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The comparative performance of different *C. tropicum* strains in respect of their ability to perforate the human hair

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Abstract
The current study is based on the keratinophilic human hair perforation ability of 15 selected strain of *C. tropicum*. It was observed that the ability to perforate hair is specific character of that fungus which did not show variation among the isolates of species. However, experiments conducted by the author on fifteen strains, of *C. tropicum* it was found that fourteen strains possessed ability to perforate the hair, one strains did not possess perforating ability.

Keywords: Keratinophilic fungi, dermatophytes, human hair, perforation

Introduction
The ability of keratinophilic fungi and dermatophytes to decompose and parasitize keratinous substrate is closely associated with the depends upon the utilization of keratin. Fungi capable of colonizing keratinous substrates such as human hair, skin, feathers, hooves, horns, and nails are widely spread in nature. Among the multitude of fungal species known to colonize keratin, some are able to parasitize men and animals, causing diseases (Gentles, 1962; Singh, 1969; Hubalek and Hornick, 1977) [24, 25, 4]. These keratinophilic fungi include genera *Chrysosporium*, *Trichophyton*, *Epidermophyton*, *Microsporum*, *Myceliophthora*, *Malbranchea* and their teleomorphs.
Among keratinophilic fungi, genus *Chrysosporium* is one of the most important fungus having ability to degrade keratinous substrates to higher degree as compared to others. However, work on its ability to degrade keratin is limited and requires further exploration. The affinity of *C. tropicum* for keratinic substrates has been shown in numerous isolations from soil. Its capacity of utilize keratin has been shown by Jain and Agrawal (1980) [26].
The digestion is accompanied by the marked alkalization of the medium and by the high activity of proteolytic exoenzymes in culture fluid, the cleavage products with the characters of amino acids, peptides and protein were established. Enzymes with proteolysis and keratinolytic activity were found in the culture filtrate too. Now a days there are no doubts concerning the enzymatic character of keratinolysis in dermatophytes and keratinophilic fungi. The keratinophilic fungi when cultured in media containing keratin may degrade and use these compounds as a basic source of carbon and nitrogen. However, the way in which these fungi attack and digest keratin is not yet thoroughly known. Mechanical penetration followed by enzymatic degradation has been suggested. Further the growth of these fungi on skin, hair, nails and feathers suggest that these pathogens synthesize enzymes which can degrade keratin.) Nonpathogenic fast growing keratin degrading fungi have been found implicated in keratin digestion in recent days. Reports on their frequent occurrence were made by Nigam and Kushwaha (1989a) [27] and by some other researcher.
In a related type of study Padhye, *et al.*, (1980) [28], have carried out in vitro experiments on the ability to perforate hair of 44 species of different dermatophytes. It was observed that the ability to perforate hair is specific character of that fungus which did not show variation among the isolates of species. However, experiments conducted by the author on fifteen strains, of *C. tropicum* it was found that fourteen strains possessed ability to perforate the hair, one strains did not possess perforating ability.

Material method
The test procedure followed was that of Ajello and Georg (1957) [29]. Fifteen isolates of *C. tropicum* were examined for their colonized and perforating ability of human hair. Hair of young women were cut into small pieces. Several fragments of colonies of *C. tropicum* served as inoculum which were taken from 7 days old colonies.

Black Sterilized human hair segments were placed in petridishes to which thirty grams of washed and sterilized sand was kept (Plate 1-2). The sand was moistened by adding sterilized water. The dishes were examined daily for any sign of mycelial growth on hair. The microscopic observations, were made at 7 days interval over a period of 42 days.

Hair segments overgrown with mycelium were removed from the petridishes after each 7 days of incubation with sterile forceps, placed in a drop of lacto phenol cotton blue mounting fluid and examined under the microscope for hair perforation and micro morphological changes in the hair caused by the test fungi. The hair segments were considered to be lysed when they could not be picked up with the help of forceps and the bundles of keratin fibrils proceeded to separation and disintegrate hair segments showed faded colour when comparing with control. The experiments were conducted at 28:2 °C in the dark. All the experiments were carried out in triplicate.

Result and Discussion

During perforation study different types of micro morphological changes were observed in hair. Cuticle, cortex and medulla are three parts of the hair. Tuft of mycelium and conidial germination on hair surface has been frequently observed. In some hair segments cuticle undulation and cortex disruption was noted. Perforating organs were found in cortex and medulla region. These perforating organs were of different shape and size. Perforators were narrow, broad, short and long. When the perforator was less than the half of width of hair, it was supposed to be short and when it was more than half of width of hair then it was regarded to be long, Shortest perforator measured to um and longest one was 91 um. Different shapes of perforators like spoon-shaped, needle shaped, torpedo shaped, pin-head shaped. Fissure-like, tunnel like and wedge shaped perforation were also observed in different strains of *C. tropicum*, Cortical perforation and wedge shaped perforation were observed in hair colonized by *C. tropicum* GPCK 511. Cuticle lifting, medullary, perforation and cuticle disruption caused by *C. tropicum* GPCK 510 and GPCK 515 were illustrated (Plate 3). Pin-head shaped perforation, medullary digestion of hair, cuticle disruption and medullary perforation were noted in hair penetrated by *C. tropicum* GPCK 511, GPCK 519 and GPCK 518 (Plate 4). Neddle shaped perforation were observed in case of c, tropicum GPCK 511, GPCK 512, GPCK 521 and GPCK 516. Spoon shaped perforators were formed in *C. tropicum* GPCK 514 and GPCK 517. Tunnel and fissure shaped perforator was observed in *C. tropicum* GPCK 511, GPCK 513, GPCK 520 and GPCK 519.

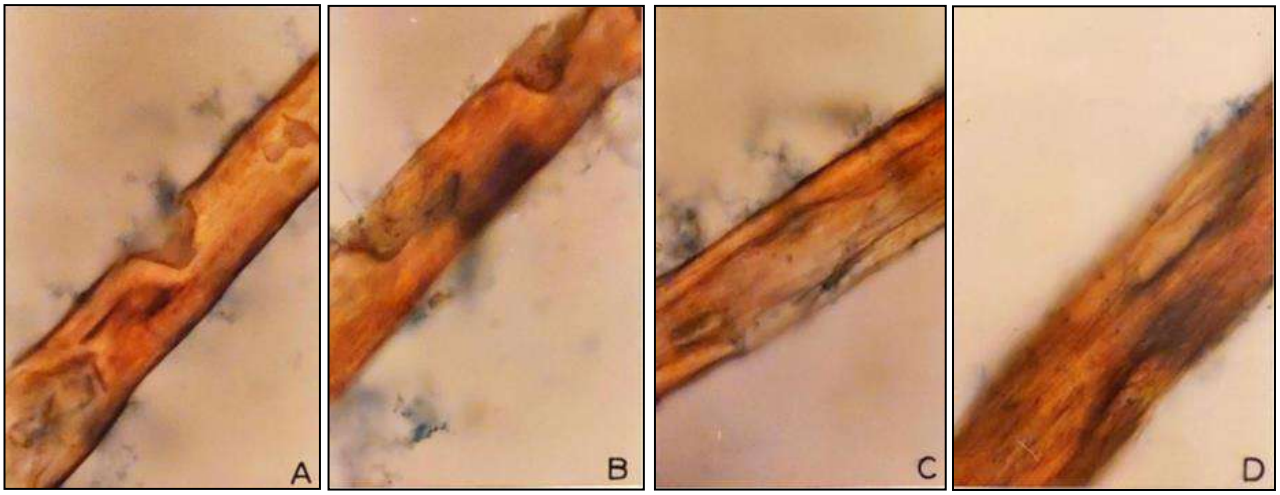

Plate 1

A. Cortical perforation in human hair caused by *Chrysosporium tropicum* GPCK 511x400.
B. Wedge shaped perforation in human hair caused by *Chrysosporium tropicum* GPCK 511x400.
C. Cuticle lifting and medullary perforation in human hair caused by *Chrysosporium tropicum* GPCK 510x400.
D. Cuticle disruption in human hair caused by *Chrysosporium tropicum* GPCK 515x400.

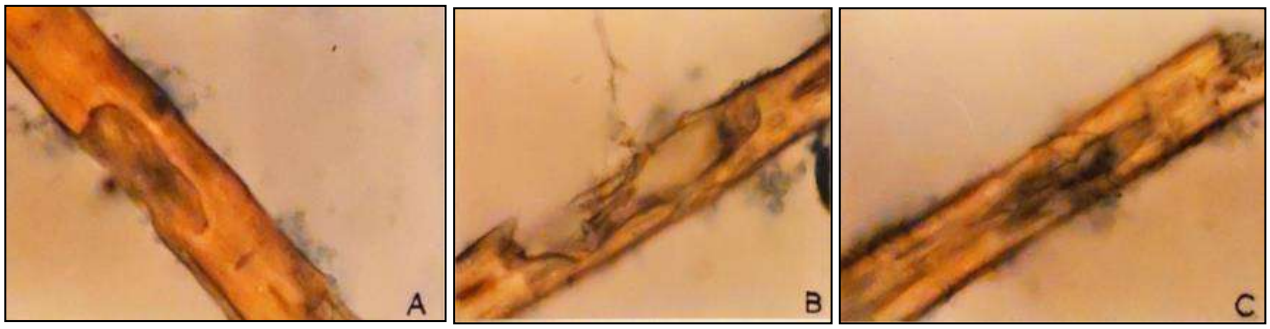

Plate 2

A. Pin-head shaped perforation in human hair caused by *Chrysosporium tropicum* GPCK 512x400.
B. Medullary digestion of human hair Caused by *Chrysosporium tropicum* GPCK 519x400.
C. Medullary perforation in human Hair caused by *Chrysosporium tropicum* GPCK 518x400.

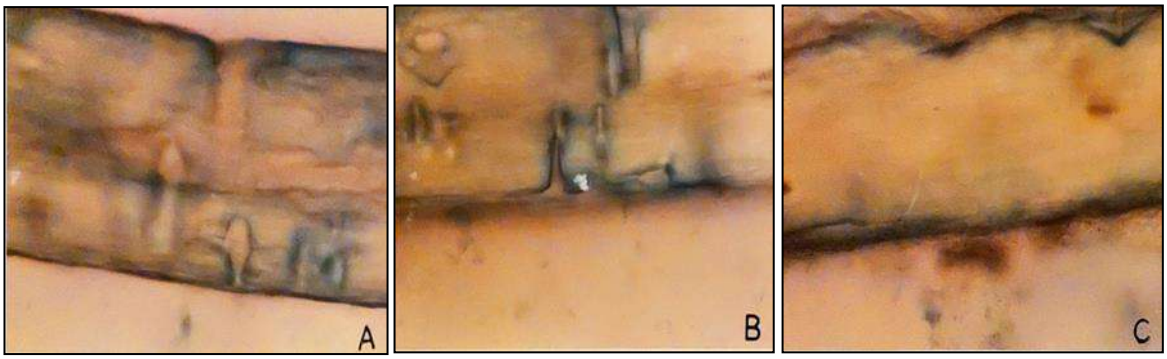

Plate 3
A. Torpedo shaped perforation in human hair developed by *Chrysosporium tropicum* GPCK 512x400.
B. Fissure shaped perforation in human hair developed by *Chrysosporium tropicum* GPCK 511x400.
C. Cuticle disruption in human hair developed by *Chrysosporium tropicum* GPCK 516x400.

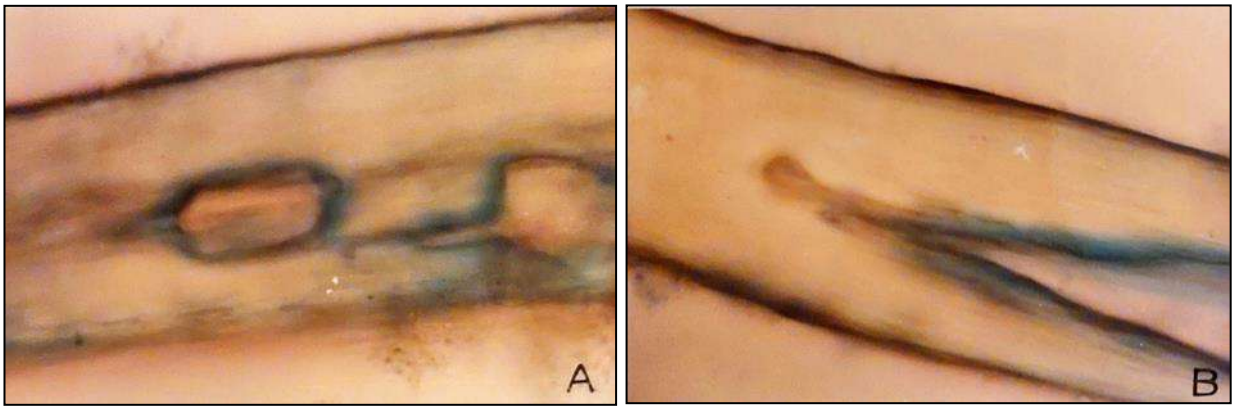

Plate 4
A. Medullary perforation in human Hair caused by *Chrysosporium tropicum* GPCK 511x400.
B. Medullary digestion in human hair caused by *Chrysosporium tropicum* GPCK 512x400.

Torpedo shaped perforators were reported by Shrivastava (1985) [30] observed tunnels Issuers in hair penetrated by soil fungi. Tunnel formation by H. toruloidea in hair was reported by Campbell (1974) [31]. Evolceanu *et al.*, (1963) [32] used the expression 'organs perforators' and English (1963) [21] used the term 'boring hyphae' for perforators. Shallow depressions and perforation canals were observed by Buchta and Hejtmanek (1985) [33] in hair. Cuticle lifting, cuticle disruption, cuticle undulation, narrow perforating organs, broad perforating organs, projections from medulla, discoloration and complete digestion of hair has been observed by Bahuguna and Kushwaha (1989) [34]. The manner in which the *Chrysosporium* species attacked hair was found to be intermediate between the dermatophytes and non-keratinophilic molds in the present study. The keratinolytic ability of some *Chrysosporium* spp. was similar to that of dermatophytes (Kushwaha, 1983) [13].

Conclusion

On the basis of this preliminary screening it was concluded that the 14 strains of *C. tropicum* used have got an ability to degrade hair. The best performance was given by two strains of *C. tropicum* i.e. GPCK 511 and GPCK 512, it is therefore these two strains were used for further study.

References

1. Kaaman T, Forslind B. Ultra structural studies on experimental hair infections in vitro caused by *Trichophyton mentagrophytes* and Trichophyton Rubrum. Acta Derm. Venereol. 1985;65:536-539.
2. Fillipello Marchisio V. Keratinolytic and keratinophilic fungi of children's sandpits in the city of Turin. Mycopatholo. 1986;94:163-172.
3. Hsu YC, Volz PA. Penetration of *Trichophyton* Terrestrials in human hair. Mycopathologia. 1975;55:179-183.
4. Hubalek Z, Hornick M. Experimental infection of white mouse with *Chrysosporium* and *Paecilomyces*. Mycopathologia. 1977;62:173-178.
5. Stahl WH, Mcque B, Mendels GR, Siu RGH. Studies on the microbiological degradation of wool III Digestions normal and modified fibritlar proteins. Text. Res. J. 1950;20:570-579.
6. Takatori K, Udagawa S, Kurata H, Hasegawa A. Microscopic observation of human hairs infected with Micros *Porum ferruginous*. Mycopathologia. 1983;81:129-133.
7. Takluchi I, Sei Y, Takagi H, Negi M. Partial Characterization of the extracellular keratinize from *Microsporum canis*. Sabouraudia. 1984;22:219-224.
8. Young RA, Smith RE. Degradation of feather keratin by culture filtrates of Streptomyces radiate. Can. J. Microbiol. 1975;21:583-586.
9. Yu RJ, Harman SR, Blank F. Hair digestion by a Keratinize of *Trichophyton mentagrophytes* J. Invest. Dermatol. 1969;53:166-170.
10. Yu RJ, Harman SR, Blank F. Isolation urination of an extracellular keratinize of the mentagrophytes. J Bact. 1968;96:1435.
11. Kunert J. The digestion of human hair by the

dermatophytes, Micros *Porum gypsum* in a submerged culture. Mykosen. 1972;15:59-71.
12. Kunert J, Krajci D. An electron microscopy study of keratin degradation by the fungus Micros *Porum gypsum in vitro*. Mykosen. 1981;24:485-496.
13. Kushwaha RKS. The in vitro degradation of peacock feathers by some fumgi. Mykosen. 1983;26:324-326.
14. Mercer EH, Verma BS. Hair digested by *Trichophyton mentagrophytes*. J Invest. Dermatology. 1963;48:357-360
15. Nigam N, Kushwaha RKS. Occurrence of keratinophilic fungi with special reference to Chrysosporium species in India. Sydowia. 1990a;42:200-208.
16. Nigam N, Kushwaha RKS. Biodegradation of wool by Chrysosporium keratinophilic acting singly or in combination with other fungi. Trans. Mycol. Soc. Japan. 1992;33:481-486.
17. Stahl WH, Mcque B, Mandels GR, Siu. Studies on the microbiological degradation of wool. II Nitroger Metabolism. Arch. Biochem. 27:211-220.
18. Baxter M, Mann PR. Electron microscopic studies of the invasion of human hair in vitro by three keratinophilic fumet. Sabouraudia. 1969;7:33-37.
19. Carmichael J. Chrysosporium and some other endosporic hyphomycetes. Can. J. Bot. 1962;40:1137-1173.
20. Deshmukh SK, Agrawal SC. Degradation of human hair by some dermatophytes and other keratinophilic fungi. Mykosen. 1985;28:463-466.
21. English MP. The saprophytic growth of keratinophilic fungi on keratin, Sabouraudia. 1963;2:115-130.
22. English MP. The saprophytic growth of non-keratinophilic fungi on keratinized substrate and a comparison with keratinophilic fungi. Trans. Brit. Mycol. Soc. 1965;48:219-235.
23. Evans EGV, Hose H. In vitro degradation of human hair by Hendersonula toruloidea. Sabouraudia. 1975;13:323-328.
24. Dawson CO, Gentles JC. The perfect states of Keratinomyces ajelloi van-Breuseghem, *Trichophyton terrestre* Durie & Frey and *Microsporum nanum* Fuentes. Sabouraudia. 1962 Jan 1;1(1):49-57.
25. Singh I, Khanna PK, Srivastava MC, Lal M, Roy SB, Subramanyam CS. Acute mountain sickness. New England Journal of Medicine. 1969 Jan 23;280(4):175-84.
26. Jain RC, Agrawal R, Jha MP. Effect of climatic variables on rice yield and its forecast. Mausam. 1980 Oct 1;31(4):591-6.
27. Bahuguna S, Kushwaha RK. Hair Perforation by Keratinophilic Fungi: Haar perforation durch keratinophile Pilze. Mycoses. 1989 Jul;32(7):340-3.
28. Padhye VW, Salunkhe DK. Studies on black gram (*Phaseolus mungo* L.) trypsin inhibitor. Journal of food biochemistry. 1980 Aug;4(2):119-38.
29. Ajello L, Georg LK. In vitro Hair Cultures for differentiating between Atypical Isolates of *Trichophyton mentagrophytes* and Tri-chophyton Rubrum. Mycopathologia. 1957;8(1):3-17.
30. Shrivastava P, Grant JH. Empirically derived models of strategic decision-making processes. Strategic management journal. 1985 Apr;6(2):97-113.
31. Campbell GS. A simple method for determining unsaturated conductivity from moisture retention data. Soil science. 1974 Jun 1;117(6):311-4.
32. Evolceanu R, Alteras I, Cojocaru I. Isolation of Trichophyton quinckeanum from Rumanian soils. Sabouraudia: Journal of Medical and Veterinary Mycology. 1963 Jan 1;2(1):14-7.
33. Buchta V, Hejtmanek M. Keratinolytic activity and its use in the identification of dermatophytes. Acta Universitatis Palackianae Olomucensis Facultatis Medicae. 1985;108:53-61.
34. Bahuguna S, Kushwaha RK. Hair Perforation by Keratinophilic Fungi: Haarperforation durch keratinophile Pilze. Mycoses. 1989 Jul;32(7):340-3.