

Dermatophytosis in donkeys (*Equus asinus*) due to *Microsporium racemosum*, an unusual geophilic agent



Simona Nardoni^{a,*}, Guido Rocchigiani^a, Roberto Amerigo Papini^a, Vincenzo Veneziano^b, Giovanni Brajon^c, Mina Martini^a, Federica Salari^a, Francesca Mancianti^a

^a Dipartimento di Scienze Veterinarie, Università di Pisa, Viale delle Piagge, 2, I 56124 Pisa, Italy

^b Dipartimento di Medicina veterinaria e Produzioni animali – Università degli Studi di Napoli Federico II Napoli, Via del Pino, 1, I 80137 Napoli, Italy

^c Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana, Via di Castelulci, I 50010 San Martino alla Palma, Italy

ARTICLE INFO

Article history:

Received 30 May 2016

Received in revised form

7 June 2016

Accepted 20 June 2016

Available online 21 June 2016

Keywords:

Microsporium racemosum

Donkey

Equus asinus

Ringworm

Geophilic dermatophyte

ABSTRACT

Reports about ringworm in donkeys are scanty and refer to zoonotic agents such as *Trichophyton mentagrophytes* and *Trichophyton verrucosum*. Seventeen Asino Amiatina donkeys semi-extensively farmed in paddocks showed alopecic nummular, scaling areas mainly on head and neck. *Microsporium racemosum* cultivated from the lesions was identified by morphology and PCR. Affected animals healed spontaneously. The present record reports for the first time the occurrence of ringworm due to *M. racemosum* in naturally infected animals.

© 2016 International Society for Human and Animal Mycology. International Society for Human and Animal Mycology Published by Elsevier B.V. All rights reserved.

1. Introduction

The present paper reports for the first time the occurrence of an outbreak of ringworm due to *Microsporium racemosum* in a donkey herd.

This geophilic fungal species was firstly isolated by Borelli [1] from a *Rattus rattus* in Venezuela, then from amazonian forest soil [2], from soil and animal hairs in Europe [3,4]. Its perfect state was described by Rush-Munro et al. [2] and natural pathogenicity for humans has been reported [5–9]. Information about usual clinical presentation in animals is lacking, except for experimental infection of guinea pig, achieved using the clinical isolate of the second human case from the USA. In this animal species an erythematous, scaling lesion developed in a few days after the inoculation of spores obtained from culture [7], underlining the “highly pathogenic potential” of *M. racemosum* stated by Alteras and Evolveanu, [4]. In the present case donkeys showed scaling alopecic areas on head and neck.

2. Case

All the animals were semi-extensively reared in Tuscany (Central Italy), for milk production and onotherapy. The donkey herd consisted of 151 animals (8 jacks, 80 jennies, 63 foals) kept in 11 separate paddocks. In the summer of 2015 17 animals showed dermatological signs consisting of alopecic nummular, scaling areas mainly on head and neck (Fig. 1). The lesions had developed in about 2 weeks time. In detail symptomatic subjects were distributed as follows in separate paddocks: 1 stallion and a female for mating, 3 out of 19 lactating jennies, 7 out of 7 male foals and 5 out of 37 female foals. All the subjects present in the breed were regularly submitted to veterinary controls and appeared in general good health status. Because the clinical picture was suggestive of dermatophytosis, all symptomatic donkeys were sampled by Mc Kenzie brush technique and hairs were collected for microscopic direct examination. In addition a brush sampling was carried out in the 8 animals employed in onotherapy also, suspecting the possible occurrence of a zoonotic dermatophyte, even if no human skin lesions had been reported.

Hairs specimens were both clarified in KOH 10% for microscopic examination and cultured on Sabouraud Dextrose Agar (SDA) with cycloheximide 0.5 mg/mL and chloramphenicol 0.05 mg/mL (Liofilchem, Italy) and incubated at 25 °C for 15 days.

* Corresponding author.

E-mail address: simona.nardoni@unipi.it (S. Nardoni).

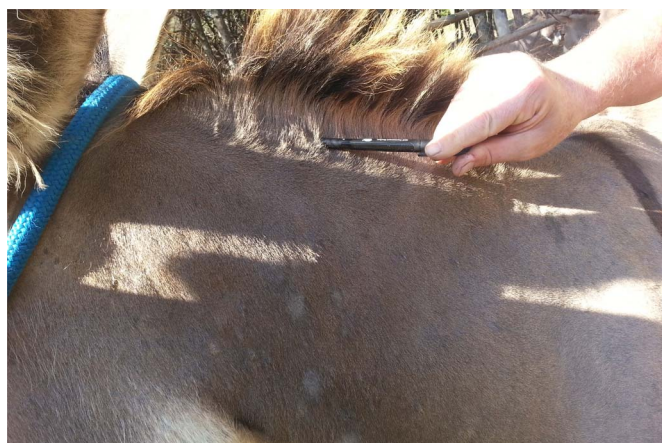


Fig. 1. Alopecic areas on the neck of an infected donkey.

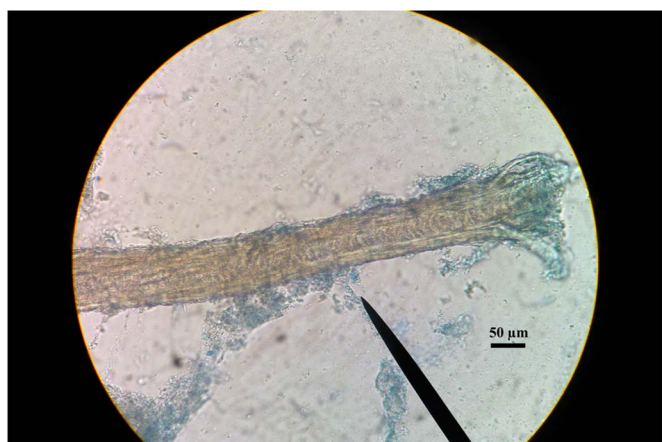


Fig. 2. Arthrospores on infected hair (lactophenol cotton blue, 400 × magnification).

Microscopic examination revealed few arthrospores of about 5 μm in diameter, sparse on hairs (Fig. 2). All symptomatic animals and 5 out of 8 donkeys employed in onotherapy were culture positive for velvety colonies, rapidly spreading to powdery, with a surface cream color and a grape red reverse. Subcultures on Malt Extract Agar were achieved.

Microscopic morphology consisted of several stalked macro and microconidia. Macroaleuriospores were large, echinulate, thin-walled and with more than 6 cells, often provided of terminal filament, while the club shaped microconidia were arranged in grape-like clusters (Fig. 3). The macro- and microscopic fungal morphology was consistent with *M. racemosum*. No other dermatophyte species was cultured. Considering the geophilic behavior of *M. racemosum*, cultures from soil of paddocks were achieved by hair bait technique, yielding ascigerous states of *M. racemosum*, *Microsporium gypseum* and *Trichophyton ajelloi*.

Fungal isolates were sent to the Centraalbureau voor Schimmelcultuur of the Netherlands for molecular confirmation. The identified strain (CBS accession N. 141511) was enlisted in the CBS culture collection.

Specific antimycotic drugs licensed for food producing animals are not available within the European Community, so the animals were not treated and spontaneous healing occurred in about three months. Further clinical cases were not registered during the following 8 months.

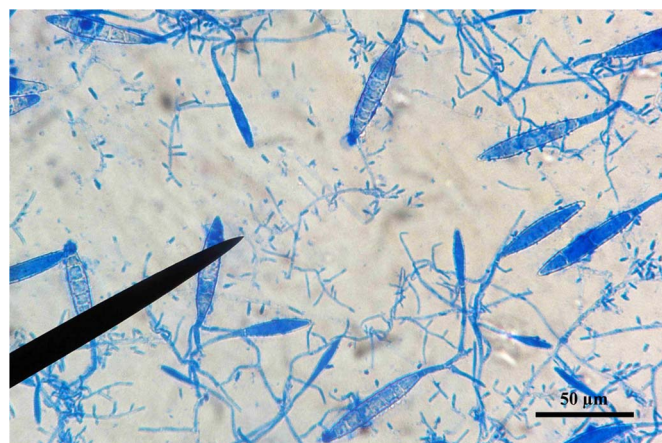


Fig. 3. Microscopic morphology of isolate: microaleuriospores stalked and in racemes and large macroaleuriospores with terminal filaments (400 × magnification).

3. Discussion

Reports about ringworm in donkeys are scanty and refer to zoonotic agents such as *Trichophyton mentagrophytes* and *Trichophyton verrucosum* [10,11]. Amiatina is an Italian native donkey (*Equus asinus*) breed classified by FAO as endangered [12]. Italian public institutions and private breeders associations made strong efforts to preserve this autochthonous breed [13], therefore the use of these animals in recreational activities (agritourism, hiking) and onotherapy (especially with children) as well as for meat (salami, stew) and milk (cosmetics industry, human nutrition) production has been promoted [12,13]. Considering the close contact between donkeys and human beings, these latter sometimes have a developing and/or impaired immune system, such as patients affected by disability or discomfort and/or children, great attention should be paid to animals' health status to avoid spread of zoonotic infections.

Geophilic dermatophytes are keratinophilic fungi able to grow on keratin baits in soil. These fungal species represent the largest group among dermatophytes and are not frequently found to infect humans or animals [14], except for *M. gypseum*, occurring in about 0.1% of human patients [15,16] and in 1.1% of dermatologically diseased dogs and cats [17]. Infections due to geophilic fungi usually do not occur simultaneously in several animals, although an outbreak of dermatophytosis caused by *Microsporium nanum* has been described in an extensive Iberian pig farm [18]. In this case 100% of lactating sows were involved, likely due to the immunomodulating effect of lactation. In the present report lactating jennies and foals aged from 1 to 4 years, appeared likely to develop skin lesions. Considering that 100% of foal males were symptomatic our findings could indicate that the stress of lactation on one hand, as well as to the biting and fighting habits of young adults, on the other hand, might have led to subtle immunosuppression which promoted clinical infection.

The results of the present study would suggest that other animal species, in addition to humans, are susceptible to infection with this fungus.

Conflict of interest

There are none conflict of interests.

Acknowledgments

The Authors thank Professor Sybren De Hoog for the molecular identification of fungal isolates.

References

- [1] D. Borelli, *Microsporium racemosum* nova species, Acta Med. Venez. 12 (1965) 148–151.
- [2] F.M. Rush-Munro, J.M. Smith, D. Borelli, The perfect state of *Microsporium racemosum*, Mycologia 62 (1970) 856–859.
- [3] K. Ulfig, M. Terakowski, G. Plaza, First isolation of *Microsporium racemosum* Borelli in Poland, Roczn. Panstw. Zakl. Hig. 47 (1996) 313–318.
- [4] I. Alteraş, R. Evolceanu, First isolation of *Microsporium racemosum*–Dante Borelli 1965 from Romanian soil (New data on its pathogenic properties), Mykosen 12 (1969) 223–230.
- [5] M.B. de Albornoz, C.A. Lopez, N. Afonso, Primero caso De Tinea corporis por EL *Microsporium racemosum* (Borelli 1965), Derm. Venez. 2 (1972) 310–318.
- [6] V. Daum, D.J. McCloud, *Microsporium racemosum*: first isolation in the United States, Mycopathologia 59 (1976) 183–185.
- [7] J.W. Rippon, T.W. Andrews, *Microsporium racemosum*. Second clinical isolation from the United States and the Chicago area, Mycopathologia 64 (1978) 187–190.
- [8] J.W. Rippon, Forty four years of dermatophytes in a Chicago clinic (1944–1988), Mycopathologia 119 (1992) 25–28.
- [9] P. García-Martos, J. Gené, M. Solé, J. Mira, R. Ruíz-Henestrosa, J. Guarro, Case of onychomycosis caused by *Microsporium racemosum*, J. Clin. Microbiol. 37 (1999) 258–260.
- [10] K.E. Ali, M.T. Abu-Samra, A.M. Ibrahim, *Trichophyton mentagrophytes* infection in the domestic donkey (*Equus asinus asinus*), Ann. Trop. Med. Parasitol. 75 (1981) 623–626.
- [11] W.G. Abdalla, E.A. Suliman, N.A. Abdo El Gabbar, A report on *Trichophyton verrucosum* in donkeys in the Sudan, Sudan J. Vet. Res. 20 (2005) 83–85.
- [12] W. Kugler, H.-P. Grunenfelder, E. Broxham, Donkey breeds in Europe: inventory, description, need for action, conservation. Report 2007/2008. Monitoring Institute for Rare Breeds and Seeds in Europe/SAVE Foundation, St Gallen, Switzerland.
- [13] L. Colli, G. Perrotta, R. Negrini, L. Bomba, D. Bigi, P. Zambonelli, et al., Detecting population structure and recent demographic history in endangered livestock breeds: the case of the Italian autochthonous donkeys, Anim. Genet. 44 (2013) 69–78.
- [14] J.S. Choi, Y. Gräser, G. Walther, A. Peano, F. Symoens, S. de Hoog, *Microsporium mirabile* and its teleomorph *Arthroderma mirabile*, a new dermatophyte species in the *M. cookei* clade, Med. Mycol. 50 (2012) 161–169.
- [15] A. Rezaei-Matehkolaei, A. Rafiei, K. Makimura, Y. Gräser, M. Gharghani, B. Sadeghi-Nejad, Epidemiological Aspects of Dermatophytosis in Khuzestan, southwestern Iran, an Update, Mycopathologia (2016) (Epub ahead of print).
- [16] E. Martinez, M. Ameen, D. Tejada, R. Arenas, *Microsporium* spp. onychomycosis: disease presentation, risk factors and treatment responses in an urban population, Braz. J. Infect. Dis. 18 (2014) 181–186.
- [17] S. Nardoni, L. Mugnaini, R. Papini, M. Fiaschi, F. Mancianti, Canine and feline dermatophytosis due to *Microsporium gypseum*: a retrospective study of clinical data and therapy outcome with griseofulvin, J. Mycol. Med. 23 (2013) 164–167.
- [18] A. Garcia-Sanchez, J. Bazan, J.H. de Mendoza, R. Martinez, S. Sanchez, M.H. de Mendoza, Outbreak of ringworm in a traditional Iberian pig farm in Spain, Mycoses 54 (2011) 179–181.