

AN EIGHT-YEAR SURVEY OF THE RINGWORM FLORA OF BIRMINGHAM

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(With 5 Figures in the Text)

PREAMBLE

To be statistically valid, a survey of this kind should either be continued for about twenty years or should cover a very great area, to produce the high numbers from which generalizations, predictions, etc., can safely be made. So the following facts and figures should be regarded as a preliminary report on work that is still in progress, and any conclusions drawn from them as tentative. The main object of this survey is to ascertain the sources of infection, with a view to their ultimate eradication. To this end, detailed records of the cases passing through the laboratory have been kept. The survey is necessarily incomplete, because many cases that never come to our notice must occur, but a fair estimate of the distribution of species, their relative frequency and their topographical concentration should be deducible from our records.

Area

The city of Birmingham is defined as the area covered by the postal districts 1 to 34 inclusive. Out-patients invariably give their addresses in this form. Accordingly, the postal district has been adopted as a convenient unit of investigation in preference to the ward boundaries or the parliamentary constituencies, although no exact population statistics are available for the postal districts. In any case, it seems impossible to discover how many lodgers drift about the slums, in a city overcrowded with a migratory population of Irish, coloured and miscellaneous foreign work-people.

Nomenclature

The recommendations of the Medical Mycology Committee of the M.R.C. have been followed.

Technique

Specimens obtained by scraping, epilation, or both, are divided into two portions, one of which is examined in 20% KOH under the microscope and the other 'planted' on proof medium and incubated at 20° C. for as long as is necessary for identification or for at least a fortnight before being discarded as negative. Infected hairs are inspected under filtered ultra-violet light in another department and the result communicated to the laboratory. Special media are used where necessary to confirm the identification of the rarer species. At this point, I should like to thank Dr Duncan, Dr Jacqueline Walker and Dr Riddell, each of whom has confirmed one of my provisional identifications.

At the beginning of 1946 the standard American medium of Hodges (1928) was introduced in place of the pure maltose agar used here until then, with excellent

results. But in May of the same year it became necessary to find a British-made substitute for one of the ingredients. Oxoid mycological peptone proved suitable, and from June 1946 to the present time the all-British glucose proof medium (Carrier, 1948) has been in regular use.

DISCUSSION

One thousand and twenty cases of ringworm of the scalp, nails and glabrous skin from Birmingham, as defined, were seen in the laboratory between 1 January 1945 and 31 December 1952. In addition, 800 cases were referred from the neighbouring counties during the period under review. The patients comprised children and adults of all ages and of both sexes.

Species

The species identified are listed in Table 1, with their numerical and geographical distribution. Here the areas represented by Warwickshire, Worcestershire and Staffordshire comprise the whole of each county exclusive of those regions that fall within the Birmingham postal districts 1 to 34. Thus, Smethwick appears under Staffordshire.

Though the table is self-explanatory, a few points merit elucidation.

Eight per cent of all fungi in this table have been incompletely identified because the cultures have failed to grow for one main reason, viz. premedication, which effectively impairs the viability *in vitro* even of thick-walled chlamydo-spores. We seldom succeed in growing a fungus after treatment with iodine or, in recent years, with certain proprietary specifics that have come on the market. In the case of the unspecified *Microspora* from Warwickshire and Gloucestershire, the probability is that most of the infection was due to *Microsporium audouini*, but it is unsafe to make any such assumption, because nine cases of *M. canis* occurred in Cheltenham alone in 1946, and twenty-nine in the Warwickshire coalfield during the 3 years of the local epidemic. The fungi involved have therefore been listed as unspecified *Microspora*.

Another assumption that it would be unsafe to make from Table 1 is that no case of cattle ringworm occurred in Gloucestershire—a predominantly agricultural county—in the whole of the 8-year period. The fact that none were brought to our notice must surely indicate that such cases as occurred were treated elsewhere. The same probability applies to Shropshire and to some extent to the other Midland counties.

The main interest of the table lies in its clear indication of the wealth of the ringworm flora in Birmingham. Only one species has come to our attention from the Midlands, *Trichophyton persicolor*, from Staffordshire, which is not represented within the city.

Of the genera involved, the *Microspora* are by far the commonest, *Epidermophyton* being remarkably rare, much rarer, indeed, than the statistics published by Duncan (1946) would lead one to expect. (Fig. 1).

Microspora

There was a minor epidemic of *Microsporum audouini* in an orphanage at Handsworth in 1946, otherwise the outbreaks of this infection appear to be sporadic and to be brought under control before many contacts become involved, even in schools and places where children congregate. As regards the *Microspora* of animal origin, there is little evidence here to support Walker's suggestion that from 70 to 80% of cases are transmitted from child to child. With the exception of one proved case, each local outbreak has been confined to a maximum of six children living in the same house, all of whom have had access to the same infected pet. Cruikshank (1953) states that infection with this fungus can pass from one child to a succession of others, becoming attenuated in the process and dying out after four to six transfers. It can hardly be claimed that the local figures disprove this observation, though they certainly fail to substantiate it.

Perhaps the most striking feature of the *Microsporum* incidence is the decline in *M. audouini* and the simultaneous increase in *M. canis* over the 8-year period.

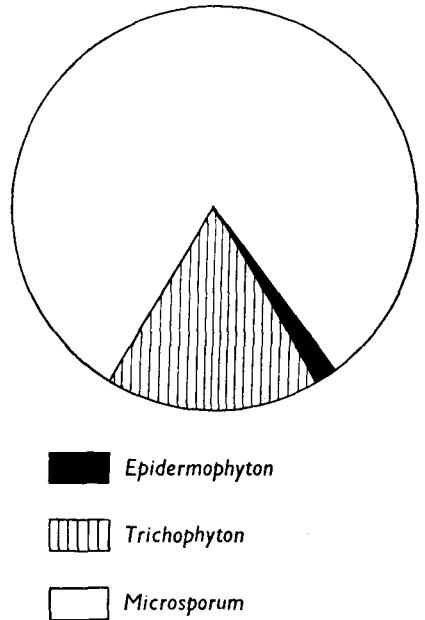


Fig. 1. Distribution of the three genera.

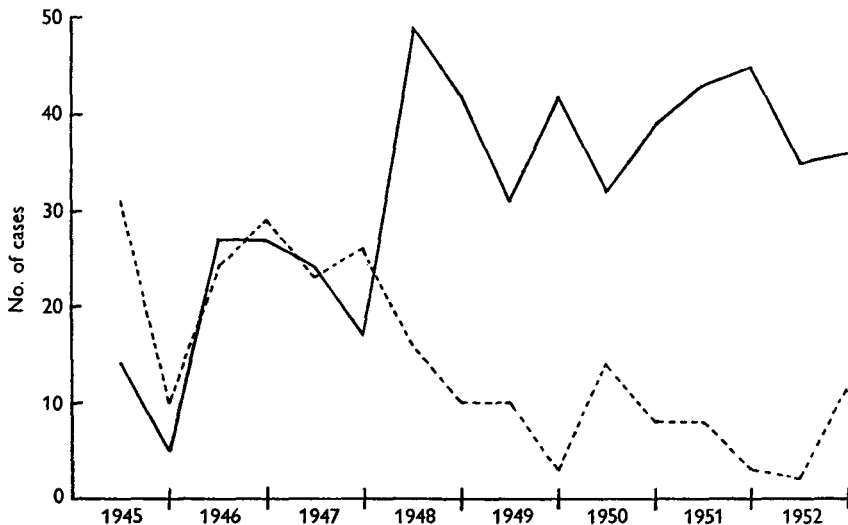


Fig. 2. Sporadic cases of small-spored ringworm (omitting, for clarity, the Handsworth orphanage outbreak of 1946), based on the 6-monthly figures, estimated on 30 June and 31 December in each year. The broken line represents *M. audouini* and the entire line *M. canis*.

M. canis is ubiquitous, Birmingham 2 and Birmingham 34 being the only regions from which no single case has been seen. The highest incidence is in the slum

districts, Birmingham 12 (40 cases), 11 (39 cases), 18 (36 cases) and 19 (30 cases). The suburb of Kings Heath, with a localized outbreak in 1948, has the next highest total incidence (25 cases), but no case has appeared from this district (Birmingham 14) since 1949.



Fig. 3. Seasonal fluctuation in the incidence of *M. canis*, at 6-monthly intervals, calculated on 31 March and 30 September.

Fig. 3 shows not only the well-known seasonal fluctuation in the incidence of *M. canis*, with a peak at the end of the winter and a trough in the late summer, but demonstrates a steady rise all through 1946 from September 1945 to March 1947. In the absence of any information about the incidence among cats and dogs, one can only hazard a guess that animals were poorly fed and out of condition at the end of the war and thus unusually liable to infection. However that may be, it seems clear that it was at this period that the fungus established its ascendancy.

Thirty of the specimens were of the citreous and two of the non-pigmented (*M. canis*, var. *album*) type, described by Walker (1950). The rest showed vigorous normal growth in culture.

M. gypseum is rare, a single case having occurred in a schoolgirl at South Yardley (Birmingham 25).

Trichophyta

T. mentagrophytes is the commonest *Trichophyton* in the city, where it is widely distributed in small numbers. The only district with more than nine cases is Kings Heath, with fifteen. It is frequently seen in the form of 'athlete's foot' and in lesions on the calves and shins, possibly caused by riding infected ponies. We have no evidence against any individual riding school. Lesions on the wrists and forearms, coupled with a history of the hand-milking of cattle known to be infected with ringworm, suggests that this fungus may be one of the causes of cattle ring-

worm in the Midlands. If this is so, some of the leg lesions in children may be due to climbing gates and fences against which infected animals have rubbed. In the absence of corroboration from a reliable veterinary source, this suggestion must be regarded as purely speculative.

Of the 121 isolates, 79 were of the *asteroides*, 37 of the *interdigitale* and 5 of the *niveum* types. The distribution of the *niveum* cases in central districts only and the evidence, if trustworthy, that we elicited in two of them tend to confirm Sabouraud's observation that this variety is of feline origin.

T. rubrum is surprisingly rare, in view of the large coloured population in Birmingham to-day. As the London incidence is very much higher, it would be interesting to know whether the bulk of the metropolitan cases comes from the area round the docks.

T. flavum is most prevalent in the outer suburbs, three cases having been recorded from Birmingham 29 near the Worcestershire boundary and only seven from central districts. This fungus is also found in Warwickshire, Worcestershire, Staffordshire and Salop, which indicates a local 'pocket' of infection. Sabouraud suspected *T. flavum* of animal origin, though he was unable to prove it. I incline to the same opinion because most of our specimens have come from farms and small-holdings, though there is no available local evidence as to what the animal host may be.

The origin of the isolated cases of *T. tonsurans* and *T. sabouraudi* remains a mystery. Of the latter, two cases have appeared in Staffordshire with a 5-year interval between them and one in Warwickshire that may or may not have some connexion with the second Staffordshire case. As these species are propagated by thick-walled chlamydospores, which may retain their vitality for years, for all that is known to the contrary, it is impossible to predict what cases are likely to arise and at what interval of time from this source.

The same is true of *T. sulphureum*, which recurs from time to time in Staffordshire. In the last year of the survey we have seen two cases, brothers, from a northern suburb where the city and county boundaries over-lap. No cases within the city were recorded before this.

Of the three cases of *T. violaceum*, one occurred on the scalp of a Polish child from a Russian concentration camp, one was traced to a parcel from the Far East handled by the patient's father, and was presumably transmitted by chlamydospores in the sacking in which the goods were packed and the third case proved to be untraceable. No specimen has been received since 1948.

T. discoides appears to be much rarer in the Midlands than in the south of England. This may be because country cases are treated locally and only the most persistent kerions find their way to the Skin Hospital, Birmingham. The urban incidence is low.

T. schoenleini. Four of the six Birmingham favus patients belong to a family of 'squatters' from the Hockley district. The Warwickshire case, a mild one of about 30 years' duration, came to light in an institution for mental defectives, and the Worcestershire case was found on admission to an orphanage.

Epidermophyton

Most of the *Epidermophyton* cases are confined to ex-Service personnel and their contacts.

CONCLUSIONS

Of the foregoing, the following species are common to animals and man :

	Cases
<i>Microsporium canis</i>	508
<i>M. gypseum</i>	1
<i>Trichophyton mentagrophytes</i>	121
<i>T. flavum</i>	20
<i>T. discoides</i>	7
Total	657

The annual incidence is as follows :

Year	<i>M. canis</i>	<i>M. gypseum</i>	<i>T. mentagrophytes</i>	<i>T. flavum</i>	<i>T. discoides</i>
1945	19	0	8	0	0
1946	53	1	14	1	0
1947	41	0	10	2	1
1948	91	0	19	2	1
1949	74	0	19	4	1
1950	71	0	14	3	2
1951	88	0	17	4	0
1952	71	0	20	4	2
Total	508	1	121	20	7

In view of the high incidence of *Microsporium canis*, it is obvious that of the animal hosts involved, by far the commonest are the small domestic pets, especially cats and dogs. Infected animals are rarely brought to the laboratory for inspection (though we have seen a couple of pedigree kittens) and the evidence available as to the probable animal contacts of human patients is often highly dubious, coming, as it does, from untrained and sometimes prejudiced sources. It is in this field that veterinary co-operation would be invaluable, not only in the interest of the animals concerned but in limiting the spread of infection to human contacts. If direct, well-informed evidence were forthcoming in a high instead of a low proportion of cases, effective control measures could be taken, perhaps without the merciless slaughter of pets that seems to go on at present.

Peculiar to man are the following species :

	Cases
<i>Microsporium audouini</i>	253
<i>Trichophyton rubrum</i>	6
<i>T. tonsurans</i>	1
<i>T. sabouraudi</i>	2
<i>T. sulphureum</i>	2
<i>T. violaceum</i>	3
<i>T. schoenleini</i>	6
<i>Epidermophyton floccosum</i>	14
Total	287

The annual incidence is shown in Table 1.

It is thus apparent that even in an industrial city the size of Birmingham there is a great preponderance of animal ringworm over that which is specific to man. The observed proportion is of the order of eleven to seven.

The results of the foregoing investigations are summarized in Table 2, which shows the numerical distribution of species over the city. An attempt has here been made to ascertain whether there are any recognizable ringworm districts and if so where they are. From the figures it is clear that postal districts 11 and 12, taken as a unit, far outnumber any other two districts of equivalent size, Balsall Heath providing the highest incidence within the area.

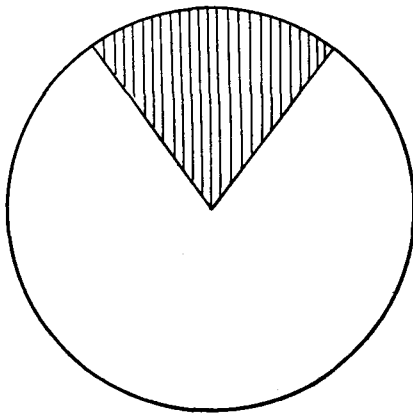


Fig. 4. Animal hosts.

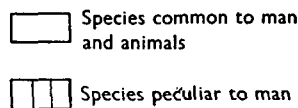
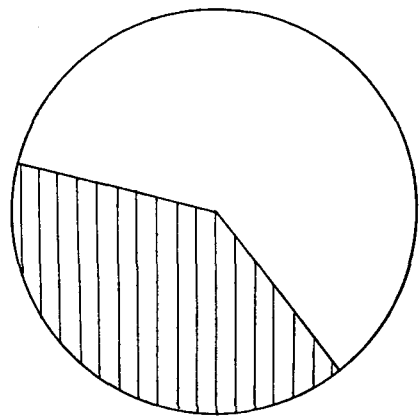


Fig. 5. Relative proportion of ringworm of animal and of human origin.

The stigma attaching to ringworm in the popular mind is not without foundation. This survey proves (what is tacitly assumed in any case) that it is in the slums and to a lesser extent in the slum-clearance areas that the disease flourishes, for it is here that the highest incidence and the richest flora are to be found. Ringworm is obviously a disease favoured by overcrowding and neglect, both of children and of domestic animals. It is favoured, too, by stupidity and ignorance, some of which ought to be remediable. The ancient theory that ringworm, along with lice and scabies, is spontaneously generated by dirty people dies hard. Even institutional staff seem ill-informed as to how to prevent the spread of infection from a newcomer to other residents. In this connexion, two concrete instances come to mind, in which I saw orderlies, one from an orphanage and one from a home for mental defectives, comb the hair of children who were negative to filtered ultra-violet light with the same comb that had been used for positive cases. Every child so treated was found to be positive a fortnight later. Both orderlies from these unconnected institutions declared that they had been given no instructions about spreading infection in this way and that they were issued with only one comb.

How widespread such practices may be must remain a matter of conjecture. It should surely be a simple matter to teach institutional personnel that ringworm fungi are propagated by spores, which are detachable and transmissible, and to furnish them with the essential tools of their trade.

Any discussion of the current theories of spore dissemination and of prophylactic measures, such as those reviewed by Sir Archibald Gray (1946), would be out of place in a survey of this nature. Suffice it to say that much distress to children and loss of school time could be averted if efficient preventive measures, including a cheap—or free—veterinary service, were adopted. Though there will always be a reservoir of infection among the thriftless, it would be greatly to the advantage of the child population to restrict this reservoir to the lowest attainable limit.

I should like to record my indebtedness to Dr Baylis Ash, Dr Avit Scott, Dr Cranston Walker, Dr Henly and Dr Hocken Robertson for referring so many interesting cases to this laboratory, to Prof. McKeown for valuable criticism, to Dr Hirst, Dr Dykierman and Mr Bertram Sealey for the loan of literature, to Sister Simpson and to the Misses G. Hyde, J. Shakespeare and M. A. Lardner, all three of whom have contributed no little labour toward this survey.

SUMMARY

An attempt has been made to establish the nature of the ringworm flora of Birmingham, comprising: (1) the species encountered; (2) their relative concentration; (3) their distribution.

A marked increase in the number of cases due to fungi of animal origin has been demonstrated.

It has been shown that the main reservoir of infection in the city is centred upon Sparkbrook and Balsall Heath, with a rather smaller focus in the Hockley–Lozells area.

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