

Dermatophytic Flora of *Tinea Capitis* of Eastern Anatolia

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The dermatophytic flora of *Tinea capitis* in Central and Western Anatolia have been studied by several authors;¹⁻⁴ however, no study has been made of this flora in Eastern Anatolia. The patients who come to our Out - Patient Clinic are not only from the city of Erzurum and her surrounding small towns, but also from nearby cities where there are no dermatology clinics, such as Kars, Ağrı, Artvin, Gümüşhane, Trabzon, Rize and Van. Patients even come to us from the neighbouring town of Muş, which does have a dermatology clinic. Therefore, the area included in this study comprises almost all of the Eastern part of Turkey. We feel that in this paper we have been able to complete the picture of the dermatophytic flora causing *Tinea capitis* in Turkey.

Materials and Methods

In this study, 380 cases with *Tinea capitis* were examined from September 27, 1966, to December 1, 1967. Specimens obtained from each patient were inoculated onto two Sabouraud dextrose agars with Mysteclin^R. One of the cultures was incubated at room temperature and the other in the incubator at 37°C. The identification of the dermatophytes was made by their cultural characteristics and by making culture mounds. **

Besides the identification of the causative organism, we also noted the following points : 1) the incidence of varying forms of *T. capitis* and their relationship to different fungi causing these forms; 2) geographical distribution; 3) id reaction and involvement of other parts of the body; 4) family incidence; 5) possible source of the disease and 6) sex, age distribution and duration of the disease.

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** The stock cultures obtained from Dr. L. Ajello⁵ were useful, particularly in the identification of *T. verrucosum*.

Results

Cultures were obtained in 333 out of the 380 cases of *T. capitis*. The rate of occurrence of anthropophilic dermatophytes was found to be somewhat higher than the zoophilic. The anthropophilic dermatophytes were 53.8 per cent (*T. schoenleini*, 43.5 per cent and *T. violaceum*, 10.3 per cent). The zoophilic dermatophytes were 43.8 per cent (*T. verrucosum*, 27.3 and *M. canis*, 16.5). *T. mentagrophytes*, which can be contracted from either animal or human sources, was only 2.5 per cent of the total. The number of cases in which various fungi were found can be seen in Table 1.

TABLE 1
CASES PRODUCED BY DIFFERENT FUNGI

Anthropophilic (No. of Cases)		Zoophilic (No. of Cases)		Other (No. of Cases)	
<i>T. schoenleini</i>	155	<i>T. verrucosum</i>	92	<i>T. mentagrophytes</i>	8
<i>T. violaceum</i>	24	<i>M. canis</i>	54		

From the 380 cases, the clinical form most commonly seen was favus (170 cases), closely followed by 130 cases of inflammatory *T. capitis* (kerion). There were only 80 cases of noninflammatory *T. capitis*.

The majority (155) of favus cases was caused by *T. violaceum*; the two cases of mixed infections were caused by *T. violaceum* plus *T. schoenleini*. The separation of these fungi into anthropophilic and zoophilic types can be seen in Table 2.

TABLE 2
FUNGI CAUSING FAVUS CASES

Anthropophilic (No. of Cases)		Zoophilic (No. of Cases)		Other (No. of Cases)	
<i>T. schoenleini</i>	155		None		None
<i>T. violaceum</i>	7				

Of the 80 noninflammatory *T. capitis* cases, the majority (38 patients) was caused by *M. canis*, followed by *T. verrucosum* (23 cases). Nine were caused by *T. violaceum* and four by *T. mentagrophytes*. The anthropophilic and zoophilic classification can be seen in Table 3.

TABLE 3
FUNGI CAUSING NON-INFLAMMATORY *T. CAPTIS* CASES

Anthropophilic (No. of Cases)		Zoophilic (No. of Cases)		Other (No. of Cases)	
<i>T. violaceum</i>	9	<i>M. canis</i>	38	<i>T. mentagrophytes</i>	4
		<i>T. verrucosum</i>	23		

The fungus found in the majority of the kerion cases was *T. verrucosum*. The other three causative fungi were : *M. canis*, 16 cases; *T. violaceum*, eight cases; and *T. mentagrophytes*, four cases. The anthropophilic and zoophilic classification can be seen in Table 4.

TABLE 4
FUNGI CAUSING KERION CASES

Anthropophilic (No. of Cases)		Zoophilic (No. of Cases)		Other (No. of Cases)
<i>T. violaceum</i>	8	<i>T. verrucosum</i>	69	<i>T. mentagrophytes</i> 4
		<i>M. canis</i>	16	

The majority of the favus and kerion cases came from rural areas, 90 per cent, and the majority of the noninflammatory cases from urban areas, also 90 per cent.

The id reaction, which particularly involved the face, was present in only three of the 170 cases of favus. Involvement of other parts of the body was observed in four cases, all of which had onychomycosis, and two of which also had *T. corporis*.

Of the 80 noninflammatory cases, only two had id reactions and there were a few cases with *T. corporis*. Of the kerion cases, however, 18 had id reactions : *T. verrucosum* caused 15; *M. canis* caused one; and from two, no fungus could be isolated. One of the 15 cases caused by *T. verrucosum* had a lesion resembling erythema nodosum; another had acute glomerulonephritis caused by beta hemolytic streptococci.

Family incidence was observed in 42 families in which the cause was *T. schoenleini* : in two of the 42 families the disease was seen in the mother; in the other 40, in the siblings. In 24 cases of *T. capitis* caused by *T. violaceum*, only three families had infections in more than one member. In the 54 cases caused by *M. canis*, four families had infections in more than one member; in the 92 cases caused by *T. verrucosum*, there were also four such families.

Most of the patients were unable to give a very definite idea of the source of their infection. In the case of favus where more than one member of a family had the infection, the source could be traced to a relative. In kerion, the patients sometimes stated that their infections had been contracted from cattle or sheep. The patients with noninflammatory *T. capitis* were unaware of the source of the infection. This is easily understood since this last type is usually contracted from cats and dogs which are apparently uninfected.

In all three forms of *T. capitis*, males were predominant. In favus there were 95 males and 75 females; in noninflammatory *T. capitis*, 60 males and 20 females; and in kerion, 95 males and 35 females.

After puberty, favus was seen in 30 cases, kerion in only two cases and there were no cases of noninflammatory *T. capitis*. All three forms of the infection usually occurred between the ages of five and nine. The duration of the disease was found to be longest in favus with an average of about four years. The noninflammatory form usually lasted two to three months and only six patients had the disease for a year or more. From four of these six cases *T. violaceum* was isolated and from two, cultures were not obtained.

Discussion

Within 15 months, from September 27, 1966, to December 1, 1967, 5375 patients with various dermatoses were examined and 380 cases of *Tinea capitis* were found (7.1 per cent). This indicates that in Eastern Anatolia, *T. capitis* is very common.

Even though the clinical form of *T. capitis* included only 170 cases of favus and 210 cases of other forms of *T. capitis* (80 noninflammatory and 130 inflammatory—kerion), it would be difficult to say that favus is less common than other types of *T. capitis*. This is because favus has an insidious course, usually without an acute phase, so the patient does not feel any need to consult a physician. Therefore, we feel that this apparently low incidence of favus is artificial.

The most common fungus identified in 333 of these 380 cases was *T. schoenleini* (43.5 per cent). Marchionini and Götz,³ Ekmen¹ and Erbakan and Ekmen,² who worked on the *T. capitis* flora of Central Anatolia, also found *T. schoenleini* as the most common fungus (80 per cent, 69.3 per cent and 43.2 per cent, respectively). Unat,⁴ however, who worked on the *T. capitis* flora of the Istanbul region, found the most common fungus to be *T. violaceum* (43.2 per cent). It is to be expected that the fungal flora in various parts of the country will not necessarily be exactly the same, which is confirmed by the work of Grin⁶ in Yugoslavia, who found that the causative fungi of dermatitis varied from village to village.

The most important difference between our results and the authors who worked in Central Anatolia concerned the second most

frequently occurring fungus, *T. violaceum*. As mentioned previously, it was the most common fungus found by Unat⁴ in the Western region (43.2 per cent). In our work, however, it was found that *T. violaceum* infections were not common (6.9 per cent). These findings may suggest that *T. violaceum* infections gradually decrease from Western to Eastern Turkey.

The second most common fungus found in our study was *T. verrucosum* (27.7 per cent). In Central Anatolia, however, it was found to be only 1.8 per cent (the average of the findings of Marchionini and Götz,³ Ekmen¹ and Erbakan and Ekmen²). According to Unat,⁴ *T. verrucosum* was nonexistent in the Istanbul area (west), but the incidence of zoophilic fungi, especially *M. canis*, was fairly high (34.4 per cent). Of the zoophilic fungi, there were 63.0 per cent *T. verrucosum* and 37.0 per cent *M. canis*. These findings suggest that *T. verrucosum* infection is very common in the Eastern part of Turkey and that generally *T. capitis* due to zoophilic fungi is also frequent, probably because most of the population in these areas is involved in the handling of cattle and sheep.

Even though Dr. L. Ajello⁵ isolated *M. gypsum*, a geophilic fungi, from the soil of the Eastern parts of Turkey, in our study no *T. capitis* cases were found to be caused by this or any other geophilic fungi. *T. mentagrophytes*, which is both a zoophilic and an anthropophilic fungus, occurred infrequently (2.4 per cent).

As has been mentioned, in 162 cultures obtained from 170 favus cases, 155 were *T. schoenleini*, five were *T. violaceum* and two were *T. violaceum* plus *T. schoenleini*, isolated from mixed infections. Grin⁶ in Yugoslavia demonstrated only two mixed infections from 7951 *T. capitis* cultures. The two cases of mixed infection found in this study were the first to be reported in Turkey.

The course of the disease in seven cases caused by *T. violaceum* (including the two mixed cases) was from three months to 30 years. Even though there was no secondary infection, several atrophic alopecia patches were present. The hairs were not broken as in the other types of *T. capitis*, other than favus; therefore, we made the diagnosis of favus in these seven cases. It is already well known that *T. violaceum* infection lasts for many years and that permanent scarring may result.⁷ The findings suggest that favus might be caused either by *T. violaceum* alone or mixed with *T. schoenleini*. It was also observed that one of the seven patients whose disease was

caused by *T. violaceum* had a brother who had had an infection for more than a year without any inflammation, but which suddenly developed into kerion. A similar observation was made in the other group of *T. capitis* not including favus. While one brother had a typical noninflammatory reaction of the black-dot form, the other brother had kerion due to *T. violaceum*. This indicates that *T. violaceum* infection sometimes lasts for long periods without any inflammatory process, and that it may change into the kerion type. Its course probably depends on the individual host resistance or on a change in the virulence of the fungi.

Of the noninflammatory type, *M. canis* was predominant, while *T. verrucosum* was more common in the inflammatory type. Since, like most of the favus cases, kerion cases also came mostly from rural areas where cattle and sheep are common, it is to be expected that *T. verrucosum* infections would be frequent. Our results from kerion cases in Central Anatolia are similar to the findings of Küçükterzi and Ekmen.⁸ Most of the noninflammatory *T. capitis* cases (90 per cent) came from urban areas. This, however, is no indication that noninflammatory types are not so common as kerion types in the rural areas, because most of the patients with this type do not consult physicians since the infection is usually not striking. People in rural areas usually «cure» this type of infection themselves with garlic or gentian violet pencils.

The id reaction was not high in favus or noninflammatory *T. capitis*. In 170 favus cases only three id reactions were observed and in 80 noninflammatory cases there were only two id reactions. The reaction was, however, much higher in the kerion type. In 18 of our 130 cases with kerion, patients showed id reactions, particularly in a diffuse perifollicular erythematous papule form. Of these 18 cases 15 were due to *T. verrucosum*, one to *M. canis*, one to *T. violaceum* and in one a culture was not obtained. One of the 18 cases with an id reaction due to *T. verrucosum* had an erythema nodosum-like lesion. Another one had acute glomerulonephritis from which beta hemolytic streptococci were isolated. So, in the light of these findings, it is difficult to decide whether in these 18 cases *T. verrucosum* caused the id reaction or whether it might have been caused by a secondary pyogenic infection. To be more certain, it would be necessary to make further serological and immunological studies.

Concerning involvement of other parts of the body besides the scalp, onychomycosis was observed in four cases of favus. In

two of them, besides onychomycosis and favus of the scalp, *T. corporis* was also seen. These cases were caused by *T. schoenleini*, which is very interesting in view of the fact that auto-inoculation is very rare in cases of *T. schoenleini*. In other forms of *T. capitis*, *T. corporis* was not often seen. Cross infections among siblings, however, were very common in the *T. capitis* cases caused by *T. schoenleini* (the 42 cases of family incidence—24.6 per cent) and *T. violaceum* (12.5 per cent). On the other hand, in the cases caused by zoophilic fungi, the family incidence was very low; for example, in *M. canis* infections it was only 7.4 per cent and in *T. verrucosum*, 4.3 per cent. This shows us that anthropophilic fungi are obviously easily passed by direct contact or by fomites, while the zoophilic pass from animal to man but not on from man to man.

As far as the occurrence in the different sexes is concerned, in the three forms of *T. capitis*, males were more often infected than females. Particularly in the kerion and noninflammatory types, there was a higher proportion of males than females. It is generally thought that not only does the females' long hair partly protect them against infection, but also in this area girls do not usually have their hair cut, whereas the disease can be readily passed from boy to boy by infected barber instruments. As far as the zoophilic species go, males are usually in much closer contact with animals.

Favus was common in the age group from five to 14 years, while in the other forms it was common between the ages of five and nine. We observed 30 cases of favus in patients beyond puberty, in all of which the infection had started before puberty and lasted for a year after. We did find two cases of kerion in which the infection was contracted after puberty: one of these patients was 60 years of age, the other 25. The latter, whose general health was very poor, had fever and an erythema nodosum-like lesion besides the *T. capitis*. He said that one of his sheep had «kecelik», the name of the ringworm of animals in this area. In both of these cases the infection was due to *T. verrucosum* and was localized in the occipital area. As a result of these findings it is obvious that *T. verrucosum* rarely invades the scalp after puberty, nor has *T. schoenleini* been seen to do so, at least as far as our study was concerned.

The duration of the disease in the favus form was an average of five years, but in the cases after puberty, of course, it was as

high as 30 years. The longest duration in the noninflammatory form was two to three months, but in the kerion form it was only about three weeks. This probably is because the first two forms take an insidious course and do not bother patients to the extent that they seek medical aid.

Summary

In this study a total of 5375 patients with dermatoses was examined in a period of 15 months and of these, 380 (7.1 per cent) were diagnosed as *Tinea capitis*. Of the 380 cases, 170 were favus and 210 were other forms of *T. capitis*, 130 of these kerion.

Positive cultures were obtained from 333 specimens. The fungus causing the highest percentage of these 333 cases was *T. schoenleini*, 43.5 per cent; this was followed by *T. verrucosum*, 27.3 per cent. The other fungi in order of their frequency were: *M. canis*, 16.5 per cent; *T. violaceum*, 10.5 per cent; and *T. mentagrophytes*, 2.5 per cent.

In both Central and Eastern Anatolia the predominant fungus was *T. schoenleini*. The fungus second in order in Central Anatolia was *T. violaceum* as opposed to *T. verrucosum* in the East. *T. violaceum* increases in the number of cases that it produces as we move west to the point where it is the leading cause in the region near Istanbul. This is a clear indication of the regional variation of the dermatophytic flora of Turkey.

Out of 170 cases of favus, *T. violaceum* was found to cause five. Two cases of mixed infection caused by *T. schoenleini* and *T. violaceum* were demonstrated. This is the first time that either infections by *T. violaceum*, in the form of favus, or mixed infections in *T. capitis* have been reported in Turkey.

T. verrucosum was the major cause of kerion in Eastern Anatolia and *M. canis* was second. They were reversed with *M. canis* as the major cause in the case of noninflammatory *T. capitis*.

Id reactions were seen more often in the kerion form, 18 out of 130 cases. Of these, 15 were due to *T. verrucosum* and most of the 15 were a diffuse follicular erythematous papular form.

Auto-inoculation was not usually seen in the cases caused either by anthropophilic or zoophilic fungi. However, cross-infection between siblings occurred frequently in the *T. capitis* caused by

T. schoenleini and *T. violaceum*. In the zoophilic infections, the family incidence was almost nonexistent.

In all types of *T. capitis*, males were found to be affected at a much higher rate than females. The age group most commonly affected by favus was from five to 14 years and by the other two forms from five to nine years.

Of the favus cases caused by *T. schoenleini*, 30 were observed after puberty, but in all of these the infection had begun before puberty and had continued for a long period of time. However, two cases of kerion were seen whose onset took place after puberty. One of these patients was 25 and the other 60 years of age and in both the site of the disease was the occipital area.

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