International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
VET 2024; 9(4): 481-484

www.veterinarypaper.com
Received: 01-04-2024
Accepted: 04-05-2024

PI Ganesan
Professor & Head, Department of Veterinary Medicine, Apollo College of Veterinary Medicine, Jaipur, Rajasthan, India

Hridya Raju
UG Scholars, Department of Veterinary Pharmacology & Toxicology, Apollo College of Veterinary Medicine, Jaipur, Rajasthan, India

Zerin Mathew
UG Scholars, Department of Veterinary Pharmacology & Toxicology, Apollo College of Veterinary Medicine, Jaipur, Rajasthan, India

Raut Akash
Assistant Professor, Department of Veterinary Pharmacology & Toxicology, Apollo College of Veterinary Medicine, Jaipur, Rajasthan, India

Corresponding Author:
PI Ganesan
Professor & Head, Department of Veterinary Medicine, Apollo College of Veterinary Medicine, Jaipur, Rajasthan, India

Studies on the utility of *Aloe-vera*, neem, and turmeric in equine fungal and multiple dermatophytes infection

PI Ganesan, Hridya Raju, Zerin Mathew and Raut Akash

Abstract
The present study was carried out in an equine affected with laminitis and skin lesions. Infected tissue materials of the wound were screened for fungal and dermatophytes infections using SDA and LPCB. The texture of the skin was dry with loss of lusture. Clinical examination of the infected equine revealed ecthma gangrenosum – like lesions, folliculitis-like eruption, subcutaneous nodules and tense hemorrhagic bullae with laminitis. The horse was treated with levofloxacin as per antibiogram profile (ABST) with partial response, and then the culture studies of the skin lesions were carried out which revealed the mixed infections of *Candida albicans*, with the dermatophytes namely *Microsporum nanum*, *Microsporum gypseum*, *Tricophyton mentagraphytes*, *Tricophyton rubrum* and *Exserohilum rostratum*. Thereafter, the infected equine was treated with the application of *Aloe-vera* gel with turmeric plus neem oil paste for a period of 60 days continuously as an alternate therapy which showed a positive response on wound status of the infected horse.

Keywords: Dermatophytosis, equine management, alternate therapy, *Aloe vera*

Introduction
Dermatophytosis is a common contagious disease caused by group of a fungi called as dermatophytes. Some species of fungi normally live in the environment and have potential to act as parasites under certain conditions. In living hosts, dermatophytes usually remain in superficial tissues such as the hair, nails and epidermis. Infrequently, dermatophytes invade subcutaneous tissues and other sites, especially in immune-compromised hosts (Spickler *et al.*, 2013) [32]. Across globe, prevalence of fungal infections is common in unhealthy and immuno-compromised humans and animals (Köhler *et al.*, 2015; Gnat *et al.*, 2020a) [22, 14]. Presence of multiple fungal infection in animals has been reported earlier. Concurrent infections of *M. audouinii* and *Mucormycosis* in buffaloes (Sravani & Ganesan, 2024) [33]; of *T. equinum* and *M. equinum* in equines (OIE, 2005; Radostits *et al.*, 2007) [27, 28]. Similarly, Dicken M *et al.* (2010) [11] reported fungal granulomas due to *Alternaria* spp. infection in a horse in New Zealand. Mahendra Pal & Chang-woo Lee (1994) [25] reported *Exserohilum rostratum* in a 2 years old equine suffered with chronic dermatitis. Asadi *et al.* (2011) [4] reported the prevalence of *T. equinum* in Iran in a private equine farm. OIE (2005) [27] reported the prevalence of *T. equinum* and *M. equinum* in equines infected with skin lesions. Although several cases of equine dermatophytosis due to various fungal species has been recorded, *Tricophyton* and *Microsporum species* are the main dermatophytosis causing fungi in horses (Stannard & White, 2002) [34]. Disease manifestation in horses ranges from mild or subclinical disease to severe lesions and mostly found in saddles or tack and causes significant discomfort and unsightly nuisance (esthetic) (Cafarchia *et al.*, 2013) [9]. Further, it affects working capacity of equines and their use in sports (polo, racing), thus decreasing the cost value of the horse. In the context of zoonosis, affected equines serve as reservoirs for the zoophilic dermatophytes and their infections (Cafarchia *et al.*, 2013) [9]. Antifungal agents (topical/systemic), corticosteroids, and immune boosters forms the mainstay of therapy. However, improper administration or application of antifungals and other sanitary measures might be responsible for unfruitful therapeutic outcomes and development of immunocompromised state. In cases where drug therapy fails, phytochemicals can be an alternative.

India has rich heritage of biodiversity in the form of fauna and flora and is well recognized for traditional knowledge. Due to chronic nature of wound, unresponsive to routine treatment, we sought to evaluate efficacy of *Aloe vera* in combination with neem and turmeric in chronic wound.

Materials and Methods

Case details

Mare with a history of unhealed wound in the pastern-fetlock joint for more than 3 months was referred to the Veterinary Clinical Complex Hospital of Apollo College of Veterinary Medicine, Jaipur. Clinical examination of the infected equine revealed, proud flesh in the pastern-fetlock region. Materials collected from the chronic wound were subjected antibiotic sensitivity testing (ABST) and culture studies of fungal infections.

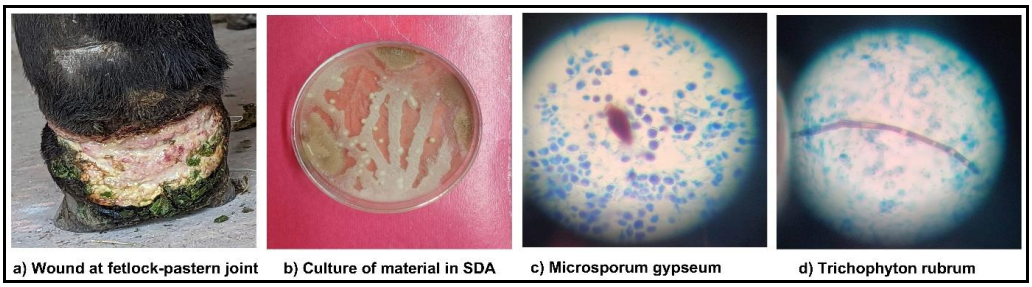
Laboratory diagnosis

The antibiotic culture sensitivity testing was done as per the guideline (CLSI, 2020). Laboratory diagnosis was carried out by using infected wound materials in SDA culture and followed by staining with LPCB. Identification of the organisms carried out as per the guidelines given by the mentioned authors as detailed below. *Candida albicans* (Kalis *et al.*, 2014; Saigal *et al.*, 2011) [20, 29]. *Tricophyton mentagraphytes* (Habeb *et al.*, 2016) [16]; *Tricophyton rubrum* (Hernández *et al.*, (2007) [18]; *Microsporum nanum* (St-Germain G & R Summerbell, 1996) [35]; & *Exserohilum rostratum* (Mahendra Pal & Chang-woo Lee, 1994) [25].

Results and Discussion

Clinical examination of the affected skin shows dry and lusture-less skin with ecthma gangrenosum – like lesions, folliculitis-like eruption, subcutaneous nodules and tense hemorrhagic bullae (Fig. 1) with laminitis. Infected wound materials in SDA culture (Fig. 1) and LPCB staining revealed presence of mixed infections of *Candida albicans* along with the dermatophytes which included *Microsporum nanum*, *Tricophyton rubrum* & *Tricophyton mentagraphytes* and *Exserohilum rostratum* (Fig. 1).

Candidiasis is classified as either superficial or invasive. Superficial cutaneous candidiasis typically manifests as beefy-red patches and plaques with fine scale and satellite papules or peripheral pustules and generally involves skin folds, genitals or oral mucosa. Invasive candidiasis, however, exhibit ecthma gangrenosum – like lesions, folliculitis-like eruption, subcutaneous nodules and tense haemorrhagic bullae (Shields *et al.*, 2019) [31]. Presence of mixed fungal infections in equines has been also reported earlier Vipparti, 2014 [37]; Gawaz and Weisel (2018) [13], with coexistence of yeast like fungi and dermatophytes or mould in the same lesions. Moreover, coexistence and interaction of yeast and the other filamentous fungi with other prokaryotic micro-organisms was also reported (Leclair and Hogan 2010; Nogueira *et al.*, 2019; Scott *et al.*, 2019 & Amanati *et al.*, 2020) [10, 26, 30, 2]. Presence of numerous fungal species in wounds and their interaction further aggravates the wound causing peeling of skin, exudation, and subsequently laminitis. Even, several fungal infectious diseases caused by true and opportunistic pathogens both in animals and human beings due to wide spectrum of yeast and fungi is well known (Fisher *et al.*, 2012; Bisnoi *et al.*, 2018; Gnat *et al.*, 2021) [12, 7, 15]. Opportunistic fungal infections are important in the epidemiology of infectious diseases since they can be caused by exogenous and endogenous pathogens. In this study also we found mixed infection due to various dermatophytes and *candida albicans* in equine wound. Treatment of multiple types of infection often needs variety of medicines to broaden efficacy against microorganisms. Due to mixed infection and chronic nature of wound, antibiogram profile revealed resistance to routinely used antimicrobials except levofloxacin. Phytotherapy using plant extracts is well known for medical conditions. India with rich history of Ayurveda, is known for the use of traditional medicine in treatment after China. Phytoconstituents in the plants offers protection or cure ailments in variety of clinical situations. Number of reports showed *in-vitro* and *in vivo* efficacy of plant extract against plant, animal, human pathogens causing fungal infections (Bokhari, 2009; Sravani and Ganesan, 2024) [8, 33]. Plants like *Curcuma longa* (turmeric) (Barchitta *et al.*, 2019) [5]: *Allium sativum* (garlic) (Bhandari, 2012) [6]; *Azadirachta indica* (neem) (Hewlings & Kalman, 2017) [19]; *Nigella sativa* (black cumin) (Hamdan *et al.*, 2019) [17]; *Piper longum* (Khushbu *et al.*, 2011) [21]; *Aloe vera* (Surjushe *et al.*, 2008) [36] etc., have been tested against a number of diseases including wound healing. *Aloe vera*, member of Liliaceae family, has been employed for thousands of years in traditional medicine It is best-known for its therapeutic potential across the globe and often regarded as nature precious gift. Aloe Gel contains a plethora of complex biomolecules containing polysaccharides (approx. 55%), sugars (approx. 17%), minerals (approx. 16%), proteins (approx. 7%), lipids (4%), and phenolic compounds (approx. 1%) (Kumar *et al.*, 2019) [23]. It promotes wound-healing process and tissue regeneration due to biocompatible, bioavailable, and biodegradable matrix in the aloe and often heal wounds without scar formation. Polyherbal preparation of *Aloe-vera* cured the wound infection in buffalo calves infected with *Microsporum audouinii* (Sravani G and Ganesan, 2024) [33] and against dermatophytosis (Antikchi *et al.*, 2009) [3]. Moreover, equine dermatophytosis due to *T. equinum* was successfully treated using garlic-*Aloe-vera* gel applied for 25 days (Asadi *et al.*, 2011) [4]. Adejumo & Bamidele (2009) [1] also reported the utility of garlic and *Aloe-vera* as successful antifungal agents for variety of diseases including ringworm infections. The *Aloe-vera* gel has been found to promote wound healing due to the presence of some components like anthraquinones and hormones, which possess anti-bacterial, anti-fungal and anti-viral activities. In the present investigation, application of *Aloe-vera* gel with neem and turmeric helped to cure the wound in an infected equine (Fig. 2).



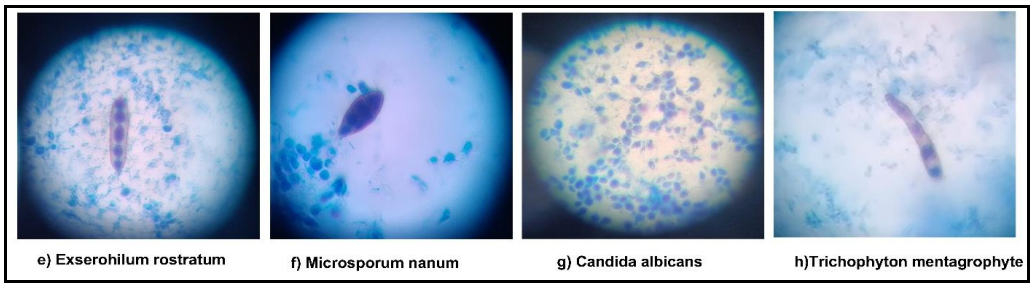


Fig 1: Presence of different fungi in infected material collected from equine wound

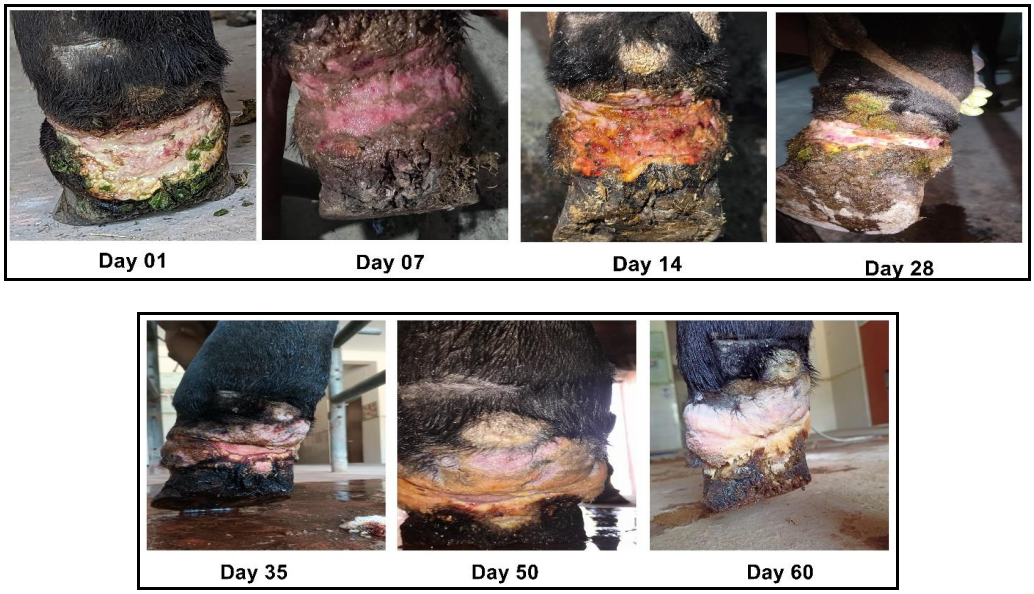


Fig 2: Day wise healing pattern in equine infected with Dermatophytoses

Conclusions

The culture of skin lesions and the infected wound materials revealed the mixed infections of bacteria and fungi like *Candida albicans*, along with the dermatophytes infection which included *Microsporum nanum*, *Microsporum gypseum*, *Tricophyton mentagraphytes*, *Tricophyton rubrum* and *Exserohilum rostratum.* Dermatophytes lesions were treated with *Aloe-vera* turmeric neem paste as topical application for a period of 60 days with a desirable response. The study indicated the utility of herbal medicine in fungal and dermatophytes infections, and in treating chronic wounds unresponsive to treatment and may help to curb down MDR problem.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Adejumo TO, Bamidele BS. Control of dermatophyte-causing agents (*Trichophyton mentagrophytes* and *Trichophyton rubrum*) using six medicinal plants. J Med Plants Res. 2009;3(11):906-913.
2. Amanati A, Lotfi M, Masoudi M. Cerebral and pulmonary aspergillosis, treatment and diagnostic challenges of mixed breakthrough invasive fungal infections: case report study. BMC Infect Dis. 2020;20:535.
3. Antikchi M, Najafzadeh H, Ahmadpoor K, Najafi K, Dadvar M, Shafie A. A comparison between effects of Aloe vera, Vinegar, *Salivia officinalis*, and Pine cone on some treatment process of dermatophytosis in calves. Int J Vet Res. 2009;1(2):2-4.
4. Asadi MR, Alipour Z, Ferdowsi HR, Kayghan DM, Köfer J, Schobesberger H. A comparison between the routine treatment of equine dermatophytosis and treatment with garlic-*Aloe vera* gel. In: Animal hygiene and sustainable livestock production. Proceedings of the XVth International Congress of the International Society for Animal Hygiene, Vienna, Austria, 3-7 July 2011, Volume 2. Tribun EU. 2011. p. 959-962.
5. Barchitta M, Maugeri A, Favara G, Magnano San Lio R, Evola G, Agodi A, *et al*. Nutrition and wound healing: An overview focusing on the beneficial effects of curcumin. Int J Mol Sci. 2019;20(5):1119.
6. Bhandari PR. Garlic (*Allium sativum* L.): A review of potential therapeutic applications. Int J Green Pharm. 2012;6:118-129.
7. Bisnoi A, Vinay K, Dogra S. Emergence of recalcitrant dermatophytosis in India. Lancet Infect Dis. 2018;18(3):250-251.
8. Bokhari FM. Antifungal activity of some medicinal plants used in Jeddah, Saudi Arabia. Mycopath. 2009;7(1):51-57.
9. Cafarchia C, Figueredo LA, Otranto D. Fungal diseases of horses. Vet Microbiol. 2013;167(1):215-234.
10. Clinical and Laboratory Standard Institute (CLSI). Performance Standards for Anti-Microbial Susceptibility Testing. 30th ed. CLSI; 2020. M100.
11. Dicken M, Munday JS, Archer RM, Mayhew IG, Pandey SK. Cutaneous fungal granulomas due to Alternaria spp.

infection in a horse in New Zealand. N Z Vet J. 2010;58(6):319-320.
12. Fisher MC, Henk DA, Briggs CJ, Brownstein JS, Madoff LC, McCraw SL, *et al*. Emerging fungal threats to animal, plant and ecosystem health. Nature. 2012;484(7393):186-194.
13. Gawaz A, Weisel G. Mixed infections are a critical factor in the treatment of superficial mycoses. Mycoses. 2018;61(10):731-735.
14. Gnat S, Łagowski D, Nowakiewicz A. Major challenges and perspectives in the diagnostics and treatment of dermatophyte infections. J Appl Microbiol. 2020;129(2):212-232.
15. Gnat S, Łagowski D, Nowakiewicz A, Dyląg M. A global view on fungal infections in humans and animals: Opportunistic infections and microsporidioses. J Appl Microbiol. 2021;131(5):2095-2113.
16. Habeb KA, Maikhan HK, Rachid SK. Molecular identification of dermatophytes among clinical isolates. Asian J Nat Appl Sci. 2016;5(2):108-118.
17. Hamdan A, Haji Idrus R, Mokhtar MH. Effects of Nigella sativa on type-2 diabetes mellitus: A systematic review. Int J Environ Res Public Health. 2019;16(24):4911.
18. Hernández-Hernández F, Manzano-Gayosso P, Córdova-Martínez E, Méndez-Tovar LJ, López-Martínez R, de Acevedo BG, *et al*. Morphological varieties of *Trichophyton rubrum* clinical isolates. Rev Mex Micologia. 2007;(25):9-14.
19. Hewlings SJ, Kalman DS. Curcumin: A review of its effects on human health. Foods. 2017;6(10):92.
20. Kalis FM, de Koster CG, Brul S. Cell wall-related bio-numbers and bio-estimates of *Saccharomyces cerevisiae* and Candida albicans. Eukaryot Cell. 2014;13(1):2-9.
21. Khushbu C, Roshni S, Anar P, Carol M, Mayuree P. Phytochemical and therapeutic potential of *Piper longum* Linn: A review. Int J Res Ayurveda Pharm. 2011;2(1):157-161.
22. Köhler JR, Casadevall A, Perfect J. The spectrum of fungi that infects humans. Cold Spring Harb Perspect Med. 2015;5(1)
23. Kumar R, Singh AK, Gupta A, Bishayee A, Pandey AK. Therapeutic potential of *Aloe vera*—A miracle gift of nature. Phytomedicine. 2019;60:152996.
24. Leclair LW, Hogan DA. Mixed bacterial-fungal infections in the CF respiratory tract. Sabouraudia. 2010;48(Supplement_1)
25. Mahendra Pal, Chang-woo Lee. *Exserohilum rostratum*: First isolation from equine dermatitis. J Vet Clin. 1994;11(2):525-527.
26. Nogueira MF, Pereira L, Jenull S, Kuchler K, Lion T. Klebsiella pneumoniae prevents spore germination and hyphal development of *Aspergillus* species. Sci Rep. 2019;9(1):218.
27. OIE. The Centre for food security and public health. Iowa University; c2005. p. 706.
28. Radostits OM, Gay CC, Hinchcliff KW, Constable PD. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats. 10th ed. Elsevier Saunders; 2007. p. 1476-1478.
29. Saigal S, Bhargava A, Mehra SK, Dakwala F. Identification of *Candida albicans* by using different culture Medias and its association in potentially malignant and malignant lesions. Contemp Clin Dent. 2011;2(3):188-193.
30. Scott J, Sueiro-Olivares M, Ahmed W, Heddergott C, Zhao C, Thomas R, *et al*. *Pseudomonas aeruginosa*-derived volatile sulfur compounds promote distal *Aspergillus fumigatus* growth and a synergistic pathogen-pathogen interaction that increases pathogenicity in co-infection. Front Microbiol. 2019;10:2311.
31. Shields BE, Rosenbach M, Brown-Joel Z, Berger AP, Ford BA, Wanat KA. Angio-invasive fungal infections impacting the skin: background, epidemiology, and clinical presentation. J Am Acad Dermatol. 2019;80(4):869-880.
32. Spickler AR, Larson L, Salmonellosis K. Salmonellosis: Disease information and prevention; c2013. Available online: http://www.cfsph.iastate.edu. Disease Info/factsheets.php.
33. Sravani G, Ganesan PI. Concurrent infections of M. audouinii and Mucormycosis in buffaloes and attributed risk factors for fungal infections. Int J Vet Sci Anim Husbandry. 2024;9(3):252-255.
34. Stannard AA, White SD. Mycotic diseases. In: Smith BP, editor. Large animal internal medicine. 3rd ed. Toronto: Mosby; c2002. p. 1213-1214.
35. St-Germain G, Summerbell R. Identifying filamentous fungi: A clinical laboratory handbook. 1st ed. Belmont, CA: Star Publishing Company; 1996. p. 152.
36. Surjushe A, Vasani R, Saple DG. Aloe vera: A short review. Indian J Dermatol. 2008;53(4):163-166.
37. Vipparti H. Mixed fungal lung infection with Aspergillus fumigatus and *Candida albicans* in an immune-compromised patient: case report. J Clin Diagn Res. 2014;8(4):DD08-DD10.

How to Cite This Article
Ganesan PI, Raju H, Mathew Z, Akash R. Studies on the utility of *Aloe-vera*, neem, and turmeric in equine fungal and multiple dermatophytes infection. International Journal of Veterinary Sciences and Animal Husbandry. 2024;9(4):481-484.