

Dermatophilosis of Alpine Chamois (*Rupicapra rupicapra*) in Italy

D. De Meneghi¹, E. Ferroglia¹, E. Bollo², L. Leon Vizcaino³, A. Moresco^{4*}, L. Rossi¹

¹ Dipartimento di Produzioni Animali, Epidemiologia ed Ecologia e ² Dipartimento di Patologia Animale, Università di Torino, ³ Facultad de Medicina Veterinaria, Unidad de Enfermedades Infecciosas, Universidad de Murcia,

^{4*} Istituto Zooprofilattico Sperimentale delle Venezie, Belluno.

Abstract

A proliferative dermatitis similar to the condition generally referred to as strawberry footrot was observed in two Alpine chamois (*Rupicapra rupicapra*) from Eastern Alps, Italy. Branching septated filaments and packets of PAS-positive coccoid organisms were observed in histological sections of the affected skin. The actinomycete, *Dermatophilus congolensis*, was isolated from crusted lesions in one chamois. As wild ruminants are presumed to be a reservoir of infection in the Alpine area, the authors discuss the potential role of chamois in the epidemiology of dermatophilosis.

Key words: *Dermatophilus congolensis* – chamois (*Rupicapra rupicapra*) – strawberry footrot – dermatophilosis – Italian Alps

Dermatophylose der Gemse (*Rupicapra rupicapra*) in den Italienischen Alpen

Bei zwei Gamsen (*Rupicapra rupicapra*) aus den östlich gelegenen Alpen in Italien konnte eine proliferative Dermatitis, unter ähnlichen Bedingungen, wie sie bei der «strawberry footrot» bekannt sind, beobachtet werden. In den histologischen Schnitten der befallenen Haut konnten verzweigte Septum-Fasern und PAS-positive Kokken beobachtet werden. *Dermatophilus congolensis* wurde von verkrusteten Läsionen bei der Gemse isoliert. Die mögliche Bedeutung von wildlebenden Wiederkäuern als Infektionsreservoir in den Alpen wird diskutiert.

Schlüsselwörter: *Dermatophilus congolensis* – Gemse (*Rupicapra rupicapra*) – strawberry footrot – Dermatophylose – Italienische Alpen

Introduction

Dermatophilosis is an exudative to proliferative skin disease caused by the actinomycete bacterium *Dermatophilus congolensis* (*Actinomycetales*, *Dermatophilaceae*), affecting various domestic animals, wild hosts – over 20 different species – as well as humans (Richard, 1981). The disease is more prevalent in the tropics, but it is not rare in countries with temperate climate (van Tonder and Horner, 1994). In continental Europe, dermatophilosis is signalled in livestock and domestic carnivores (Chermette et al., 1983; Leoni et al., 1993; Vassaire and Dufrene, 1995), while reports in wildlife are limited to few cases in Alpine chamois (*Rupicapra rupicapra*) from Switzerland (Nicolet et al., 1967), Austria (Deutz and Hinterdorfer, 1997) and Italy (Sironi et al., 1999) and in roe deer (*Capreolus capreolus*) from Switzerland (De Giorgis et al., 1997). The purpose of this paper is to describe two more cases of dermatophilosis in Alpine chamois, to report

the first *D. congolensis* isolation from Eastern Italian Alps and to discuss the potential role of this mountain ungulate in the epidemiology of dermatophilosis.

Animals, Material and Methods

Animals and study area

The carcass of a chamois from Flavon, Trento province, Italy, was presented to one of the authors (A.M.) for post mortem examination. The animal, a 3 year old ewe, had been shot the previous day due to the presence of scabby lesions on the lower legs. The hunter stated that the lesions resembled from distance sarcoptic mange – a severe epizootic disease not observed so far in chamois from this area (Rossi et al., 1996). One month later the dressed carcass of a second chamois, a female yearling, shot in Spiazzo, Trento, Italy was also presented to A.M. The hunter reported that he had not noticed any

* present address: Azienda Sanitaria Locale, Cles (Tn)

skin lesion or abnormal signs before shooting the animal.

Post mortem examination was performed, skin specimens from both chamois were collected by scraping and Giemsa ↔ stained smears were prepared. One hind leg from each chamois was frozen shipped to the Veterinary School in Turin (Italy). Here, skin specimens were fixed in 10% buffered formalin, embedded in paraffin, sectioned (4 µm) and stained either with hematoxylin-eosin or periodic acid-Schiff (PAS).

Skin lesions (e.g. scales and scabs) were digested in 10% NaOH and samples were then examined under microscope for mites and dermatophytes. The presence of pathogenic fungi was also evaluated on Sabouraud dextrose agar cultures.

Blood agar plates were inoculated with finely chopped scabs from the first chamois and aerobically incubated at 37°C for 7 days and then stored at 4°C until development of colonies. Gram-stained smears of these colonies were prepared. The organisms isolated were maintained at room temperature on Brain Heart Infusion agar plates containing polymyxin B sulphate (Abu-Samra and Walton, 1977).

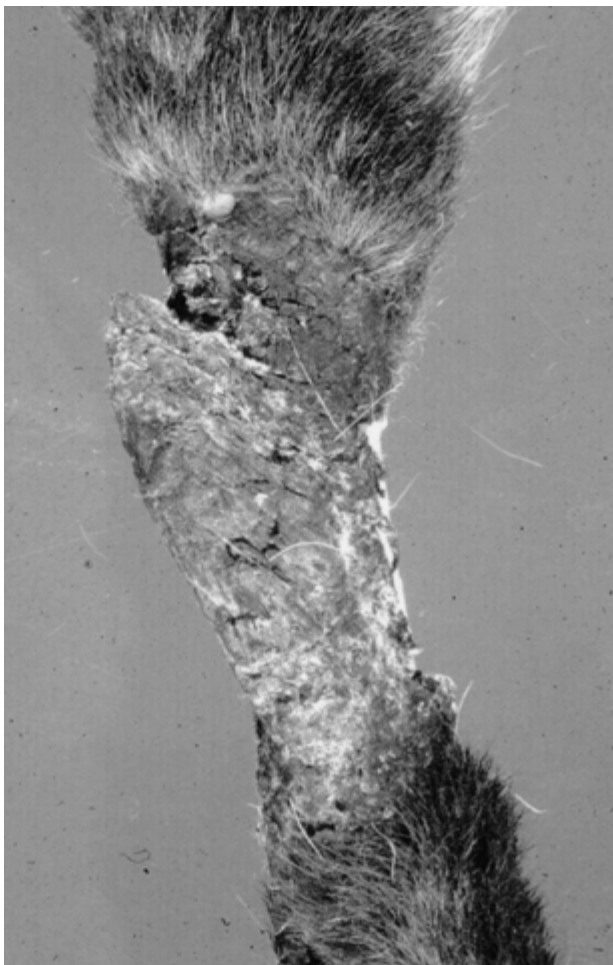


Figure 1: Chamois, 3 years old ewe, right metatarsal region (thick and hard crusts).

Results

Post mortem examination and gross pathological findings

The first chamois was in good condition as judged by the amount of subcutaneous and visceral fat. Skin lesions were localized on the nose and the hind legs, from the hocks down to the coronets. Loss of hair, scaliness and slight scabs were present on the dorsal aspect of the nose. Affected areas of the limbs were characterized by loss of hair and thick, hard, dry, confluent and brown to greyish crusts, firmly attached to the underlying tissues. A moist yellowish-to-brown greasy exudate was also present. Crusts were particularly thick (3–4 cm) on the right metatarsal region (Fig. 1), whereas patches of flat scabs were present on the opposite hind leg. Upon removal of the crusts, a reddish granular surface was exposed. Moreover, a conspicuous overgrowth of the right hoof was present, due to diminished function, presumably as a consequence of pain. Gross lesions were not observed in other areas of the skin nor in other tissues, except pleural sinechiae and chronic broncho-pneumonitis in the antero-ventral aspect of the right lung. The second chamois was also in good condition. Loss of hair, scaliness and greyish scabs were also present on the metatarsi and the dorsal aspect of the nose, but lesions were milder than in the former case. Gross lesions were not observed in other areas of the skin nor in other tissues of the dressed carcass.

Parasitological and microbiological examinations

Rows of coccoid bodies with a railroad track appearance were observed in Giemsa – stained smears prepared from both chamois (Fig. 2). Specimens from both chamois were negative for mites and dermatophytes. Cultures on Sabouraud dextrose agar confirmed the absence of pathogenic fungi. Blood agar plates prepared from material collected from the first chamois grew yellow-orange colonies by day 40 p.i. Growth, morphological and biochemical characteristics, defined at the Laboratory of Infectious Diseases, Veterinary School in Murcia, were typical of *D. congolensis* (Gordon, 1964; Pier et al., 1963; Holt et al., 1994).

Histopathological findings

Microscopically, epidermal lesions were characterized by hyperkeratosis, hyperplasia of the basal layers, cell degeneration, presence of several layers of necrotic debris and dried exudate on the epidermal surface and accumulation of neutrophils (Fig. 3). Edema, neutrophilic infiltration as well as microabscesses characterized the outer portions of

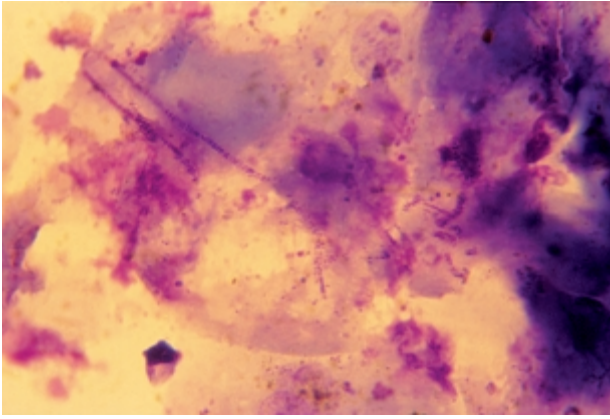


Figure 2: *D. congolensis* in Giemsa stained smear: rows of coccoid bodies with railroad track appearance (1000×)

the dermis. The basement membrane was locally destroyed, as a consequence of granulocytes infiltration; in this case, the whole underlying dermis appeared congested, oedematous and infiltrated by inflammatory cells. In some areas, packets of PAS-positive coccoid organisms together with branching septated filaments invading the dermis were observed. Histopathological lesions and the associated microorganisms were similar in the two chamois.

Discussion

Isolation of the agent from field material was quite difficult and somewhat fortuitous due to overgrowth of the culture media with contaminants and maybe for the chronicity of the lesions. The origin of the above infection in these chamois is speculative. *D. congolensis* is not highly pathogenic *per se*, although a combination of factors may predispose the host to the infection and eventually lead to the development of a severe disease form. Normal skin appears to be resistant to infection and factors that

reduce physiologic barriers of the skin are important in the initiation of the disease. Rainfall and moisture, traumatic abrasions (rough pasture and thorns) as well as insects bites (ixodid ticks and biting flies) are believed to be key factors in the pathogenesis of dermatophilosis (Ambrose, 1996). Rainfall, a factor which is known to enhance transmission of *D. congolensis* by rendering the skin more susceptible to infection and by releasing the motile infective zoospores (Stewart, 1972b; van Tonder e Horner, 1994), is high in the Trento area (1200–1300 mm/year, peak values occurring from May to August). However, during spring-summer before the carcasses were found, rainfall was reported as slightly below the normal average.

Regarding insects bites, a progressive chronic form of dermatophilosis in cattle, associated with Ixodid ticks infestation, was reported by Ambrose et al. (1999). Ticks, namely *Ixodes ricinus*, have been reported in wild ruminants, including chamois from Eastern Alps (Boch and Schneidawind, 1988; Chemini et al., 1997; Fraquelli, personal communication). However the chamois from our study did not host Ixodid ticks. Out of 75 chamois examined for the presence of ectoparasites, only one chamois from Pinzolo district, Trento province (not far from the study area) hosted few *I. ricinus* (Fraquelli, personal communication).

Both chamois from our study area shared the pasture with cattle from June to September. However, infection is not presumed to have been transmitted from cattle, since dermatophilosis has never been described in this host in Italy, nor observed in domestic ruminants from the study area. Though dermatophilosis in sheep has been described in Italy (Leoni et al., 1993), small ruminants are not grazed where chamois have been shot. Clinical presentation of the previous cases of dermatophilosis in Alpine chamois differed in that dermatitis,

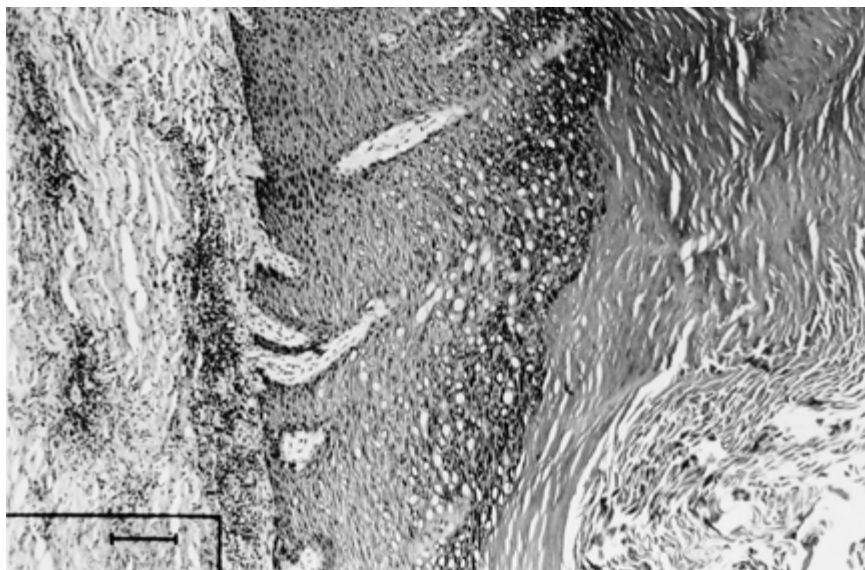


Figure 3: Chamois, left hind leg, skin: hyperkeratosis, hyperplasia of the basal layers of the epidermis, degeneration of epidermal cells and accumulation of neutrophils in the underlying derma (haematoxylin and eosin staining; 100×)

although similarly localized, was exudative and paint brush lesions consisting of focal matting of hair were observed (Nicolet et al., 1967; Sironi et al., 1999).

The new cases reported here indicate that a proliferative dermatitis similar to the condition generally referred to as strawberry footrot (Stewart, 1972a) may also develop in chamois and this is the first report of such a case in this species. As regards dermatophilosis in other wild ungulates, an extensive dermatitis with lesions characterized by thickening of the skin and crusts was also described in the Kafue Lechwe (*Kobus lechwe kafuensis*), a medium size antelope living in the Kafue river flood plains in Southern Zambia (Pandey et al., 1994). Dermatophilosis in cattle is highly prevalent in Zambia, including Kafue flats area (Samui and Hugh-Jones, 1990; De Meneghi, unpublished data), and the close contact between cattle and lechwe which share pasture and drinking water for several months is an ideal condition to maintain the infection/transmission cycle of *D. congolensis* in both domestic and wild ungulates. In North America, some cases of dermatophilosis were reported in white tailed deer (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*) (Richard, 1981; Salkin et al., 1983; Williams et al., 1984). In particular, Salkin et al. (1983) reported besides the typical skin lesions, the isolation of the etiological agent from internal organs in a white tailed deer, thus suggesting a transient septicemia. Young age is a recognized risk factor in strawberry footrot in sheep (van Tonder and Horner, 1994). In our study, both cases occurred in healthy sub-adult chamois, as previously reported by Nicolet et al. (1967). Conversely, Sironi et al. (1999) described a condition of exudative dermatitis in adult animals (5 to 6 years of age) whose body conditions were considered poor.

Regarding differential clinical diagnosis, other dangerous skin disorders in chamois, such as the contagious ecthyma (orf) and sarcoptic mange (scabies) should be differentiated from dermatophilosis. In case of ecthyma, scabs develop on the lips and muzzle, and less regularly, on eyelids, feet, udder and teats. Clinical signs include lesions in the oral cavity and loss of condition (Boch and Schneidawind, 1988; Rosati et al., 1993), while in our cases animals were in good condition and lesions were limited to the lower feet and nose only.

Mange is known to be highly pruritic and the affected chamois loose rapidly condition. Thick scabs with a tendency to crack develop primarily on the face, the ears and the dorsal aspect of the neck (Boch and Schneidawind, 1988). Mites are abundant and easy to demonstrate in skin scrapings (Rossi et al., 1996). Cases of scabies occur mainly

during colder months (Rossi et al., 1996), while in our study, both cases were described from chamois culled during early autumn. Besides, the two animals were in good condition and thick scabs and crusts were observed only on lower feet region, while scaliness and loss of hair were observed on the nose.

As to the zoonotic potential of *D. congolensis* no skin lesion developed in people who had handled and dressed the chamois carcasses of our study (e.g. hunters, game wardens) and this in spite of reports of human infection due to contact with affected game animals (Dean et al., 1961).

Dermatophilosis in chamois, although limited to few sporadic cases, has been reported over the last years from various Alpine districts, e.g. Switzerland (Nicolet et al., 1967), Austria (Deutz and Hinterdorfer, 1997) and Italy (Sironi et al., 1999; De Meneghi et al., this paper). Nevertheless, the presence of more than 20% of seroreactors to *D. congolensis* in chamois from Savoie, French Alps (Gauthier et al., 1992) suggests a circulation of the pathogen throughout the Alps. Serum antibodies titres to *D. congolensis* are reportedly not correlated with resistance to the infection, and isotype, location and specificity of the antibodies are believed to be more important than total anti *D. congolensis* titres. However, the role of skin surface antibodies and their possible role in preventing both infection and subsequent lesion resolution has still to be elucidated (Ambrose et al., 1999). Chronically infected carrier animals with no apparent skin lesions but with specific antibodies against *D. congolensis* are believed to be the main source of infection (Ambrose, 1996; Ambrose et al., 1999).

We hypothesise that free-ranging wild ruminants could be a reservoir of infection in the Alps, and the infective stages may be spread interspecifically by ticks, flies and contaminated fomites. It could be possible that in these wild hosts, a disease condition may develop in the event of a combination of predisposing factors (e.g. immunosuppressive effects of stress, inter-current infections, parasites, climatic factors, etc.), as it has been already demonstrated in domestic ruminants (Ambrose, 1996; Ambrose et al., 1999).

Nevertheless, it is felt that testing this hypothesis would require more data and further research is needed for a better understanding of the epidemiology of this disease in Alpine wild ruminants.

Acknowledgements: the contribution by dr. M. Bruatto, prof. F. Tolari and dr E. Zanin during early stages of laboratory work is highly acknowledged here. The authors would also like to thank dr. C. Fraquelli for providing useful data on tick infestation in chamois from Trento province.

Dermatofiosi del Camoscio Alpino (*Rupicapra rupicapra*) in Italia

Una dermatite proliferativa assimilabile ad una forma clinica della pecora nota come «strawberry footrot» è stata osservata in due camosci (*Rupicapra rupicapra*) provenienti dalle Alpi orientali italiane. Le sezioni istologiche allestite dalla cute colpita hanno evidenziato forme filamentose-ramificate settate e aggregati di organismi coccoidi PAS-positivi. L'actinomicete *Dermatophilus congolensis*, è stato isolato in coltura da uno dei due camosci. Gli Autori discutono il possibile ruolo del camoscio nell'epidemiologia della dermatofiosi, ipotizzando che i ruminanti selvatici siano i serbatoi dell'infezione nell'area alpina.

Dermatophilose du Chamois des Alpes (*Rupicapra rupicapra*) en Italie

Une dermatite proliférative semblable à une forme clinique du mouton nommée «Strawberry footrot» a été observée sur deux chamois des Alpes orientales italiennes.

Les sections histologiques préparées à partir de la peau atteinte ont mis en évidence des formes filamenteuses, ramifiées et septées, et agrégats d'organismes arrondis PAS-positifs. L'Actinomycète, *Dermatophilus congolensis*, a été isolé en culture sur l'un des deux chamois. Les auteurs discutent le possible rôle du chamois dans l'épidémiologie de la dermatophilose, considérant que les ruminants sauvages peuvent être les réservoirs de l'infection dans la région alpine.

References

- Abu-Samra M.T., Walton G.S.: Modified techniques for the isolation of *Dermatophilus* spp. from infected material. *Sabouraudia*. 1977, 15: 23–27.
- Ambrose N.: The pathogenesis of dermatophilosis. *Trop. Anim. Hlth Prod.* 1996, 28: 29S–37S
- Ambrose N., Lloyd D., Maillard J.C.: Immune response to *Dermatophilus congolensis* infections. *Parasitology Today*. 1999, 15: 295–300.
- Boch J., Schneidawind H.: Krankheiten des Jagdbaren Wildes. Buchverlag Parey, Berlin, 1988, 398 pp.
- Chemini C., Rizzoli A., Merler S., Furlanello C., Genchi C.: *Ixodes ricinus* (Acari: Ixodidae) infestation on roe deer (*Capreolus capreolus*) in Trentino, Italian Alps. *Parassitologia* 1997, 39: 59–63.
- Chermette R., Bussieras J., Houdas M.: Identification de la dermatophilose bovine en France. *Rec. Med. Vet.* 1983, 159: 25–28.
- Dean D.J., Gordon M.A., Severinghause C.W., Kroll E.T., Reilly J.R.: Streptothricosis: a new zoonotic disease. *N.Y. State J. Medic.* 1961, 61: 1283–1287.
- Degiorgis M.P., Suter M., von Tscherner C., Nicolet J., Giacometti, Bacciarini L.N.: Dermatophilosis in a free-ranging roe deer (*Capreolus capreolus*) in Switzerland: case report.. In: *Proc. Ann. Conf. Amer. Ass. Zoo Veter.* Houston, USA, 1997: 322–323.
- Deutz A., Hinterdorfer F.: Dermatophilose bei Rind, Pferd und Gemse – Epidemiologie, Diagnostik, Therapie und zoonotische Aspekte. *Wien. Tierärztl. Mschr.* 1997, 84: 97–101.
- Gauthier D., Gibert P., Hars J.: Sanitary consequences of mountain cattle breeding on wild ungulates. In: *Proc. Intern. Symposium «Ungulates 91»*. Ed. F Spitz, SFEPM-IRGM Paris-Toulouse, 1992: 621–630.
- Gordon M.A.: The Genus *Dermatophilus*. *J. Bacteriol.* 1964, 88: 509–522.
- Holt J.G., Krieg N.R., Sneath P.H.A., Staley J. T., Williams S.T.: *Bergey's Manual® of Determinative Bacteriology*. 9th ed., Williams & Wilkins, Baltimore, 1994.
- Leoni A., Fadda M., Nieddu A.M., Pittau M., Sanna E., Pirino S., Contini A.: Dermatophilosis in sheep: first report in Italy, experimental reproduction and evaluation of immune response. *Bull. It. Biol. Sper.* 1993, 69: 775–783.
- Nicolet J., Klinger K., Fey H.: *Dermatophilus congolensis*, agent de la streptotrichose du chamois. *Pathol. Microbiol.* 1967, 30: 831–837.
- Pandey G.S., Mweene A., Suzuki A.K., Nambota A., Kaji T.: Dermatophilosis (cutaneous streptothricosis) in Kafue lechwe (*Kobus lechwe kafuensis*). *J. Wildl. Dis.* 1994, 30: 586–588.
- Pier A.C., Neal F.C., Cysewski S.J.: Cutaneous streptothricosis in Iowa cattle. *J. Am. Vet. Med. Assoc.* 1963, 142: 995–1000.
- Richard J.L.: Dermatophilosis. In: *Infectious Diseases of Wild Mammals*. Eds. J.W Davis, L.R. Karstad, D.O. Trainer, The Iowa State University Press, Ames, Iowa, 1981, 339–346.
- Rosati S., Tolari F., Cornaglia E., Meneguz P.G., Di Iorio C.: Focolai di ectima contagioso del camoscio – Accertamenti di laboratorio. *Summa* 1993, 6: 51–53.
- Rossi L., Meneguz P.G., De Martin P., Rodolfi M.: The epizootiology of sarcoptic mange in chamois (*Rupicapra rupicapra*) from the Italian eastern Alps. *Parassitologia* 1995, 37: 233–240.
- Salkin I.F., Gordon M.A., Stone W.B.: Cutaneous granules associated with dermatophilosis in a White-tailed deer. *J. Wildl. Dis.* 1983, 19: 361–363.
- Samui K.L., Hugh-Jones M.E.: The prevalence of bovine dermatophilosis in Zambia. *Acta Veterinaria Scandinava* 1988, S84: 369–370.

- Sironi G., Grilli G., Citterio C., Sala M., Vallone L., Finazzi M.:* Infezione da *Dermatophilus congolensis* nel camoscio. Segnalazione di due casi. In: Atti XVII Convegno Associazione Patologi Veterinari Italiani, Sassari. 1999, 19–22.
- Stewart G.H.:* Dermatophilosis: a skin disease of animals and man. Part I. Vet. Rec. 1972a, 91: 537–544.
- Stewart G.H.:* Dermatophilosis: a skin disease of animals and man. Part II. Vet. Rec. 1972b, 91: 555–561.
- Van Tonder E.M., Horner R.F.:* Dermatophilosis, In: Infectious diseases of livestock with special reference to Southern Africa. Eds. J.A.W. Coetzer, R. Thomson, R.C. Tutsin, Oxford University Press, Cape Town-Oxford-New York, 1994, 1472–1481.
- Vassaire J., Dufrene M.:* À propòs de cas de dermatophilose à *Dermatophilus congolensis* en France dans les différentes espèces animales. Bull. Acad. Vet. France. 1995, 68: 63–68.
- Williams E.S., Pier A.C., Wilson R.W.:* Dermatophilosis in a mule deer (*Odocoileus hemionus*) from Wyoming. J. Wildl. Dis. 1984, 20(3): 236–238.

Address of correspondence:

Dipartimento di Produzioni Animali, Epidemiologia ed Ecologia, Università degli Studi di Torino,
Via Leonardo da Vinci 44 - 10095 Grugliasco (To), Italy
e-mail: demeneg@veter.unito.it; fax: +39-011-6709186

Received for publication: 2 August 2001

Accepted in the present form: 2 December 2001