

## Mixed Onychomycosis Case with *Fusarium Solani*: A Case Report

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### Abstract

**Background:** *Fusarium* species are found in soil and are important plant pathogens. *Fusarium* species may cause nail and corneal infections in healthy people.

**Case:** A 20-year-old male patient presented to Trakya University Hospital with complaints of discoloration and dullness of the nail that had started 2-3 months prior. A *Pseudomonas* infection was considered, as a greenish colour change was observed in the nail of the first digit on the left hand. As the greenish colour on the nail began to turn black, a fungal examination was performed. Total nail avulsion was planned when hyphae were observed in a direct preparation of the nail scraping sample with 30% KOH. In the first scraping sample after nail removal, fungal hyphae were observed in a direct preparation with 30% KOH. Culturing process, bacteria, yeast, saprophytic fungi were observed. The cultures were repeated after nail removal, and the results were similar to the previous cultures.

**Conclusions:** *Fusarium solani*, *Candida parapsilosis* and *Pseudomonas aeruginosa* grew in both cultures. *Fusarium solani* was identified by using molecular methods in addition to its macroscopic and microscopic features. Sequence analysis was performed with Sanger sequencing. Species identification was confirmed via phylogenetic data analysis based on DNA of the obtained sequences. *Candida parapsilosis* and *Pseudomonas aeruginosa* were identified with the classical method and VITEK® 2 Compact.

**Key words:** Onychomycosis, Nail, *Fusarium solani*

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## *Fusarium solani*'ye Bağlı Miks Onikomikoz Olgusu

### Özet

**Giriş ve Amaç :** *Fusarium* türleri toprakta bulunur ve önemli bitki patojenleridir. *Fusarium* türleri sağlıklı kişilerde tırnak ve kornea enfeksiyonlarına neden olabilir.

**Olgu:** 20 yaşındaki erkek hasta, 2-3 ay önce başlayan tırnaktaki renk değişikliği ve matlaşma şikâyetleriyle Trakya Üniversitesi Tıp Fakültesi Hastanesi'ne başvurdu. Sol el birinci tırnağında yeşilimsi renk değişikliği saptanan olguya *Pseudomonas*'a bağlı enfeksiyon düşünüldü. Tırnaktaki yeşilimsi renk siyahlaşmaya başladığından fungal inceleme yapıldı. Tırnak kazıntı örneğinin %30'luk KOH'lu direkt preparatında hifler görülmesi üzerine tırnak çekimi planlandı. Hastanın tırnak çekimi gerçekleşmesinden sonraki alınan ilk kazıntı örneğine %30'luk KOH'lu direkt preparatında mantar hifleri görüldü. Kültürde bakteri, maya mantarı, saprofit fungus üremesi oldu. Tırnak çekimi yapıldıktan sonra kültürler tekrarlandı. Bir önceki ekimi yapılan kültür ile sonuç benzerdi.

**Sonuç:** Her iki kültür de *Fusarium solani*, *Candida parapsilosis* ve *Pseudomonas aeruginosa* üredi. *Fusarium solani* makroskobik ve mikroskobik özellikleri ile birlikte moleküler yöntemler kullanılarak isimlendirildi. Sangers Sekansı yöntemi ile dizi analizi yapıldı. Elde edilen sekans dizileri ile DNA tabanında flogenetik veri analizi gerçekleştirilerek tür tayini doğrulandı. Klasik yöntem ve VİTEK 2 compact ile *Candida parapsilosis* ve *Pseudomonas aeruginosa*'nın identifikasyonu yapıldı.

**Key words:** Onikomikoz, Tırnak, *Fusarium solani*

### Introduction

Dermatophytes are the most common fungus that infect superficial keratinized tissues (1). In addition to dermatophytes, other mould and *Candida* species can infect nails (2). Apart from fungi, bacteria can also infect keratinized tissues, including the clinical form of *Pseudomonas aeruginosa* referred to as green nail syndrome (3). *Fusarium* species are found in soil and are important plant pathogens (4). *Fusarium* species may cause nail and corneal infections in healthy people. Although rare, they can cause toxicosis and localized or hematogenous spread and systemic infections in humans and animals. The most common isolated species from clinical samples are *Fusarium solani*, *Fusarium oxysporum*, and *Fusarium moniliforme* (5). *Candida* species are normally found on human skin and mucosa. When factors that promote opportunistic infections are present, superficial infections cause deep acute or chronic infections. In superficial candidiasis, *Candida* penetrate and spread into the tissue through a break in the skin and mucosa. Nail infections due to *Candida* are more commonly seen in the fingernails (6).

Publications on nail infections due to *F. solani* (Mart.) Sacc., *Michelia* 2 (no. 7): 296 (1881) and clinical forms in which *Candida parapsilosis* and *P. aeruginosa*

accompanying *F. solani* are rare. In this case report, a case of onychomycosis due to concomitant *F. solani*, *C. parapsilosis* and *P. aeruginosa* is presented.

### Case Report

A 20-year-old male patient admitted to Hospital with complaints of discoloration and dullness of the nail (Figure). A *Pseudomonas* infection was considered, as a greenish colour change was observed in hand nail. Hypha were observed in a direct preparation of both of nail scraping with 30% KOH and nail fragment sample. *F. solani*, *C. parapsilosis* and *P. aeruginosa* were isolated in culture of the samples previous and after nail avulsion (Figure). The nail parts and scraping samples were incubated under the following conditions: followed by each exact condition (brain heart infusion broth (Oxoid, Netherlands) and Sabouraud dextrose agar (Oxoid, Netherlands) at 25°C; brain heart infusion broth (Oxoid, Netherlands) and Sabouraud dextrose agar (Oxoid, Netherlands) at 35°C; and brain heart infusion broth (Oxoid, Netherlands), cycloheximide (Sigma, Germany) and Sabouraud dextrose agar (Oxoid, Netherlands) at 37°C). The nail tissue and scraping samples were incubated under the appropriate conditions and media. Bacteria were observed in the culture the next day; yeast grew on approximately the third day; and saprophytic fungi were observed on the fifth day. The cultures were repeated after nail removal. The culture results were similar to the previous cultures. *F. solani*, *C. parapsilosis*, and *P. aeruginosa* isolated in both cultures. The growth rate of the cultures was checked daily for one week for identification. In the macroscopic examination of the fungal colonies, criteria such as surface appearance, topography, appearance of the colony, surface and ground colour, reproduction temperature, and the existence of dissoluble pigment were considered. In the microscopic examination of the colonies, the structures of the hyphae and the existence of conidia in coloured, lactophenol cotton blue (GBL Convastain, Turkey) and colourless preparations were examined and the features of the appearance of the fungal structures were evaluated (7). *F. solani* was identified by using molecular methods in addition to its macroscopic and microscopic features (Figure). Sequence analysis was conducted with Sanger sequencing. With the help of the obtained sequence series, phylogenetic data analysis in DNA base was conducted and the determination of the species was confirmed. The nucleotide sequences obtained in this study have been submitted to National Center for Biotechnology Information (NCBI) registration service under the accession numbers SUB10254392 1 MZ889649. Our case was a novel report of *F. solani* among onychomycosis pathogens. Identification of *C. parapsilosis* and *P. auroginosa* were conducted through classical method and VITEK 2 compact (Biomérieux, France). Written informed consent was obtained from the patient who participated in this case.



**Figure 1.** A. The appearance of the nail before surgery B. The appearance of the nail after surgery C. Colony morphology of *F. solani* at fifth day D. Microscopic morphology of *F. solani* at fifth day.

## Discussion

The frequency of onychomycosis among superficial fungal infections has been reported as the highest rate of fungal infection in Europe at 23%, in South Asia at 20% and in North America at 14% (8). Onychomycosis is the fungal infection of the nails, and is most commonly related to dermatophytes and rarely other fungi. The most common fungi are 68% dermatophytes, 29% yeast fungi and 3% non-dermatophyte mold fungi (NDMF). Sometimes more than one agent can be responsible. Mix onychomycosis such as the case presented here are seen in the rate of 5%–15% (9). Onychomycosis caused by *Fusarium* species are frequently found in toenail infections, while fingernail infections are rare. Especially those affected by trauma and dystrophic abnormalities, or in toes previously infected by dermatophytes (10). Nails with onychomycosis create convenient conditions for *P. aeruginosa* to settle and cause infection, as it can create cavities in the nail areas and empty fields under the nail spaces. Nails with onychomycosis create favourable conditions for *P. aeruginosa* to settle and cause infection, as it can create cavities in the nail areas and create empty fields under the nail spaces (11).

However, in the first admission of our case, both black and green colour changes in the nail suggest co-infection rather than super infection. In another study conducted in Korea, two case reports were presented, both of which had *F. solani* infections with and *P. aeruginosa* coinfections in toenail (12). Furthermore, in a study conducted in Romania, *T. tonsurans* and *P. aeruginosa* were isolated simultaneously from the same nail (13). In the presented our case, there was no paronychia accompanying onychomycosis; however, there was an isolated infection in the nail. In another study, *P. aeruginosa* has been shown to form a dense biofilm that covers *C. albicans* filaments and kills the fungus (14). Contrary to this information, it is noteworthy to mention that *P. aeruginosa*, *F. solani* and *C. parapsilosis* coexist in our case. In the literature review conducted in Google Scholar, Web of Science, Scopus and PubMed, no information regarding mixed nail infection caused by these three agents was found on the nail.

Systemic itraconazole was the preferred medical treatment option in *F. solani* onychomycoses. A successful result was obtained by combining systemic itraconazole and total surgical nail avulsion in patient's treatment. Oral 1500 mg/day ciprofloxacin was implemented for five weeks and oral itraconazole 100 mg/day was implemented for three months. The patient fully recovered with the treatment. In the presented case, initially given antibacterial treatment may have created a favourable environment for fungal agents to increase due to the decrease in *P. aeruginosa* efficacy. There is also the possibility that *P. aeruginosa* infection is difficult to control due to tissue damage caused by fungal infections. As a result, it was concluded that it would be beneficial to consider surgical intervention options in mixed infection in cases where there is no response to medical treatment.

**Ethics Committee Approval:** Yes

**Informed Consent:** NA

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**Conflict of Interest:** No conflict of interest was declared by the author.

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