Toenail onychomycosis by Trichophyton rubrum and concurrent infestation with Tyrophagus putrescentiae

Article *in* Le infezioni in medicina: rivista periodica di eziologia, epidemiologia, diagnostica, clinica e terapia delle patologie infettive · December 2017

CITATIONS
0

READS
47

7 authors, including:

Mario Principato
Università degli Studi di Perugia
56 PUBLICATIONS **106** CITATIONS
SEE PROFILE

Cristina Pesca
Istituto Zooprofilattico Sperimentale Umbria e Marche
16 PUBLICATIONS **1** CITATION
SEE PROFILE

Cruciani Deborah
Istituto Zooprofilattico Sperimentale Umbria e Marche
14 PUBLICATIONS **3** CITATIONS
SEE PROFILE

Silvia Crotti
Istituto Zooprofilattico Sperimentale Umbria e Marche
35 PUBLICATIONS **171** CITATIONS
SEE PROFILE

Le Infezioni in Medicina, n. 4, 377-380, 2017

Toenail onychomycosis by *Trichophyton rubrum* and concurrent infestation with *Tyrophagus putrescentiae*

Valentina Fabrizi[1], Ivana Zacconi[1], Mario Principato[2], Cristina Pesca[3], Deborah Cruciani[3], Silvia Crotti[3], Manuela Papini[1]

[1]Dipartimento di Scienze Chirurgiche e Biomediche, Clinica Dermatologica di Terni, Università degli Studi di Perugia, Terni, Italy;
[2]Dipartimento di Medicina Veterinaria, Sezione di Parassitologia, Università degli Studi di Perugia, Perugia, Italy;
[3]Istituto Zooprofilattico Sperimentale dell'Umbria e delle Marche, Perugia, Italy

SUMMARY

A remarkable case of onychomycosis by *Trichophyton (T.) rubrum* combined with nail infestation by *Tyrophagus (T.) putrescentiae* in an elderly diabetic farmer is described and discussed. Large numbers of eggs and mites in all development stages were present in nail debris, reflecting active reproduction on site. Treatment with ivermectin 0.1% cream and environmental decontamination cleared the mite infestation, while onychomycosis responded well to oral terbinafine and ciclopirox 8% nail lacquer. Such a combination of onychomycosis and mite infestation of the same nail is an exceptional finding reported only twice in the literature.

Keywords: onychomycosis, diabetes, *Trichophyton rubrum*, mite infestation, *Tyrophagus putrescentiae*.

INTRODUCTION

Fungal infection of the nail unit is estimated to represent up to 50% of all nail problems and 30% of all skin mycoses. Up to one third of people with diabetes are affected by onychomycosis. The present case of a diabetic man is notable from a biologic and a clinical point of view, as it combines a common form of toenail mycosis due to *T. rubrum* with an exceptional infestation of the same nails with *T. putrescentiae*, an environmental mite usually harmless to humans.

Corresponding author
Manuela Papini
E-mail: manuela.papini@unipg.it

CASE REPORT

A 74-year-old farmer underwent podiatric screening as part of a diabetic foot prevention project. On examination, typical aspects of interdigital tinea pedis and distal-lateral onychomycosis of both big toes were present (Figure 1). The patient stated that nail changes had been present for at least one year and he had ignored them. No other relevant signs and symptoms were present. His type 2 diabetes was in good metabolic control through diet and use of oral metformin.
Skin scraping from interdigital webs and nail fragments were sent to the laboratory for mycological examination. Microscopic examination after KOH 20% clarification of interdigital scales and nail fragments showed abundant septate hyphae. Culture tests of both samples on Sabouraud's agar with and without cloramphenicol and actidione resulted in growth of *Trichophyton*

rubrum. Species identification was confirmed by Heminested PCR and DNA sequencing according to Cafarchia et al. [1]. The surprising observation was the presence in the subungual debris of several small mites in the form of adults, larvae and ova (Figure 2), indicating a true colonization not only a simple environmental contamination.
The patient was then called for a reassessment. He returned to visit after about 10 days from the first observation. Onychoscopy performed with a VIDIX videodermoscope at 100 x magnification confirmed the presence of mites within the nail lamina (Figure 3). New nail samples were then taken for evaluation by the parasitologist.
To identificate the arthropods, the nail fragments were immersed in 85% lactic acid and the visible mites extracted under the stereomicroscope by means of micro-flat tip needles. They were kept in the same liquid for 48 hours and then mounted on a slide in Berlese solution. The microscopic preparation was then flambéed for 10 seconds and left to dry at room temperature for 10 days. Mites were identified as *Tyrophagus putrescentiae* (Figure 4) on the basis of distinctive morphological features reported in Table 1 [2, 3].
Tyrophagus putrescentiae occurs throughout the world in a wide range of wild habitats, but is also a common pest of stored products, especially those with a high protein and fat content [2-6]. Considering the biology of such a mite, the patient was asked details about his life and working habits, in order to find the possible source of mite contagion. The patient reported that its main activities were the care of poultry and the cultivation of vegetables. During those activities, he always wore the same shoes that he kept in a shed used for storage of animal feed and agricultural tools. The patient was asked to bring us the work shoes, which were also found heavily colonized by *Tyrophagus putrescentiae*.
Urea 40% and ivermectin 0.1% cream were then applied on the toenails in occlusive dressing once a day for a week. Infested shoes were destroyed and other footwear that he used was treated with permethrin 5% spray in order to eliminate possible residual mites. New nail samples were then taken. At direct examination no mites were observed, while culture test and gene sequencing re-confirmed the presence of *Trichophyton rubrum*. Onychomycosis responded well to terbinafine 250 mg/day and ciclopirox 8% nail lacquer for 16

Figure 1 - Distal-lateral onychomycosis of both big toe.

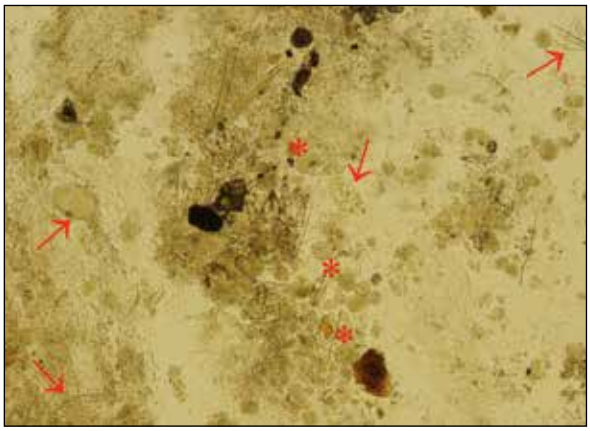

Figure 2 - Direct examination in 20% KOH of nail debris showing mites, eggs (arrows), and fecal balls (asterisks) (original magnification x 25).

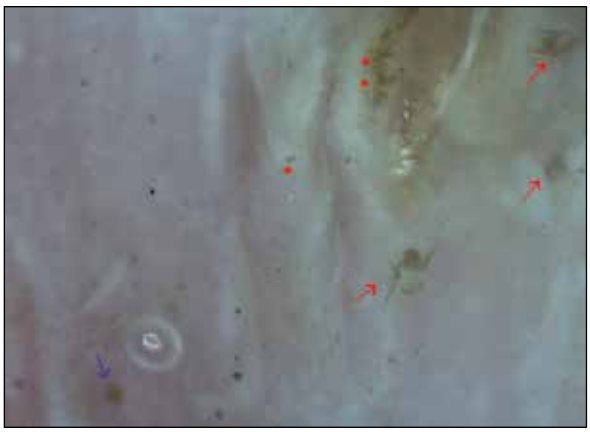

Figure 3 - Onychoscopy: mites (red arrows), eggs (blue arrow) and fecal debris (asterisks) (non polarized dermoscopic magnification x100 –VIDIX).

Figure 4 - *Tyrophagus putrescentiae*: adult female and male at steromicroscopic observation (original magnification x 100).

Table 1 - Distinctive morphological features of *Tyrophagus putrescentiae*.

Lineage: Arthropoda › Chelicerata › Arachnida › Acari › Acariformes › Sarcoptiformes › Astigmata › Acaroidea › Acaridae › Tyrophaginae › Tyrophagus	
Shield	Dorsal cuticular grove between propodosome and hysterosome.
Setae (bristles)	Dorsal setae very long and serrated. Inner scapular bristles longer than the external bristles. Supracoxal setae with swollen bases bearing fairly long pectinations. The swollen base is drawn out into a long point.
Legs	Legs slender, extending well beyond lateral body margin. Tarsus 1 with omega1 parallel-sided, but only slightly expanded distally. Tarsi of all legs terminate into an empodium with a single claw.
Genitalia	Male genital opening in ventro-dorsal view having penis support and basal element of penis separated into 2 units.

weeks. Complete clinical and mycological cure was maintained at the follow-up after 3 and 6 months.

DISCUSSION

Tyrophagus putrescentiae is a cosmopolitan mite species commonly referred to as the "mould mite" or "cheese mite". It has been found in agricultural soils and nests of birds and small mammals [7,8]. Under ideal conditions with temperatures above 30°C and humidity above 85%, it can complete its life cycle in less than three weeks and lay up to 700 eggs. *Tyrophagus putrescentiae* is saprophagous and mycetophagous and known to feed on decaying organic material and on products that are stored under poor conditions. It can colonize different human-related habitats such as urban environments, farms, food industries, and laboratory facilities [3, 6, 7]. This species also feeds on different fungi including moulds, dermatophytes, and several yeasts, and can become a pest of mycological laboratories [9, 10]. *Tyrophagus putrescentiae* has been identified as the cause of human disease in different regions. It has been found to be the cause of "copra itch" among people who handle copra in the tropics, as well as papular skin eruptions, contact dermatitis, urticaria, and respiratory allergies among people handling raw hams in Europe [3, 11, 12]. Rarely *Tyrophagus putrescentiae* can also invade and parasitize several human organs, like lung, bowel, and urinary tract [13].

In our experience, environmental mites can occasionally be observed in the subungual debris examined for mycological purpose. However, in this case, mites were numerous, persistent, and in all stages of life, including females with large developing eggs, deposited eggs, and larvae, clearly indicating that they were able to survive and actively reproduce themselves in the patient's nail. To our knowledge, there are only two previous similar reports both dating back more than 60 years ago [14, 15]. The first of them was encountered in a 15-year-old boy with onychomycosis and palmo-plantar hyperkeratotic tinea caused by *T. rubrum* and concomitant infestation by *Dermatophagoides scheremetewskyi* [14]. The second patient was a 58-year-old man showing tinea pedis by *T. mentagrophytes*, onychomycosis due to *Scopulariopsis brevicaulis*, and concurrent infestation with a Tyroglyphid mite [15]. In both these cases, the possible source of mites was not reported. In our patient, mites came certainly from work shoes, which resulted heavily colonized by *Tyrophagus putrescentiae*. The patient put its shoes every day in the shed close to the feed for chickens and seeds for garden, both typical food sources of this mite. Considering fungivory of *Tyrophagus putrescentiae*, the presence of onychomycosis by *T. rubrum* is likely to have worked as a bait attract-

ing the parasites to move from the shoes to the nails, where they implanted stably. No other skin lesions possibly related to *Tyrophagus putrescentiae* were observed on the feet or elsewhere and the patient was completely asymptomatic and unaware of his condition.

Tyrophagus putrescentiae generally does not have a parasitic behaviour and is considered a commensal on humans and animals, surviving for a short time on scales, secretions, and exudates. However, its potential parasitic activity is probably overlooked. Several reports indicate that *Tyrophagus putrescentiae*, as well as many other domestic mites, can invade pulmonary, intestinal, oral, urinary, otic, and vaginal systems [13]. Most of these cases occur in a tropical climate and/or in people with occupational exposure to mites. However, several factors could promote the parasitic potential of these mites, including environmental conditions such as climatic changes, and host factors like immune suppression or diabetic complications. We cannot know whether our patient would have developed systemic problems if the mite infestation was left untreated. Certainly, the presence of lesions of tinea pedis and onychomycosis in a subject with diabetes can be a potential entrance gate for other pathogens, included mites and their bacterial microbiota [16]. In our opinion, more effort should be devoted in trying to understand the biology of these environmental mites and their relations with humans.

Conflict of interest

None

REFERENCES

[1] Cafarchia C., Gasser R.B., Figueredo L.A. et al. An improved molecular diagnostic assay for canine and feline dermatophytosis. *Med. Mycol.* 51, 136-143, 2013.

[2] Diagnostic Methods for Mould mite *Tyrophagus putrescentiae.* Retrieved from http://www.padil.gov.au/pbt (http://www.padil.gov.au/pbt) Last accessed January 2, 2017.

[3] Colloff M.J., Spieksma F.T. Pictorial keys for the identification of domestic mites. *Clin. Exp. Allergy* 22, 823-830, 1992.

[4] Arlian L.G. Biology and ecology of house dust mites, Dermatophagoides sp. and *Euroglyphus* sp. *Immunol. Allergy Clin. North. Am.* 9, 339-356, 1989.

[5] Wharton G.W. House dust mites. *J. Med. Entomol.* 12, 577-621, 1976.

[6] Hughes A.M. The mites of stored food and houses. *Ministry of Agriculture, Fisheries and Food Technical Bulletin.* 9, 1-400, 1976.

[7] van Hage-Hamsten M., Johansson S.G.O. Storage mites. *Exp. Appl. Acarol*. 16, 117-128, 1992.

[8] Franz J.T., Masuch G., Musken H., Bergmann K.C. Mite fauna of German farms. *Allergy* 52, 1233-1237, 1997.

[9] Bahrami F., Kamali K., Fathipour Y. Life history and population growth parameters of *Tyrophagus putrescentiae* (Acari: Acaridae) on *Fusarium graminearum* in laboratory conditions. *J. Entomol. Soc. Iran.* 26, 7-18, 2007.

[10] Duek L., Kaufman G., Palevsky E., Berdicevsky I. Mites in fungal cultures. *Mycoses* 44, 390-394, 2001.

[11] Liao E.C., Ho C.M., Lin M.Y., Tsai J.J. *Dermatophagoides pteronyssinus* and *Tyrophagus putrescentiae* allergy in allergic rhinitis caused by cross-reactivity not dual-sensitization. *J. Clin. Immunol.* 30, 830-839, 2010.

[12] Rodriguez del Rio P., Tudela Garcia J.I., Narganes N.J., et al. Occupational asthma caused by inhalation of *Tyrophagus putrescentiae* allergens in a dry-cured ham transporter allergic to shrimp. *J. Investig. Allergol. Clin. Immunol.* 22, 383-384. 2012.

[13] Cui Y. When mites attack: domestic mites are not just allergens. *Parasites & Vectors* 7, 411- 417, 2014.

[14] Fisher A.A., Franks A.G., Wolf M., Leider M. Concurrent infestation with a rare mite and infection with a common dermatophyte. *A.M.A. Arch. Derm. Syph.* 63, 336-342, 1951.

[15] Franks A.G., Taschdjian C.L., Gutierrez G.T. Onychomycosis due to *Scopulariopsis brevicaulis*. Case concurrent with dermatophytosis and infestation with a Tyroglyphid mite. *A.M.A. Arch. Derm.* 74, 241-244, 1956.

[16] Hubert J., Kopecky J., Perotti M. A., Nesvorna M., Braig H. R., Sagova-Mareckova M., et al. Detection and identification of species-specific bacteria associated with synanthropic mites. *Microb. Ecol.* 63, 919-928, 2012.