

Keratinophilic fungi in the soil of Szczecin

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In the course of the last fifteen years, very extensive studies on keratinophilic and keratinolytic fungi inhabiting the soil have been initiated. Some of these fungi were classified as dermatophytes due to their considerable morphological similarity and ability to digest keratin (Vanbreuseghem 1963).

The popularity of the studies increased owing to the hairbait method, suggested by the Belgian mycologist Vanbreuseghem and simple in its conception. The method enabled him in 1952 to isolate a new species of fungus, namely: *Keratinomyces ajelloi*.

In our previous papers (Prochacki, Biełuńska 1961—1964) we presented our own observations dealing with keratinophilic fungi, encountered in the Szczecin soil, their developmental cycles as well as the microflora and microfauna influences on the biocoenosis of these organisms.

In our present work we have tried to find whether are what is called geophilic dermatophytes develop in symbiosis with definite plants or if they play some other role in nature.

MATERIAL AND METHOD

Soil samples, taken from the superficial layer, were studied in Petri dishes, 8 cm in diameter and 1—1.5 cm high. The soil was wetted with sterile water. Woman's hair, sterilized and cut into small sections, was placed on the surface of the dishes and incubated at room-temperature (20—24° C).

After the lapse of 2—3 weeks and following the appearance of mycelium on the hair — the hair bits were cultured on Sabouraud's

Table 1
Appearance of keratinophilic fungi in the soils of Szczecin

Origin of soil samples	Number of dishes	Number of strains			
		<i>K. ajelloi</i>	<i>M. gypseum</i>	<i>T. terrestre</i>	<i>M. cookei</i>
hospital garden, I position	50	24	2	—	—
hotbeds (tomatoes)	10	8	—	—	—
field (lettuce)	10	4	—	—	—
hotbeds (begonias)	10	3	1	—	—
field (tulips)	10	4	—	—	—
glasshouse (asparagus)	10	1	7	—	—
" (ferns)	10	—	—	2	1
" (tomatoes)	10	2	2	1	—
from under an oak tree	10	2	—	—	1
" " a birch tree	10	4	—	—	—
" " a fir tree	10	—	—	—	—
front and back gardens	10	5	—	7	2
yard	10	4	—	—	2
yard	10	3	—	—	—
hospital garden, II position	50	26	—	—	—
total	230	90	12	10	6

media supplemented with acti-dione and other antibiotics according to Georg, Ajello, Papageorge (1954).

In all, 230 samples (dishes) of soil were obtained from various points within the boundaries of Szczecin and some other regional towns of our district.

RESULTS

As seen from the enclosed Table, 110 strains of *Keratinomyces ajelloi* (Vanbreuseghem 1952), 12 strains of *Microsporium gypseum* (Bodin 1907), 10 strains of *Trichophyton terrestre* (Durie, Frey 1957) and 6 strains of *Microsporium cookei* (Ajello 1959) were isolated from the 230 samples of the soil. The fungus isolated most frequently

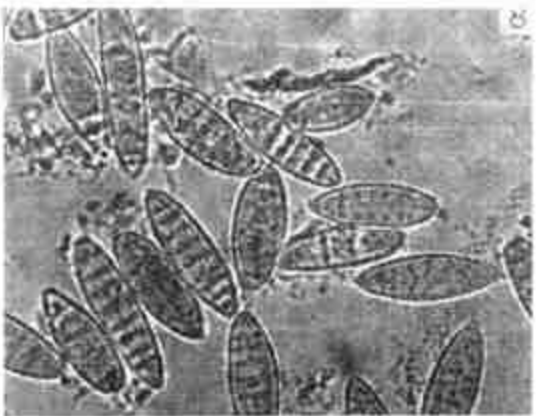
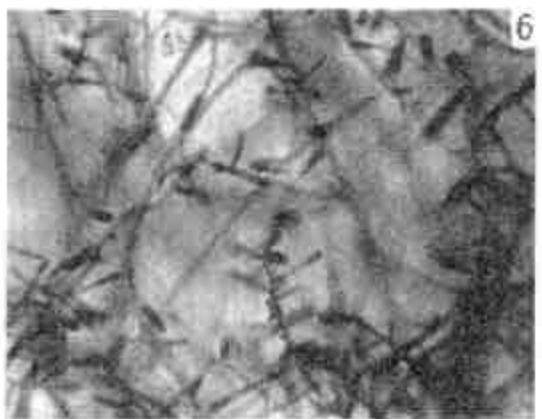
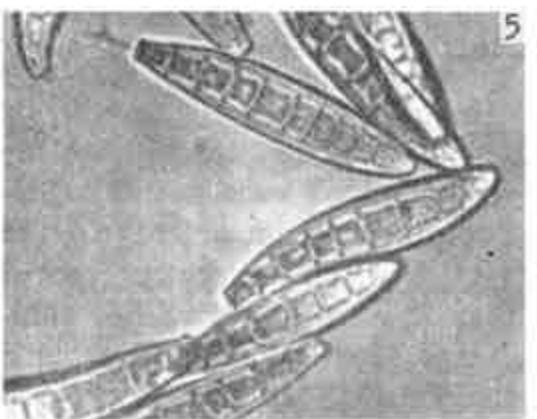
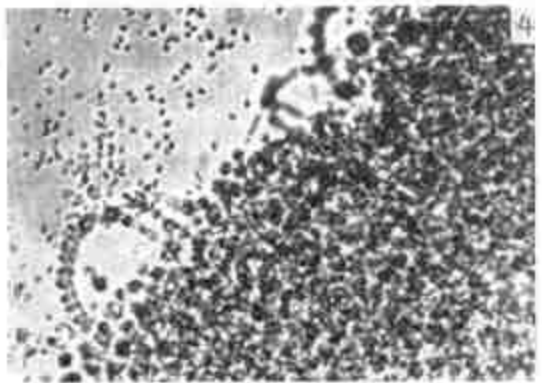
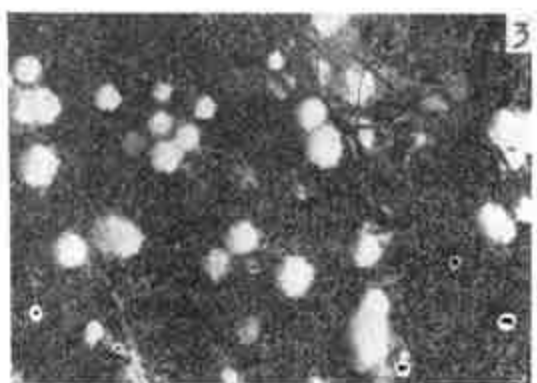
Photo. 1. Soil plate, hair filaments covered with mycelium

Photo. 2. Appearance of macroconidium of *Keratinomyces ajelloi*, on hair filament

Photo. 3. Macroscopic picture of cleistothecia of *Arthroderma uncinatum* on soil plate

Photo. 4. Microscopic picture of fragment of cleistothecia of *Arthroderma uncinatum*

Photos 5, 6, 7, 8. Microscopic picture of cultures of *Keratinomyces ajelloi*, (5), *Trichophyton terrestre*, (6), *Microsporium gypseum* (7), and *M. cookei* (8).



was *Keratinomyces ajelloi*, revealed in human dwellings in a hospital area, it was further found in hotbeds and soil taken from glasshouses. *Microsporum gypseum* was isolated in soil from a glasshouse, located in the hospital garden, and from hotbeds. *Trichophyton terrestre* was isolated from the soil of a glasshouse and from the front and back gardens. *Microsporum cookei* was isolated from soil supplied from a glasshouse, front garden and yard. We failed to isolate any keratinophilic fungi from soil taken from under a fir tree growing in a park.

We also observed spontaneous appearance of cleistothecia of *Arthroderma uncinatum* and *A. quadrifidum* (Dawson, Gentles 1961).

Besides, in many soil samples microscopic examination revealed the presence of various keratinophilic fungi on hair, e.g. *Sepedonium* sp., *Monosporium* sp., *Penicillium* sp., *Aspergillus* sp. and *Fusarium* sp. When the bits of hair had been inoculated from the Petri dishes on to Sabouraud's medium with antibiotics, only selected fungi classified as geophilic dermatophytes, were found to grow.

DISCUSSION

In our present studies *Keratinomyces ajelloi* was the most frequently isolated fungus. It was encountered in all kinds of soil samples except that within the range of the crown of a fir tree.

It seems that the exceptionally common appearance of *Keratinomyces ajelloi* in the soil is associated with the processes of putrefaction taking place in the soil, which influence the alkaline reaction of the soil. This is also supported by the investigations of some authors (Rozdziejewicz 1963). *Keratinomyces ajelloi* plays an important part in the digestion of animal keratin. In spite of these biochemical properties it was not established with certainty that *Keratinomyces ajelloi* exhibits pathogenic properties towards humans and animals. Symbiotic fungi are found to be prevalent in woodland soils, it is, therefore, possible that *Keratinomyces ajelloi* may have no appropriate existence conditions there.

Soil taken from the gardens in Szczecin seems to be rich in keratinolytic fungi.

It appears from the results obtained that geophilic dermatophytes do not live in symbiosis with individual plants, but they are likely to play an important role in the digestion of keratin found in the soil.

REFERENCES

- Ajello L., 1959, A new microsporium and its occurrence in soil and on animals, *Mycologia* 51: 69—76.
- Bodin E., 1907, Sur un nouveau champignon du favus (*Achorion gypseum*), *Ann. dermat. syph.* 8: 585—602.
- Dawson C. O., Gentles J. C., 1961, The perfect states of *Keratinomyces ajelloi* Vanbreuseghem, *Trichophyton terrestre* Durie, Frey and *Microsporium nanum* Feuntes, *Sabouraudia* 50: 49, 224.
- Durie E. B., Frey D., 1957, A new species of *Trichophyton* from New South Wales, *Mycologia* 49: 401.
- Georg L. K., Ajello L., Papageorge C., 1954, Use of cycloheximide in the selective isolation of fungi pathogenic to man, *Journ. Lab. Clin. Med.* 55: 422.
- Prochacki H., Biełuńska S., 1961, Badania nad grzybami keratynolitycznymi i keratynofilnymi bytującymi w ziemi. Księga Pamiątkowa Zjazdu Medycyny Wiejskiej w Lublinie, s. 113.
- Prochacki H., Biełuńska S., 1962, The incidence of *Microsporium cookei* in Poland, *Mycopathologia* 17: 351—355.
- Prochacki H., Biełuńska S., 1963, Incidence of dermatophytes in soil, *Acta Microbiol.* 12: 143—150.
- Prochacki H., Biełuńska S., 1963, Badania nad wyizolowaniem z ziemi dermatofitem *Keratinomyces ajelloi* (Vanbreuseghem 1952), *Przegl. Dermat.* 5: 391—398.
- Prochacki H., Biełuńska S., 1963, Investigations sur le cycle de développement des champignons keratinophiles dans le sol, *Proc. Inter. Symp. Med. Mycology, Warszawa*, s. 59—63.
- Vanbreuseghem R., 1952, Intérêt théorique et pratique d'un nouveau dermatophyte isolé du sol, *K. ajelloi* gen. sp. nov. *Bull. Acad. royal Belgique, Classe de Sc.*, 5: 1068.
- Vanbreuseghem R., 1963, La vie saprophytique des dermatophytes *Proc. Inter. Symp. Med. Mycology Warszawa*, s. 27—34.

Keratonofilne grzyby w glebie miasta Szczecina

Streszczenie

Autorzy przebadali 230 próbek ziemi z regionu Szczecina. Wyizolowali 138 szczepów grzybów zaliczanych do grupy dermatofitów geofilnych. Na podstawie wyników przypuszczają, że nie żyją one w symbiozie z roślinami. Dermatofity geofilne występowały obficie w próbkach gleb pobieranych z ogródków.