INVESTIGATION OF KERATINOPHILIC FUNGI FROM SOILS IN WESTERN AUSTRALIA
A PRELIMINARY SURVEY

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Abstract

In order to determine which species of geophilic dermatophytes were present in Western Australian soils 299 samples were investigated. These samples were collected from a range of locations, 208 from towns throughout the state and 91 samples from the Perth Metropolitan area.

Most samples were collected from areas frequented by people and animals, such as home gardens, parks and animal yards.

Of the total 299 soils, 271 (90.6 %) yielded keratinophilic fungi. A total of 181 dermatophytes were isolated, and there were 205 isolations of other keratinophilic fungi.

Microsporum gypseum (30.7 %) was the most prevalent dermatophyte recovered from soil followed by Microsporum cookei (21.7 %) and then Trichophyton ajelloi (8.0 %). No other dermatophytes were recovered. Chrysosporium indicum was the most common of all the keratinophilic fungi and was isolated from 50.1 % of the samples. Mixed growth was obtained from 33.5 % of the soil samples.

Introduction

Keratinophilic fungi living in soil serve to break down any keratin containing wastes such as skin, hair, fur and feathers. These fungi therefore have a role in the breakdown of soil debris. Some keratinophilic fungi by way of this property are potentially pathogenic to man and animals and are known as dermatophytes; those found living in soil are termed geophilic dermatophytes.

In 1894 Sabouraud (23) made the suggestion that the dermatophytes may be soil saprophytes. However it was not until Vanbreuseghem (24), described a hair baiting technique for recovering these fungi from soil that mycologists in many parts of the world were able to investigate their soils in order to recover these fungi.

The only dermatophyte isolated consistently from the soil of different countries is Microsporum gypseum. Of the other keratinophilic fungi isolated frequently from soil Trichophyton ajelloi Georg et al. (15) and Presbury and Young (22) and Microsporum cookei Mariat and Tapia (16) and Frey (13), have only on very rare occasions been reported as the cause of infection. Ajello (2) suggested two possibilities for failure to isolate the common dermatophyte fungi from soil. ‘Either these fungi have become so specialized in their growth requirements that they can survive and maintain themselves only on living animal hosts; or suitable techniques are lacking with which to detect and isolate them from their environment.’ Whatever the reason for this failure there is still no proof that soil does actually provide an alternative habitat for the important pathogenic dermatophytes. Any reports of recovering these dermatophytes from soil seem to be chance isolations and do not afford proof of a constant infection source.

Surveys of soils in different parts of Australia show somewhat different patterns in the occurrence of keratinophilic fungi. Durie and Frey (12), examined soil samples from each Australian state including 48 samples from Western Australia. Their W.A. soils yielded few keratinophilic fungi; one isolate of M. gypseum, two of T. ajelloi, two of T. terrestrre, two Trichophyton species and two Chrysosporium species. They isolated much the same species from each state and no M. cookei was recovered. The overall incidence of M. gypseum was 10.4 %, which is low compared with recovery rate in this W.A. survey (30.7 %). T. ajelloi on the other hand had a similar recovery rate in W.A. (21.7 %).
rate, 9.4% in their survey and 8.0% on this W.A. survey. They isolated T. terrestre from 2 samples of W.A. soil but although it was expressly looked for in this present survey it was not recovered. Donald and Brown (10), in South Australia recovered only M. gypseum and T. ajelloi. Dunne and Morahan (11), isolated a greater variety of species including M. cookei and their highest yield was of Chrysosporium species (102 isolates).

This present survey was undertaken as a preliminary investigation of the geophilic dermatophyte and other keratinophilic fungi in Western Australian soil, and to investigate this soil as a possible natural habitat for the pathogenic keratinophilic fungi. Because many authors have found that different soil conditions influence the distribution of keratinophilic fungi, some of these factors have also been examined. Individual biotypes are thought to play a part, and inhabited areas such as home gardens are usually considered a rich source of these fungi. Among the environmental factors thought to be important are the presence of organic matter, and the pH, temperature and moisture content of the soil.

Western Australia covers an area of 2,525,500 sq. kilometers and includes a range of climatic and soil types as can be seen in fig. 1. Much of the state is hot and dry, there are no high mountain ranges and no areas with winter snow. The soils generally have a small organic content mainly because large areas have sparse vegetation and all of the endemic trees and shrubs are evergreen. Even our best soils are low in organic matter when compared with Northern Hemisphere soils. Many areas of the state from Perth northwards, have maximum summer temperatures of 40 °C or more, and surface soil temperatures would be at least 10 °C above this temperature for great lengths of time in exposed areas. Mean highest solar radiation over 63 years for Perth in January is 62 °C, and the highest on record for Perth is 76 °C.

Information on surface soil temperatures for most of Western Australia is not available. However, in a study at Bakers Hill (72 kilometers east of Perth), on soil which was without any type of plant cover; when the air temperature was 40 °C the surface temperature of the soil reached 64 °C; and at a depth of 2 cm. it was 51 °C, (GB. Taylor, C.S.I.R.O., Perth, personal communication). Factors which significantly lower soil temperature are high moisture content and even a light vegetation cover. Soil colour and mineral composition also affect temperature.

Materials and methods

A total of 299 soil samples were collected mainly during the winter months of July and August from the 31 areas in the state of Western Australia depicted in figure 2. W.A. is divided into two almost equal halves, a northern half which is wetter in summer and a southern half which is wetter in winter (see figure 1); areas north of this dividing line were therefore sampled during their dry season. The twenty eight locations selected in different suburbs of the Perth area, (shown in figure 3), were chosen to give a representative sample of different parts of the metropolitan area. The towns selected throughout Western Australia were generally those where we have a branch laboratory so that the laboratory staff could collect the soil samples.