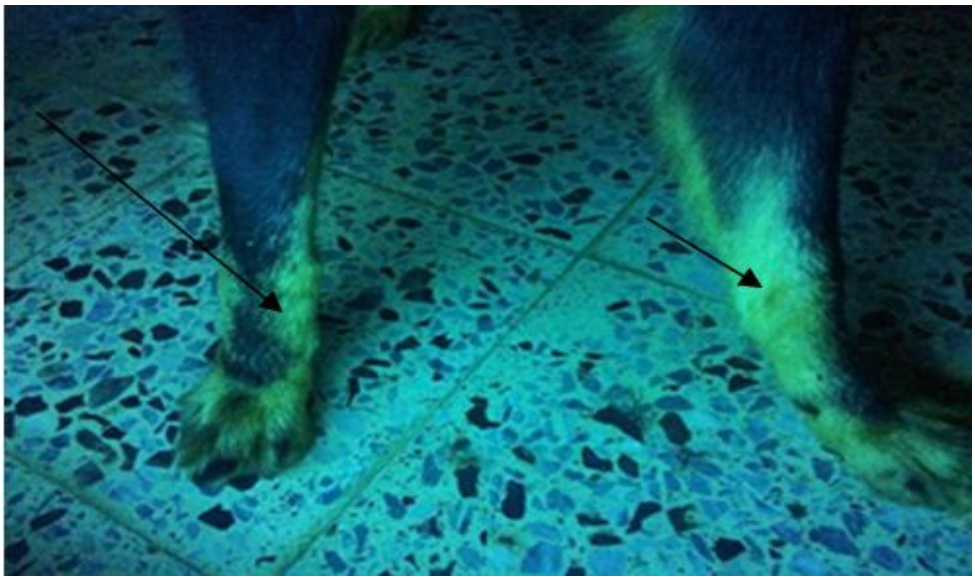

Figure 1. Cutaneous mycotic infection in the forelimbs of dogs exposed to UV rays.

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

Figure 2. Cutaneous alternariosis in the right hind limb of dogs showing patches of missing hair

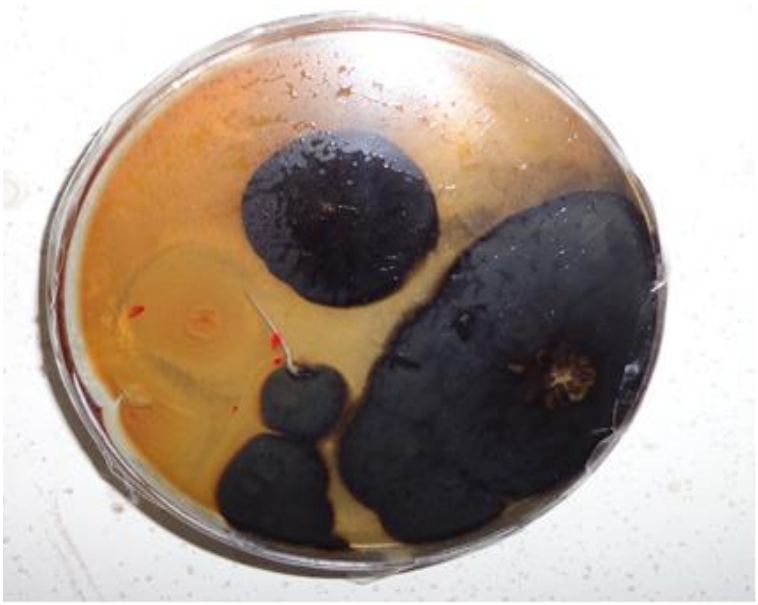

Figure 3. Growth of *Alternaria spp.* on the Sabouraud Dextrose Agar

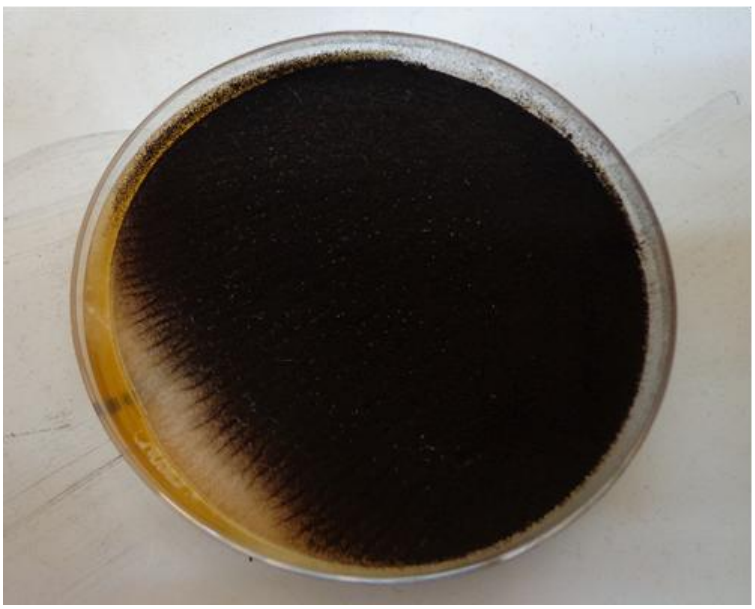

Figure 4. Growth of *Aspergillus niger* on the Sabouraud Dextrose Agar

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

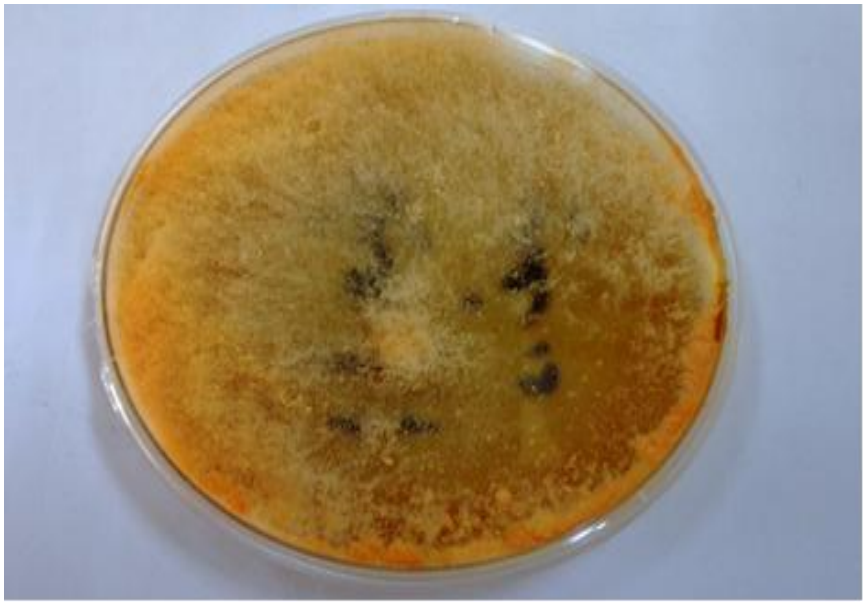

Figure 5. Growth of *Geotrichum spp.* on the Sabouraud Dextrose Agar

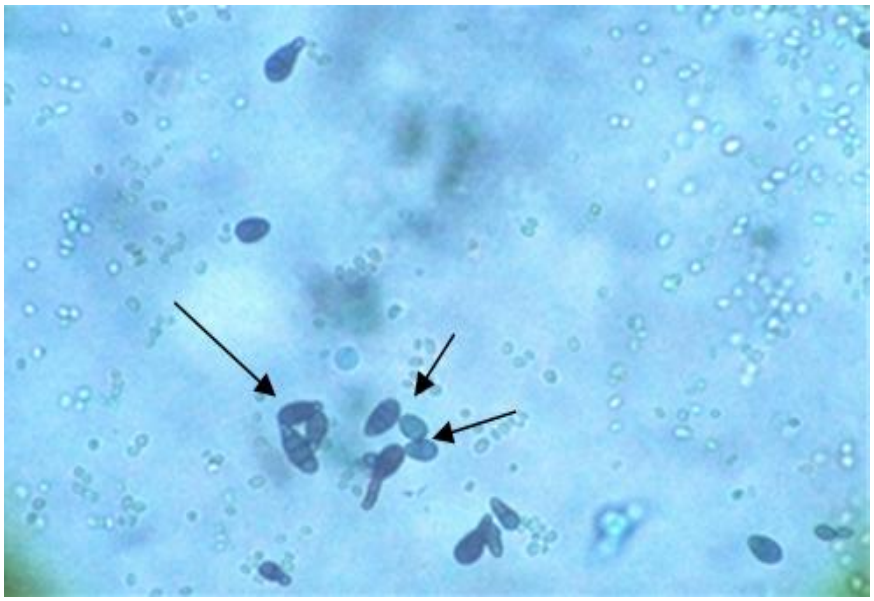

Figure 6. Spores of *Alternaria spp.* with lactophenol cotton blue stain under light microscope (40X)

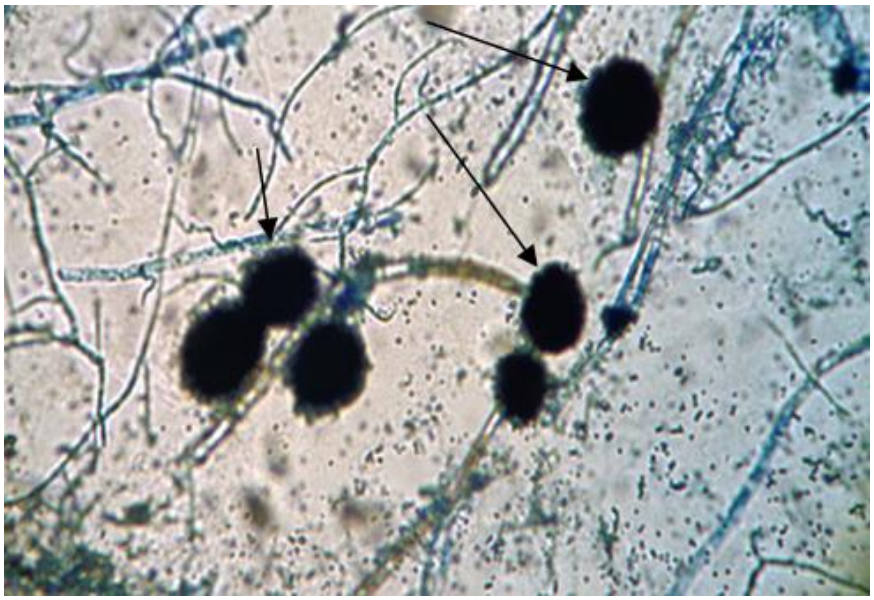

Figure 7. Spores and hyphae of *Aspergillus niger* with lactophenol cotton blue stain under light microscope (40X)

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

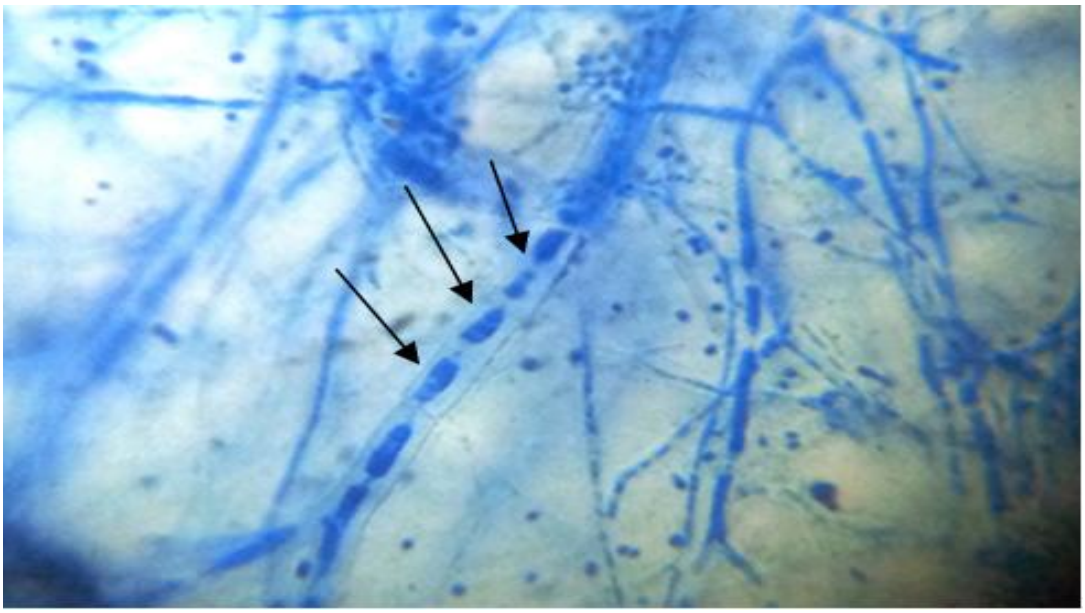

Figure 8. Spores of *Geotrichum spp.* with lactophenol cotton blue stain under light microscope (40X)

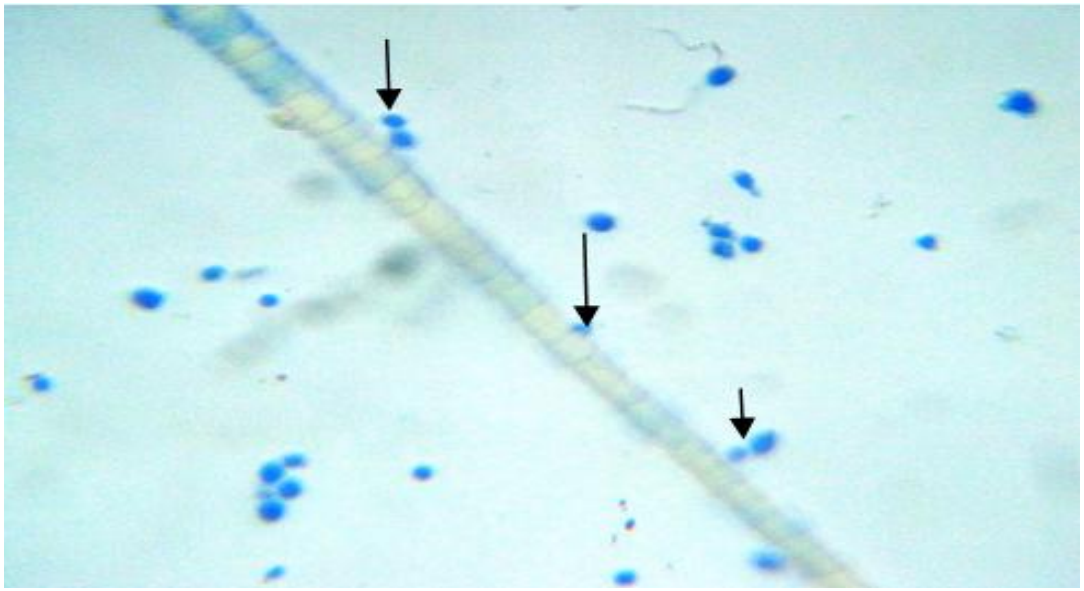

Figure 9. Spores of *Aspergillus* outside the hair shaft (exothrix) with lactophenol cotton blue stain under light microscope (10X)

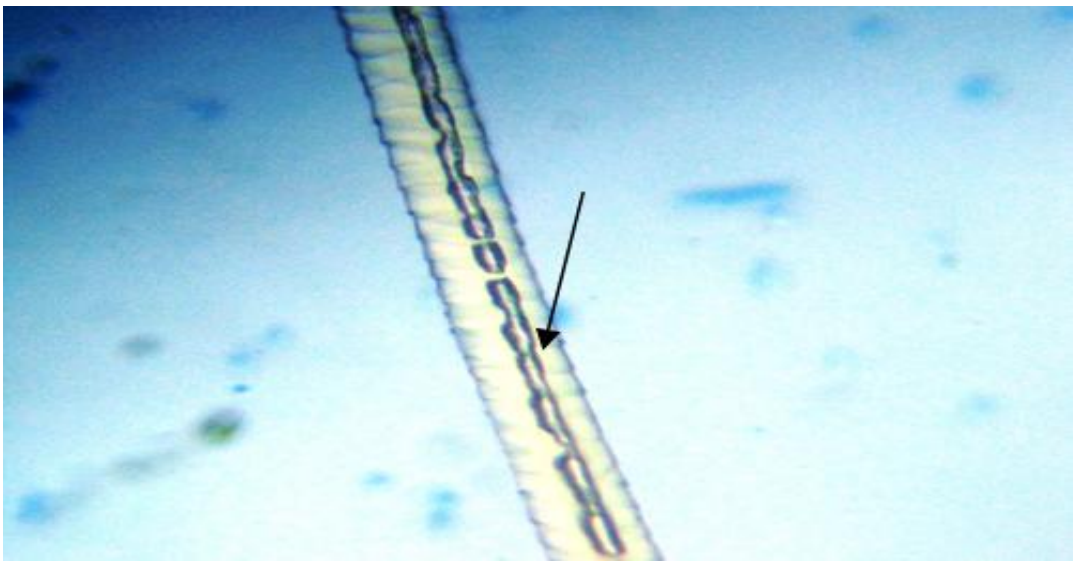

Figure 10. Spores of *Alternaria spp.* fragmentation within the hair shaft (endothrix) with lactophenol cotton blue stain under light microscope (10X)

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/

DISCUSSION

Very few studies on canine cutaneous mycotic infection have been preformed in Iraq. The present study showed that the total infection rate of cutaneous mycosis (21.05%) and the rate of alternariosis infection in dogs was (10.5%) significantly higher ($P \leq 0.05$) than other isolated fungal species (Table 1), moreover alternariosis had increased markedly on December and January (Table 3), this was pointing to a seasonal factor, the moisture of animals skin and environmental humidity are considered as the most predisposing factors, they play a contributing role in progress of such an infection (Salo et al., 2005). Also high rain fall was observed on December and January, apart from the history of diseased cases, that revealed multiple and repetitive washing of pet dogs, which in turn leads to maintaining the wetness of the skin for long periods, humid houses of pets, were also responsible for an increase of the *Alternaria* infection (Sterling and Lewis, 1998). Previously it was reported that moisture is an essential factor for mycotic infection (Koskinen et al., 1999). Furthermore, warming the environment also contributed in the increase of mycotic infection. Owners provided the pet houses with heaters during the winter months, in order to keep a warm environment close to ambient temperature (Salo et al., 2005). The severe itching observed on some of the clinical cases with more intensive lesions on the forelimbs and the animals biting them self causing massive destruction of cutaneous tissue, this might be attributed to allergic dermatitis rather than cutaneous infection, and it also indicated by behavioral changes (Hedayati et al., 2009). The spores of the *Alternaria* species were considered as potent allergens (Salo et al., 2006). Moreover authors mentioned that prolonged using immunosuppressive drugs in pets facilitated the occurrence of cutaneous infection (Dedola et al., 2010).

The total infection rate by the *Aspergillus niger* species was 8.4%. A significantly higher ($P \leq 0.05$) infection by this species was observed on March and April 2015. Also some cases had a similar history to previous cases infected by *Alternaria*, indicating the presence of moisture, in addition to the favorable environmental temperature "(25-34 °C**)** during these two months", for the growth of skin, aspergillosis occurred in winter (DeAna et al., 2006; Chew et al., 2003; Ren et al., 2001). Skin aspergillosis is an uncommon infection in dogs and cats, it is an opportunistic fungi in humans and animals, so that cutaneous aspergillosis infection is often accompanied with immune disorders (Negoiță1 and Negoiță, 2012). Severe skin aspergillosis rarely occurs and never causes loss of hair or severe lesion, although in the current study these severe signs were observed (Figure 2), this might be due to folliculitis (Weese and Yu, 2013).

The cutaneous geotrichosis was considered as a seldom cause of skin infection, in present study it was only seen in cats, and showed characteristic signs of crimp hair appearance, besides hair loss patches surrounded by erythematic lesions, these lesions might be attributed to infection of hair shaft and epithelial cells by fungal spores, resulting in dermatitis (Kozak et al., 2003; ESCCAP, 2011).

It seemed that an increase of mycotic dermatitis was related to the seasonal variation, also applying UV light on the affected skin can facilitate diagnosis in the field, and it is a rapid diagnostic test (Nowicki et al., 2012; DeAna et al., 2006).

CONCLUSION

The uncommon fungal infection increased in pet dogs and cats, particularly in the presence of predisposing factors. The seasonal variation is considered an essential factor, besides the improper dealing with pets by owners, uncommon mycotic skin infection also creates a risk to humans as leading to increment of allergic reaction cases. The danger was initiated by adaptability the wide prevalence of these fungi.

REFERENCES

Barachetti L, Mortellaro CM, Di Giancamillo M, Giudice C, Martino P, Travetti O and Miller PE (2009). Bilateral orbital and nasal aspergillosis in a cat (case report). Veterinary Ophthalmology Journal, 12(3): 176-182.

Barnes C, Tuck J, Simon S, Pacheco F, Hu F and Portnoy J (2001). Allergenic materials in the house dust of allergy clinic patients. Annals of Allergy, Asthma and Immunology Journal, 86: 517-23.

Bennett JW (2010). An overview of the genus *Aspergillus*. In *Aspergillus*: Molecular Biology and Genomics. (eds. M. Machida and K. Gomi) Caister Academic Press. Norfolk, UK, PP: 1-17.

Bourguignon E, Guimarães LD, Ferreira TS and Favarato ES (2013). Dermatology in Dogs and Cats. Insights from Veterinary Medicine book edited by Rita Payan-Carreira, ISBN. Chapter 1, PP: 3-34.

Cheesbrough M (2000). District Laboratory Practice in Tropical Countries Part 2. Cambridge University Press, Cambridge, PP: 47-54.

Chew GL, Rogers C, Burge HA, Muilenberg ML and Gold DR (2003). Dust borne and airborne fungal propagules represent a different spectrum of fungi with differing relations to home characteristics. Allergy Journal, 58: 13-20.

DeAna SG, Torres-Rodriguez JM, Ramirez EA, Garcia SM and Belmonte-Soler J (2006). Seasonal distribution of *Alternaria*. *Aspergillus*, *Cladosporium* and *Penicillium* species isolated in homes of fungal allergic patients. Journal of Investigational Allergology and Clinical Immunology, 16(6): 357-363.

Dedola C, Stuart APG, Ridyard AE, Else RW, Van Den Broek A, Choi JS, de Hoog GS and Thoday KL (2010). Cutaneous *Alternaria infectoria* infection in a dog in association with therapeutic immunosuppression for the management of immune-mediated haemolytic anaemia. Veterinary Dermatology Journal, 21(6): 626-634.

Denning DW, Pleuvry A and Cole DC (2013). Global burden of chronic pulmonary aspergillosis complicating sarcoidosis. European Respiratory Journal, 41(3): 621-6.

ESCCAP (2011). Guideline 2 superficial mycoses in dogs and cats. 2nd Ed., ESCCAP the Mews studio, Portland Road Malvern, Worcestershire, WR14 2TA, PP: 1-15.

Favrot C, Steffan J, Seewald W and Picco F (2010). A prospective study on the clinical features of chronic canine atopic dermatitis and its diagnosis. Veterinary Dermatology Journal, 21: 23-31.

Figueredo LA, Cafarchia C and Otranto D (2011). *Geotrichum candidum* as etiological agent of horse dermatomycosis. Veterinary Microbiology Journal, 148: 368-371.

Hedayati MT, Arabzadehmoghadam A and Hajheydari Z (2009). Specific IgE against *Alternaria alternata* in atopic dermatitis and asthma patients. European Review for Medical and Pharmacological Sciences, 13(3):187-191.

Horner WE, Helbling A, Salvaggio JE and Lehrer SB (1995). Fungal allergens. Clinical Microbiology Reviews Journal, 8: 161-79.

Ibrahim S and Rahma MA (2009). Isolation and identification of fungi associated with date fruits (Phoenixdactylifera, Linn), sold at Bayero university, Kano, Nigeria, Bayero. Journal of Pure and Applied Sciences, 2(2): 127-130.

Jand SK and Gupta MP (1989). Dermatomycosis in dogs. Mycoses Journal. 32(2): 104-105.

Kano R, Itamoto K, Okuda M, Inokuma H, Hasegawa A and Balajee SA (2008). Isolation of *Aspergillus udagawae* from a fatal case of feline orbital aspergillosis. Mycoses Journal, 51: 360-361.

Koskinen OM, Husman TM, Meklin TM and Nevalainen AI (1999). The relationship between moisture or mould observations in houses and the state of health of their occupants. European Respiratory Journal, 14: 1363-1367.

Kozak M, Bilek J, Beladicova V, Beladicova K, Baranova Z and Bugarsky A (2003). Study of dermatophytes in dogs and the risk of human infections. Bratislavské lekárske listy Journal, 104(7-8): 2011-2017.

Kurtdede A, Haydardedeoglu AE, Alihosseini H and Colakoglu EC (2014). Dermatophytosis caused by *Trichophyton mentagrophytes* var. *erinacei* in a dog: a case report. Veterinarni Medicina Journal, 59(7): 349-351.

Mathews KG and Sharp NJH (2006). Canine nasal aspergillosis-penicilliosis. In: Greene CE (ed) Infectious diseases of the dog and cat. 3rd Ed., WB Saunders, Philadelphia, PP: 613-620.

Negoiță C and Negoiță V (2012). Primary cutaneous aspergillosis caused by *Aspergillus flavus* in cat – case report. The scientific research to veterinary medicine, 2: 278-285.

Nowicki M, Nowakowska M, Niezgoda A and Kozik EU (2012). *Alternaria* black spot of crucifers: symptoms, importance of disease, and perspectives of resistance breeding. Vegetable Crops Research Bulletin, 76: 5-19.

O'Driscoll BR, Hopkinson LC and Denning DW (2005). Mold sensitization is common amongst patients with severe asthma requiring multiple hospital admissions. BMC Pulmonary Medicine Journal, 5: 4.

Pal M, Sejra S, Sejra A and Tesfaye S (2013). Geotrichosis - an opportunistic mycosis of humans and animals. International Journal of Livestock Research, 3(2): 38-44.

Ren P, Jankun TM, Belanger K, Bracken MB and Leaderer BP (2001). The relation between fungal propagules in indoor air and home characteristics. Allergy Journal, 56:419-24.

Sachin MK, Sangeeta AA and Autar KM (2006). Skin scraping and a potassium hydroxide mount. Indian Journal of Dermatology, Venereology and Leprology, 72: 238-241.

Salo PM, Arbes SJ Jr, Sever M, Jaramillo R, Cohn RD, London SJ and Zeldin DC (2006). Exposure to *Alternaria alternata* in US homes is associated with asthma symptoms. Journal of Allergy and Clinical Immunology, 118(4): 892-898.

Salo PM, Yin M, Arbes SJ Jr, Cohn RD, Sever M, Muilenberg M, Burge HA, London SJ and Zeldin DC (2005). Dustborne *Alternaria alternata* antigens in U.S. homes: Results from the National Survey of Lead and Allergens in Housing. Journal of Allergy and Clinical Immunology, 116(3):623-629.

Scott DW (2007). Color Atlas of Farm Animal Dermatology. 1st Ed., Blackwell Publishing, PP: 17.

Sterling DA and Lewis RD (1998). Pollen and fungal spores indoor and outdoor of mobile homes. Annals of Allergy, Asthma and Immunology Journal, 80(3): 279-285.

Weese JS and Yu AA (2013). Infectious folliculitis and dermatophytosis. Veterinary Clinics of North America: Equine Practice, 29: 559-575.

Ya-Jane LEE, Wei-Li HSU, Chin-Fu LIN, Shao-Wei LEE and Feng-Pang CH (2010). Intestinal geotrichosis in a German shepherd. Turkish Journal of Veterinary and Animal Sciences, 34(5): 481-484.

To cite this paper: Zenad M.M, Badawi N.M and Abdul-Jalil Wali A.R. 2015. Cross Sectional Study on Cutaneous Mycotic Infections of Dog and Cat in Baghdad. *World's Vet. J.* 5(4): 66-73.
Journal homepage: http://wvj.science-line.com/