

KERATINOPHILIC FUNGI IN SOILS OF CORRIENTES CITY (ARGENTINA)

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Palabras clave: Hongos queratinofílicos, suelos.

Key words: Keratinophilic fungi, soils.

SUMMARY

Keratinophilic fungi present in 116 soil samples from Corrientes city (Northeast Argentina) were isolated by Vanbreuseghem method.

Keratinophilic fungi were isolated from all samples (100% of positivity) belonging to the genera Trichophyton, Penicillium, Microsporum, Chrysosporium, Ctenomyces and Drechslera. In a few cases there was only one isolation, but mostly there was an association between 2, 3 or 4 different genera, present in the same sample. Microsporum was present only in 19,8% of the samples, a value considerably lesser than previous reports for other cities of Argentina. Most of the soil samples were alkaline (mean pH = 7.94), sandy and with the high contents of phosphorus.

Physical-chemical analysis of soils were also made evaluating pH, texture, phosphorus, nitrates and organic compound contents.

The results obtained showed that soils of Corrientes city are particularly adequate for the survival and development of keratinophilic fungi.

INTRODUCTION

The knowledge accumulated in the last years on the biological cycles of a great number of fungal species, as well as the information obtained

RESUMEN

[Hongos Queratinofílicos en suelos de la ciudad de Corrientes (Argentina)]

Se analizaron mediante la técnica del anzuelo, 116 muestras de suelos de la ciudad de Corrientes (Argentina), para aislar hongos queratinofílicos.

Los cultivos mostraron la presencia de estos en el 100% de las muestras, correspondiendo en orden decreciente a los géneros Trichophyton, Penicillium, Microsporum, Chrysosporium, Ctenomyces y Drechslera. En algunos casos hubo aislamientos únicos pero en la mayoría fueron asociaciones de 2, 3 y hasta 4 géneros.

Se realizó también el análisis físico-químico de los suelos, determinándose pH, contenido de fósforo asimilable, nitratos, textura y materia orgánica.

Los suelos fueron mayoritariamente alcalinos, todos arenosos y con buen contenido de fósforo asimilable.

Los resultados obtenidos revelan la existencia de condiciones particularmente favorables para el desarrollo de hongos queratinofílicos en los suelos de la ciudad de Corrientes.

through numerous surveys carried out on soils from different geographic areas with varied climatic conditions, had made possible to assert that soil is the main source of causing agents for superficial, systemic or opportunistic human infections.

Fungi use for growing a variety of substrates which may be organic, inorganic or even particular substances like keratin. Among the numerous pathogenic organisms present in soil samples keratinophilic fungi have been the most frequently found, probably due to its ability to grow in an ample variety of soils (7, 1, 10, 18, 21), but the distribution of species seems to depend on humus contents (5).

Pathologies produced by keratinophilic fungi, like *Tinea capitis* or *Tinea corporis* may be transferred from man to man by direct or indirect contacts, from animal to animal, from animal to humans and viceversa but also soils have to be considered as an important source of infection (4).

The present work reports on the results of a survey taken in Corrientes city (Northeast Argentina) in order to determine the prevalence of keratinophilic fungi in soils samples, comparing them with previous reports of other Argentine cities. We particularly analyze formerly obtained results for Resistencia (Chaco province) a city located only 16 km from Corrientes, with similar climatic conditions, but separated by a great ecological barrier, the Paraná River.

MATERIAL AND METHODS:

■ Collection of soil samples:

Samples were taken in each selected area from places most frequented by inhabitants and pets, in order to improve the possibilities for isolation of keratinophilic fungi. As it is known, they do not limit to zoophilic, antropophilic or geophilic cycles but establish a triangular movement between substrates.

On the basis of a municipal map the city was divided in 60 areas of 1 sq.km each. Places more frequently visited by inhabitants like parks, shopping centers, etc., were defined on it and later 2 samples were taken from each place, one in summer and one in winter. A total of 116 soil samples were taken because 4 winter samples had to be discarded.

After eliminating the superficial layer (about 5 mm) 500 gr. of soil were collected with a sterile spoon and kept in sterile paper envelopes.

■ Isolations of keratinophilic fungi:

Isolations of keratinophilic fungi were made according to the Vanbreuseghem method (16), employing autoclaved fragments of horse hair as hooks and incubated for 45 days at 25°C.

■ Cultures:

Macro and micromorphological analysis of fungi recovered with the hook were made after 15, 30 and 45 days of incubation at room temperature. Isolated fungi were then cultured at 28°C during 15 days on the following media: Sabouraud dextrose agar, Sabouraud-dextrose agar with 2% of rifamycin (as sodium salt), Mycobiotic agar and potato agar media.

■ Physical-chemical analysis of the soil:

- pH measure: was made by the colorimetric method using Bromothymol blue and phenolphthalein as indicators
- Phosphorus content: measured by modified Osmond method (2) recording results as Deficient (100 to 140 p.p.m.), Poor (170 to 200 p.p.m.), Medium (220 to 380 p.p.m.) and Rich (over 420 p.p.m.).
- Nitrates content: measured by Brody method (3,9).
- Organic compound content: measured by the Zafanella-Sabella technique (20).
- Texture: determined by Zafanella's method (9).

RESULTS

The results obtained are presented in Table 2 and 3 according to the season when samples were collected.

Keratinophilic fungi were isolated from 100% of samples collected in winter. In 24/56 samples only one genus was isolated (*Penicillium* in 7 and *Trichophyton* in 17), but associations between two or three different genera were found in other 32 samples. Keratinophilic fungi were also found in all

summer soil samples. In 26 of them only one genus was present (*Penicillium* in 1 and *Trichophyton* in 25) while associations between 2, 3 or 4 were present in the other 34 samples.

The physical-chemical soil analysis in which dermatophytes were isolated showed a predominance of alkaline pH (mean 7.94), with good contents of phosphorus, all of sandy texture, while contents of nitrates as well as organic compounds were varied.

DISCUSSION

Human infective forms of fungi are always present in soil, where they may maintain its pathogenical potential for long periods of time since it is its natural habitat (19).

The prevalence of superficial mycoses in the Northeast region of Argentina has been historically high. For this reason it was considered of interest to find out the isolation frequency of keratinophilic soil fungi in that area, and compares on it with similar reports from other geographic regions, to determine whether soil is a significant source of infection or just a simple reservoir from which human infections may be acquired depending on particular circumstances.

A prior survey taken in Resistencia (Argentina) showed the presence of keratinophilic fungi in 83 % of soil samples (11), which is a value very similar to ours. Though climatic conditions, as well as physical-chemical characteristics of soils are similar for both cities, there were differences in the species isolated and in its frequencies. We found

Microsporum gypseum complex in 23 soil samples (19,8%) which is the lowest value reported so far for our country. Previous informs indicated isolation rates of 65.27% for Córdoba (387 soil samples) (15), 84 % for Tucumán (75 samples) (17), 89 % in 100 samples of La Plata (8), 62 % for Santa Fe (12) and 24 % in 60 soil samples of Resistencia (11). In many of these reports the sexual form of *M. gypseum* (*Nannizzia gypsea* = *Arthroderma gypsea*) was found, but not in our case. *Trichophyton terrestre* complex or its teleomorph *A. quadrifidum*, was isolated in 82,14 % of winter samples and in 96.76% of summer samples. This value is coincident with former findings on the easy development of this fungus in soils of mild climate regions.

Physical-chemical analysis of soil samples from which keratinophilic fungi could be isolated revealed correlation with alkalinity (mean pH: 7.94) and sandy texture. Other soil components showed varied values without correlation with presence or absence of this fungi.

The type of keratin present in certain habitats may incide on qualitative and quantitative results obtained from soil surveys (6). In order to digest this insoluble scleroprotein, fungi have to develop an active alkalization of substrates and perhaps for this reason isolation of keratinophilic organisms may be facilitated in alkaline soil samples. This behaviour may have partially influenced the high isolation rates found by us, but any way, we can affirm that Corrientes city soils present particularly favourable conditions for survival and development of this fungi.

Table 1

Geographic and climatic characteristics of Corrientes and Resistencia cities (Argentina)

	CORRIENTES	RESISTENCIA
Latitude	27° 28' S	27° 20' S
Longitude	58° 49' W	58° 59' W
Height on sea level	60 m.	51 m.
Mean annual temp	21,7° C	20,9° C
Highest temp	42,4° C	41,2° C
Lowest temp	1,1° C	1,9° C
Mean dampness	72%	73%
Mean annual rainfall	1236.7 mm	1349 mm

Table 2

Keratinophilic fungi isolated from soil samples of Corrientes city (Argentina)

GENERA AND SPECIES	WINTER		SUMMER	
	RATE	%	RATE	%
Trichophyton terrestre				
Durie & D. Frey complex	46/56	82,14	58/60	96,66
Penicillium spp	24/56	42,85	2/60	3,33
Microsporium gypseum (Bodin) Guiart &				
Grigorakis complex	13/56	23,21	10/60	16,66
Chrysosporium spp	8/56	14,28	19/60	31,66
Ctenomyces serratus. Eidam	1/56	1,78	3/60	5,00
Drechslera spp	2/56	3,57	0/60	0,00

Table 3

Genera association of keratinophilic soil fungi isolated from Corrientes city (Argentina)

GENERA ASSOCIATION	WINTER		SUMMER	
	RATE	%	RATE	%
Trich-Chrys	3/56	5,36	9/60	15,00
Trich-Micr	7/56	12,50	3/60	5,00
Trich-Pen	12/56	21,43	10/60	16,66
Trich-Drechs	1/56	1,78	0/60	0,00
Micr-Pen	1/56	1,78	0/60	0,00
Trich-Chrys-Micr	2/56	3,57	1/60	1,66
Trich-Chrys-Pen	1/56	1,78	4/60	6,66
Trich-Micr-Pen	1/56	1,78	2/60	3,33
Trich-Pen-Drechs	1/56	1,78	0/60	0,00
Chrys-Micr-Cte	1/56	1,78	0/60	0,00
Chrys-Micr-Pen	1/56	1,78	0/60	0,00
Trich-Chrys-Micr-Cte	0/56	0,00	2/60	3,33
Trich-Chrys-Pen-Cte	0/56	0,00	1/60	1,66
Trich-Chrys-Micr-Pen	0/56	0,00	2/60	3,33

Trich = Trichophyton
Chrys = Chrysosporium

Pen = Penicillium
Cte = Ctenomyces

Micr = Microsporium
Drechs = Drechslera

REFERENCES

- BATELLI G. (1987). Survey of keratinophilic fungi in alpine burrows soils. *Sabouraudia* 16: 83-86.
- BRANDI R.J., DE PETRI A. (1976). Determinación rápida de fósforo en suelos, por métodos colorimétricos. *Técnicas Cát. de Conservación y manejo de los suelos.* Facultad de Agronomía y Veterinaria. Univ. Nac. del Nordeste. Corrientes (Argentina).
- BROY L. (1945). Nitrate test for soil and plant tissues. *Soil Science* 60: 219-222.
- CARRILLO L. (1973). Identificación de algunos dermatofitos aislados de suelos y estudio de la acción proteolítica. *Bioq. Clínica*, VII (2): 167-170

5. CHMEL L., VLASILIKOVA A., HRASKO J. (1972). The influence of some ecological factors on keratinophilic fungi in the soil. *Sabouraudia* 10 :26-34.
6. DIAZ M.C., SALAMANCA L., PIONTELLI E. (1984). Dermatofitosis: Un problema del pasado, un desafío del presente. *Adel. Microbiol. Enf. Infec.* Vol.3, pág. 212. Editor C. Coto, Bs. Aires.
7. FISHMAN O.- RAMOS C. (1967). Geophylic dermatophytes recovered from Rio Grande do Sul soil. *Mycoph. Mycol. Applied* 33 (2) :157-160.
8. IOVANTTI C. A., MALLIARCHUK O., CASANOVA A., DAWSON M. (1985). Estudio micológico de muestras de tierra de la ciudad de La Plata. *Rev. Arg. Micología* 8 (1) :9-11.
9. JACKSON M.L. (1964). Análisis químico del suelo. Ed. Omega. Bs.As.
10. MERCATINI R., MARBELLA R. (1980). Isolation of dermatophytes and correlated species from the soil of public gardens and parks in Rome. *Sabouraudia* 18 :123-128.
11. MONACCI M., PONS L., BAKOS E. (1979). Búsqueda de dermatofitos geófilos en la ciudad de Resistencia. *Abst. IX Jorn. Arg. Micol. Resistencia (Chaco-Argentina)*.
12. ODETTI L., ZICRE M.A., SARSOTTI P. (1982). Hongos queratófilos aislados de muestras de tierra de la ciudad de Santa Fe (Arg.). *Rev. Soc. Bioq. Santa Fe.* 2:21-24.
13. OTCENACEK M. (1977). Ecology of dermatophytes. *Mycopathology* 65 167-72.
14. PEREIRA MACHADO O., (1985). Ocurrencia de dermatofitos en micosis oportunistas de las uñas. *Rev. Arg. de Micología* 8 (2):17-20.
15. QUIROGA R.L. (1977). Micoflora de suelo de la ciudad de Córdoba y sus alrededores. VII Jorn. Arg. Micol. y I Congreso Arg. Micol. Córdoba.
16. VANBREUSEGHEM R. (1952). Technique biologique pour l'isolement des dermatophytes du sol. *Soc. Bel. Med. Trop.* 30 :173-179.
17. VAN. GELDEREN DE KOMAID A., ELIAS F. (1978). Presencia de dermatofitos en suelos de escuelas de la Prov. de Tucumán. *Rev. Lat. Amer. Microbiol.* 20 :95-98.
18. VOLZ P.A. (1971). A preliminary study of keratinophilic fungi from Abaco Island (The Bahamas) *Mycopath. Mycol. Applied* 43 : 337-339.
19. WRIGHT J.E. (1973). El suelo: fuente de hongos potencialmente patógenos. *Bioq. Clinic VII* (1) :75-80.
20. ZAFANELLA M., SABELLA J.L. (1951). Determinación colorimétrica rápida del carbono orgánico del suelo. *Ciencia e Investigación* 7 :419-423, Sept.
21. ZAROR L. (1972). Dermatofitos en suelos de Chile *Bol. Inst. Dermatol. Chile* 14 :31-35.