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Mycological study of candidiasis and dermatophytosis in the Batna university hospital, Algeria

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Abstract

Background. Ranging from mild to severe, fungal infections pose a serious public health concern worldwide, especially with their constantly changing epidemiology. The aim of the present study is to identify the most common clinical type of human dermatophytosis and candidiasis and their most common causative organisms in Batna, Algeria, as well as the effect of certain social and demographic factors on the spread of these fungi.

Methods. This was a cross- sectional study attending outpatients and inpatients of the Batna university hospital, Algeria. Clinically suspected cases of dermatophytosis or candidiasis with informed consent were included in the study. Our investigation was conducted from February to April 2024 and included 189 patients. Sampling was carried out at the laboratory and samples were subjected to KOH test, Sabouraud dextrose agar culture and the AUXACOLOR™² for *Candida* identification.

Results. Among 189 patients included in the study, 138 were examined for dermatophytosis and 51 for candidiasis. The results showed that 44 patients were positive for dermatophytosis and 12 for candidiasis. The most involved age group was > 12 years and no significant difference was observed between males and females. The predominant detected dermatophytosis was tinea capitis and the most involved organism was *Microsporum canis*. Regarding candidiasis, the most detected clinical variant was onychomycosis, and *Candida albicans* was the predominant identified organism.

Conclusion. In light of lack of data regarding fungal infections from Algeria, our study is of great importance for epidemiological surveillance of dermatophytosis and candidiasis in that country.

1. Introduction

Fungal infections pose a serious public health concern worldwide, especially with their constantly changing epidemiology concerning the occurrence and the incriminated fungi (Aissat and Denning, 2023; Gousy et al., 2023). Ranging from mild to severe, this type of infections could be either superficial or invasive (Bongomin and Adetona Fayemiwo, 2021). Among fungal infections, dermatophytosis and candidiasis are the most commonly reported worldwide (Camelia Nurdin et al., 2021; Deepika et al., 2024). Generally, these infections can lead to significant morbidity and mortality in both immunocompromised and immunocompetent individuals (Gousy et al., 2023). However, several risk factors could participate in their incidence increase such as skin burns, cancer, HIV infection and immunosuppressive treatment (Aissat and Denning, 2023).

Dermatophytosis (also referred as ringworm/tinea) result from the infection with filamentous fungi known as dermatophytes (Da Rosa Monte Machado et al., 2020; Deepika et al., 2024; Jartarkar et al., 2021). It is estimated that they represent 16–75% of mycological infections worldwide confirming their burden diffusion and importance (Rajan et al., 2024). Their biotropism is keratinized tissues including skin, nails and hair (Gelli et al., 2022).

Dermatophytes belong to nine fungal genera among which three are known to infect humans namely *Trichophyton* affecting skin, hair and nails, *Epidermophyton* known to infect skin and *Microsporum*, which usually affects skin and hair (Jartarkar et al., 2021).

In the other hand, candidiasis are caused by oval yeast divided from the genus *Candida* where the most commonly species is *Candida albicans* (Abdallah, 2024). *Candida* spp. range from normal body mycobiome of the oral cavity, gastrointestinal tract and the skin to opportunistic pathogens capable of inducing potentially life-threatening infections (Abdallah, 2024; Gelli et al., 2022). These pathogens can infect the mouth, vagina, skin, nails, bronchi or the lungs, and could lead to septicemia, endocarditis or meningitis (Camelia Nurdin et al., 2021).

Indeed, data from Algeria regarding dermatophytosis and candidiasis are very scarce where just few studies have investigated their etiology. Consequently, the epidemiology of these diseases in that country is not understood. In this context, the aim of the present study is to identify the most common clinical type of human dermatophytosis and candidiasis and their most common causative organisms in Batna, Algeria, as well as the effect of certain social and demographic factors on the spread of these fungi. In light of lack of data from Algeria, this study will contribute to better understanding the epidemiology of such diseases.

2. Methodology

It was a cross-sectional study attending outpatients and inpatients of the Batna university hospital, Algeria. Following a clinical examination, suspected cases of dermatophytosis or candidiasis with informed consent were included in the study. Our investigation was conducted from February to April 2024 and included 189 patients.

A pre structured proforma was used to collect data on history, clinical examination, patient hospitalization, KOH test, Sabouraud dextrose agar culture and the AUXACOLOR™² kit. Sampling was carried out at the laboratory.

Regarding dermatophytosis, skin scrapings, hair strands and nail clippings were collected. Samples were observed under microscope using lactophenol or 10% KOH. Subsequently, each sample was inoculated onto two Sabouraud dextrose agar slopes supplemented with chloramphenicol and cycloheximide and incubated at 27°C, for 3 to 4 weeks.

For superficial candidiasis suspected patients, sampling was carried out as described above. However, concerning other candidiasis, additional samples were collected including mucous membranes, sputum, urine, stools, cerebrospinal fluid and blood.

Microscopic observation was conducted using sterile saline or 10% KOH. Cultures were proceeded on Sabouraud dextrose agar slopes supplemented with chloramphenicol and cycloheximide and incubated at 37°C for 48h to one week, and for 10 days in cases of blood cultures. The species identification was carried out by using the AUXACOLOR™² kit.

3. Results and discussion

Among 189 patients included in the study, 138 were examined for dermatophytosis and 51 for candidiasis.

Batna province is among the largest cities in Algeria with a population of 1,119,791 (2008 census). Taking into account that the parasitology laboratory at the Batna university hospital (the study site) is the only microbiological diagnosis center for fungal infections in the province, the number of cases examined during the study period appears to be small. This could be attributed to the fact that general practitioners frequently rely on clinical suspicion for treatment without confirmatory testing (Aissat and Denning, 2023). However, this latter is of great importance for epidemiological surveillance.

3.1. Dermatophytosis

In the present study, among the 138 dermatophytosis suspected cases 44 patients presented positive (depending on culture results) results showing a positivity percentage of 31.88%.

This rate provides a concept of the effect of dermatophytosis in the population studied, reflecting the role of environmental, hygienic, or immunological factors in the prevalence of the infection. Additionally, the positivity rate is influenced by the diagnostic methods used (microscopy, culture).

The most involved age group was > 12 years with 26 cases (59.09%), followed by children of ≤ 12 years with 18 cases (40.9%). This distribution suggests that dermatophytosis affects both age groups significantly, but with a higher prevalence in adolescents and adults. The latter are more likely to be involved in physical activities that expose them to dermatophytes, such as sports, gym workouts, and social interactions. Moreover, certain professions (e.g., farmers, athletes) have a higher risk due to prolonged contact with soil and animals. In contrast, children aged 12 and younger continue to be severely impacted, most probably as a result of their immature or underdeveloped immune systems.

Indeed, In the present study 12 out of the 18 cases detected in children of 12 years or under were tinea capitis. This latter is particularly common in young children due to close physical contact in schools, and family settings.

Additionally, poor hygiene practices or lack of awareness may contribute to higher transmission among younger children. Besides, hormonal changes in adolescence might influence skin physiology, making older individuals more disposed to certain dermatophyte infections.

In addition, we noticed a slight predominance of males compared to females (54.55% vs. 45.45%). Differences in skin composition and hormone levels may contribute to variations in dermatophyte susceptibility. As well, males are more likely to engage in outdoor activities, manual labor, sports and jobs involving direct contact with animals and soil; increasing exposure to dermatophytes. In an epidemiological study carried out in Annaba, Algeria, a nearly equal gender distribution was reported where males had higher rates of tinea pedis and onychomycosis, while females were more affected by tinea corporis (Ennaghra et al., 2016). The most common clinical variant of the detected dermatophytosis was onychomycosis, which was observed in 20 cases (45.5%), followed by tinea capitis with 16 positive patients (36.3%) and finally, tinea corporis (glabrous skin) with 8 positive cases (18.2%).

The high rate of onychomycosis could be related to the fact that this type of infection is often chronic and difficult to treat, leading to accumulation of cases over time, in addition to several risk factors including poor foot hygiene, prolonged shoe wearing, and humidity, which create an ideal environment for fungal growth.

Our results align with findings from other Algerian regions. An investigation from April 2011 to March 2013 in Annaba collected 166 swabs from 118 patients. The prevalence rates were 4.21% for tinea capitis, 44.57% for tinea corporis, and 51.20% for tinea unguium (Ennaghra et al., 2016).

Identification results showed that the commonest isolated organism was *M. canis* with 47.72% (21 cases), followed by *T. rubrum* with 43.18% (19 cases), *T. mentagrophytes* with 6.82% (3 cases), and finally *T. violaceum* in only one case (2.28%). This distribution provides valuable insight into the predominant fungal species causing dermatophytosis in Batna region. In the study carried out by Ennaghra and colleagues in Annaba region, Algeria, the predominant identified species were *Trichophyton rubrum*, *T. mentagrophytes*, *T. verrucosum*, and *Microsporum audouinii* (Ennaghra et al., 2016).

In addition, in the present study six out of the 44 positive patients were in contact with pets. This study identified *M. canis* as the most prevalent dermatophyte (47.72%), which aligns with the association between pet contact and infection. Indeed, cats and dogs are primary reservoirs of *M. canis*, often carrying the fungus asymptomatically and spreading it to humans through direct contact or contaminated environments.

The zoonotic nature of *M. canis* indicates a need for public health interventions addressing animal-to-human transmission, particularly in children. This highlights the importance of both veterinary collaboration and community education.

3.2. Candidiasis

Regarding candidiasis, among the 51 suspected cases 12 patients presented positive results showing a positivity percentage of 23.53%. We noticed that not all suspected cases were positive. Yet, better diagnostic criteria and more sensitive detection methods could improve accuracy. In addition, high-risk groups, such as diabetics, immunosuppressed patients, and individuals using broad-spectrum antibiotics, should be monitored more closely.

The most involved age group was > 12 years with 11 cases, followed by children of < 12 years with only one case suggesting that adolescents and adults are more susceptible to candidiasis than young children. This susceptibility could be attributed to several factors including hormonal changes (puberty, pregnancy, menopause) that may alter skin and mucosal immunity, the increased use of antibiotics or corticosteroids, which can disrupt normal microbiota and promote fungal overgrowth, lifestyle factors, and higher rates of diabetes in older individuals, as hyperglycemia creates an environment favorable for *Candida* growth. In addition, the positive cases were distributed equally between males and females with six cases each. Unlike some fungal infections where gender differences exist (e.g.,

onychomycosis is more common in men, while vaginal candidiasis affects only women), this study shows no significant gender bias in candidiasis cases. This suggests that in our study population, both sexes are equally exposed to risk factors.

Regarding clinical variant of the detected candidiasis, the detected cases were equally distributed between superficial and invasive infections. Superficial candidiasis were detected in fingernails (onychomycosis) (5 cases) and tongue (thrush) (1 case). In the other hand, invasive candidiasis were detected in sputum (2 cases), urine (1 case) and dialysis fluid (3 cases). This distribution highlights the dual nature of *Candida* infections: as both a common skin/mucosal pathogen and a serious systemic opportunistic infection.

Identification results showed that the commonest isolated organism was *Candida albicans* with five cases, followed by *Candida tropicalis* and *Candida parapsilosis* with two cases each, and finally *Candida dubliniensis*, *Candida lusitanae* and *Candida* sp. with one case each. This species distribution highlights both the dominance of *C. albicans* and the increasing presence of non-*Candida albicans* species, which are often associated with antifungal resistance and hospital-acquired infections.

Indeed, frequent association of *C. albicans* with mucosal and invasive candidiasis, particularly in immunocompromised individuals, raises concerns about overuse of antibiotics or corticosteroids, and the potential emergence of antifungal resistance.

In a prospective study conducted in the Intensive Care Unit of Setif hospital, *C. albicans* was identified as the most common species among bloodstream infections (Meradji et al., 2023). In addition, in the present study three out the 12 positive patients were inpatients, however nine cases were outpatients.

4. Conclusion

This study provides valuable insights into the epidemiology of dermatophytosis and candidiasis in Batna, Algeria, emphasizing species distribution and patient demographics. In light of lack of data regarding fungal infections from Algeria, our study is of great importance for epidemiological surveillance of dermatophytosis and candidiasis in that country.

Raising awareness within the medical community about the significance and severity of fungal infections could enhance interest in mycology, ultimately leading to improved diagnosis and management of these infections.

Indeed, underreporting and reliance on clinical diagnosis without laboratory confirmation pose significant limitations to effective management where fungal infections may be misdiagnosed or underdiagnosed, especially in settings where laboratory infrastructure is

lacking. In addition, The reliance on clinical suspicion alone can lead to inappropriate treatment and contribute to therapeutic failures or recurrence.

Current treatment approaches in Algeria largely follow international standards; however, they may not fully reflect the local epidemiological patterns we observed.

It needs a combined approach of surveillance, early diagnosis, infection control, and improved public information so as to curtail the spread and minimize the consequences of dermatophytosis and candidiasis. Furthermore, carrying out more epidemiological research in different regions of Algeria would enhance an understanding of the fungal infections along with evolving changing trends in antifungal resistance.

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References

- Abdallah, A.L.M., 2024. An Overview about Management Lines of Onychomycosis 6.
<https://doi.org/doi.org/10.48047/AFJBS.6.2.2024.4502-4512>
- Aissat, F.Z., Denning, D.W., 2023. Fungal infections in Algeria. *Mycoses* 66, 594–603.
<https://doi.org/10.1111/myc.13585>
- Bongomin, F., Adetona Fayemiwo, S., 2021. Epidemiology of fungal diseases in Africa: A review of diagnostic drivers. *Curr. Med. Mycol.*
<https://doi.org/10.18502/cmm.7.1.6246>
- Camelia Nurdin, R.S., Vitayani, S., Amin, S., Kadir, D., Djamaluddin, W., Adriani, A., 2021. Cutaneous candidiasis caused by *Candida kefyr*. *Pan Afr. Med. J.* 38.
<https://doi.org/10.11604/pamj.2021.38.178.28054>
- Da Rosa Monte Machado, G., Diedrich, D., Ruaro, T.C., Zimmer, A.R., Lettieri Teixeira, M., De Oliveira, L.F., Jean, M., Van De Weghe, P., De Andrade, S.F., Baggio Gnoatto, S.C., Fuentefria, A.M., 2020. Quinolines derivatives as promising new antifungal candidates for the treatment of candidiasis and dermatophytosis. *Braz. J. Microbiol.* 51, 1691–1701. <https://doi.org/10.1007/s42770-020-00348-4>
- Deepika, T., Sivasankari, S., Senthamarai, S., Akila, K., Subha, V.J., Anitha, S., Kamalraj, M., Ambuja, S., Sijimol, S., 2024. Prevalence of Fungal Infections Among Dermatophytosis Patients in Our Tertiary Care Hospital, Kanchipuram 13.
<https://doi.org/10.33472/AFJBS.6.6.2024.1401-1406>

- Ennaghra, N., Meddour, A., Soumati, B., Kabouchi-Bouzidi, L., 2016. Epidemiological Survey on the Dermatophyte Flora in the Area of Annaba East of Algeria.
- Gelli, A., Nobile, C.J., Pericolini, E., Wellington, M., 2022. Editorial: Women in fungal pathogenesis 2021. *Front. Cell. Infect. Microbiol.* 12, 1068446. <https://doi.org/10.3389/fcimb.2022.1068446>
- Gousy, N., Adithya Sateesh, B., Denning, D., Latchman, K., Mansoor, E., Joseph, J., Honnavar, P., 2023. Fungal Infections in the Caribbean: A Review of the Literature to Date. *J. Fungi* 9, 1177. <https://doi.org/10.3390/jof9121177>
- Jartarkar, S.R., Patil, A., Goldust, Y., Cockerell, C.J., Schwartz, R.A., Grabbe, S., Goldust, M., 2021. Pathogenesis, Immunology and Management of Dermatophytosis. *J. Fungi* 8, 39. <https://doi.org/10.3390/jof8010039>
- Meradji, A., Ranque, S., Bachtarzi, F., Mosbah, N., Moulahem, T., 2023. Incidence, Species Distribution, and Antifungal Susceptibility of Candida Bloodstream Infections in a Tertiary Algerian Hospital, in: ECM 2023. Presented at the ECM 2023, MDPI, p. 30. <https://doi.org/10.3390/ECM2023-16684>
- Rajan, R., Narayanankutty, S., Theodore, R.B.J., Majeed, N., 2024. Clinicomycological study of dermatophytosis in a tertiary care centre. *J. Acad. Clin. Microbiol.* 18, 110–113. <https://doi.org/10.4103/0972-1282.194939>

Figure's legend

Figure 1. Macro and microscopic appearance of isolated dermatophytes (left: SDA results, right: KOH results).

Figure 2. Macro and microscopic appearance of isolated *Candida* sp. (left: SDA results, right: microscopic observation).

Table 1. Details of the dermatophytosis cases in this study.

Patients	Gender	Age (years)	Contact with animals	Sample type	KOH results	SDA results
1	Female	57	No	Toenails	+	<i>T. rubrum</i>
2	Female	57	No	Skin	+	<i>T. rubrum</i>
3	Female	43	No	Hand nails	+	<i>M. canis</i>
4	Male	7	Yes	Hair scalp	+	<i>M. canis</i>
5	Male	10	No	Hair scalp	+	<i>T. rubrum</i>
6	Female	23	No	Skin	-	<i>M. canis</i>

7	Male	5	No	Hair scalp	+	<i>M. canis</i>
8	Male	7	Yes	Hair scalp	+	<i>M. canis</i>
9	Male	4	No	Hair scalp	+	<i>M. canis</i>
10	Female	29	No	Skin	+	<i>M. canis</i>
11	Female	36	No	Toenails	+	<i>T. rubrum</i>
12	Male	27	No	Toenails	+	<i>T. rubrum</i>
13	Male	62	No	Skin	+	<i>T. rubrum</i>
14	Female	38	No	Skin	+	<i>T. mentagrophytes</i>
15	Male	2	No	Hair scalp	+	<i>M. canis</i>
16	Female	4	Yes	Hair scalp	+	<i>M. canis</i>
17	Male	46	No	Toenails	+	<i>T. rubrum</i>
18	Male	60	No	Toenails	+	<i>T. rubrum</i>
19	Male	52	No	Toenails	+	<i>T. rubrum</i>
20	Male	27	No	Hand nails	+	<i>M. canis</i>
21	Female	1	No	Skin	-	<i>T. mentagrophytes</i>
22	Male	70	No	Toenails	+	<i>T. rubrum</i>
23	Male	58	No	Toenails	+	<i>M. canis</i>
24	Female	25	No	Hair scalp	+	<i>M. canis</i>
25	Female	18	No	Hand nails	+	<i>T. rubrum</i>
26	Female	35	No	Toenails	+	<i>T. rubrum</i>
27	Male	1	No	Hair scalp	+	<i>M. canis</i>
28	Male	69	No	Hair scalp	+	<i>M. canis</i>
29	Female	35	No	Hair scalp	+	<i>M. canis</i>
30	Male	21	Yes	Toenails	+	<i>T. rubrum</i>
31	Female	2	No	Toenails	+	<i>T. rubrum</i>
32	Female	12	No	Skin	+	<i>T. mentagrophytes</i>
33	Female	3	No	Skin	+	<i>T. violaceum</i>
34	Male	21	Yes	Toenails	+	<i>T. rubrum</i>
35	Male	10	No	Hand nails	+	<i>T. rubrum</i>
36	Male	15	No	Hair scalp	+	<i>M. canis</i>
37	Male	12	No	Hair scalp	+	<i>M. canis</i>
38	Male	5	No	Hair scalp	+	<i>M. canis</i>
39	Female	58	No	Toenails	+	<i>T. rubrum</i>

40	Male	3	No	Hand nails	+	<i>T. rubrum</i>
41	Male	57	No	Toenails	+	<i>M. canis</i>
42	Female	8	No	Hair scalp	+	<i>M. canis</i>
43	Female	7	No	Hair scalp	+	<i>M. canis</i>
44	Male	57	No	Toenails	-	<i>T. rubrum</i>

Table 2. Details of the candidiasis cases in this study.

Patient	Age	Gender	Sample type	Microscopic observation	AUXACOLOR results	Hospitalization ward/outpatient
1	Adult	Female	Sputum	+	<i>C. tropicalis</i>	Public hospital
2	Adult	Male	Dialysis fluid	+	<i>C. albicans</i>	Nephrology ward
3	Adult	Female	Hand nails	+	<i>C. lusitaniae</i>	Out patient
4	Adult	Male	Dialysis fluid	-	<i>C. albicans</i>	Nephrology ward
5	Adult	Female	Hand nails	-	<i>C. parapsilosis</i>	Out patient
6	Baby	Female	Hand nails	+	<i>C. albicans</i>	Out patient
7	Adult	Male	Urine	+	<i>Candida</i> sp.	Out patient
8	Adult	Male	Sputum	-	<i>C. dubliniensis</i>	Hematology ward
9	Adult	Male	Tongue	+	<i>C. albicans</i>	Public hospital
10	Adult	Female	Hand nails	+	<i>C. parapsilosis</i>	Out patient
11	Adult	Female	Hand nails	+	<i>C. tropicalis</i>	Out patient
12	Adult	Male	Dialysis fluid	+	<i>C. albicans</i>	Nephrology ward

Figure 1.

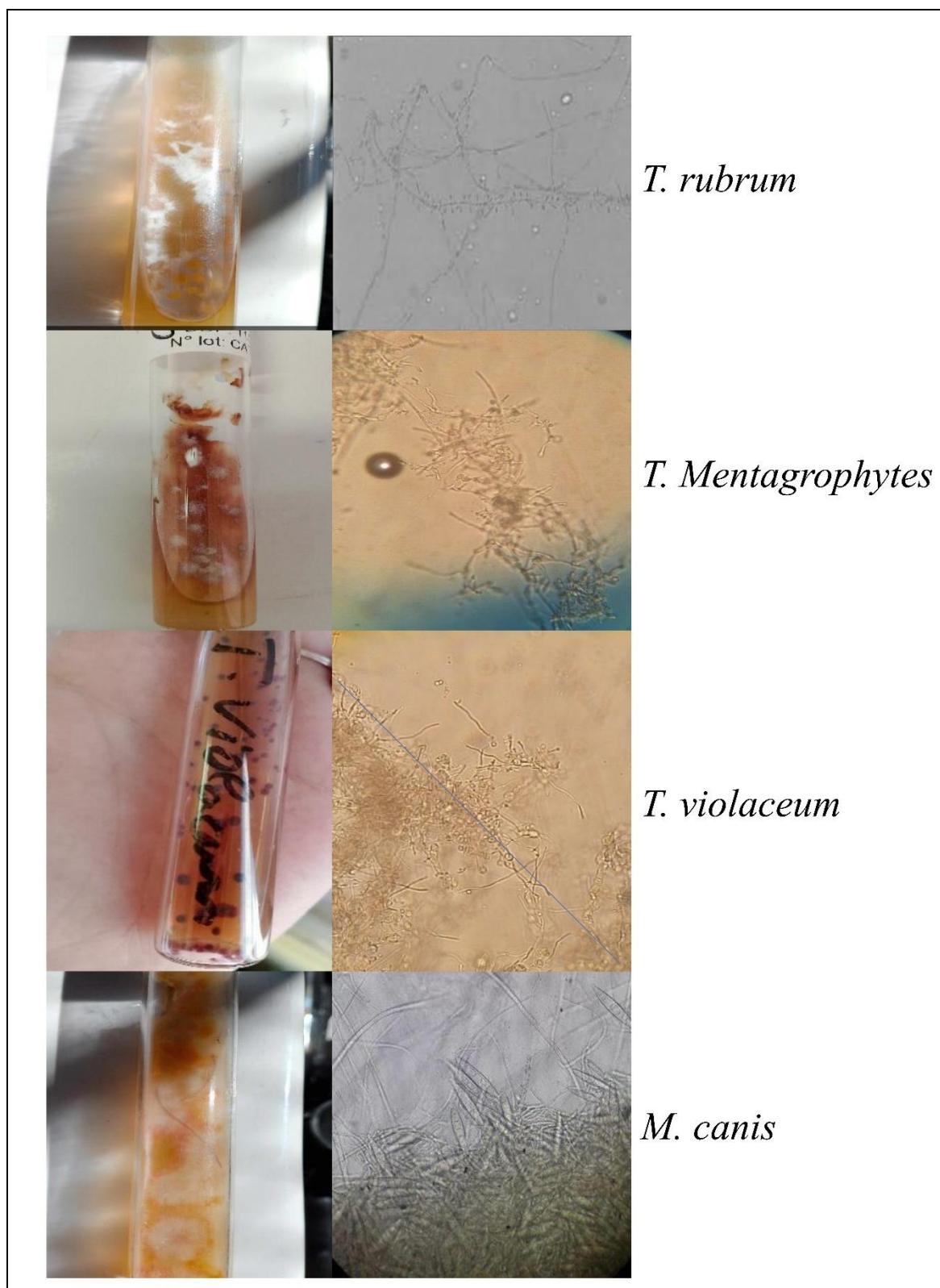


Figure 2.

