5. DISCUSSION

Ulcerative keratitis is the commonest cause of blindness next to the cataract in India. It is such a common ophthalmic problem that some beds in our hospital are marked as "Ulcer beds" and other cases are allowed to occupy those beds only under extra-ordinary conditions.

The present study was undertaken to find out the incidence of infection in corneal ulcer cases in and around Aligarh and to study the prevalence of bacterial and fungal infections along with their antimicrobial susceptibility patterns.

In one year duration, 102 clinically diagnosed cases which were confirmed by fluorescein dye as "Corneal ulcer" were studied. A control group comprising 25 persons was also studied.

5.1 CORNEAL ULCER CASES IN RELATION TO AGE AND SEX:

In the present study, the majority of corneal ulcer cases (48.6%) were found between 31 to 50 years of age. Ulcers were more commonly found in this age group, may be because, our study group included mainly farmers and labourers and probably the most common age group working in fields is also 30 to 50 years. Therefore the persons were more prone to sustain ulcers during this period of
life. The same age group has been reported as the most vulnerable by Koul and Pratap (1975) and Haldar et al. (1992). While other workers found the maximum number of their cases between 41-50 years or 41 to 60 years of age (Puttanna, 1969; Dutta et al. 1981; Sharma et al., 1986 and Chander et al., 1993).

In the present series of patients, the male-female ratio was found to be 4:1. Other workers also have shown that males are more commonly affected than females, although the ratio of males suffering from corneal ulcers was found a bit lower. The male preponderance was because of the fact that in this part of the country field workers are mainly affected and they were mainly males. Our findings are comparable to those of Chander et al. (1993) who have reported male-female ratio of 3:1. However the other workers have reported variable ratio of male and female. Puttana (1969) has reported ratio of 2:1; Grover et al. (1975) ratio of 1:1; Koul and Pratap reported ratio of 2:1; Dutta et al. (1981) ratio of 3:2; Sharma (1981) reported the ratio of 3:2. Sharma et al. (1986) in their study have mentioned male-female ratio of 1:1; Haldar et al. (1992) have reported the ratio of 5:1.
5.2 PREVALENCE OF CORNEAL ULCERS IN RELATION TO SOCIO-ECONOMIC-STATUS :

Ulcerative keratitis as reported by various workers is the disease of the poor. Out of 102, 80 (78.5%) corneal ulcer cases were seen in upper, lower and lower socio-economic groups. From Table -2, it was evident that with decrease in the socio-economic status, there was increasing trend in the incidence of corneal ulcers. This finding of ours is in accordance with the reports of several workers (Puttanna, 1969; Dutta et al., 1981; and Sharma et al., 1986).

5.3 DISTRIBUTION OF CORNEAL ULCER CASES IN DIFFERENT OCCUPATIONAL GROUPS :

Farming was found to be the most predominant occupation detected in this study. Out of 102 cases 57.8 percent corneal ulcer cases were found in farmers, followed by 20.6 percent cases among housewives.

Our findings are comparable with Sharma’s (1981), who detected 57.9 and 26.3 percent cases among farmers and housewives respectively. Sharma et al. (1986) in another study found maximum number (51%) of corneal ulcer cases in farmers and labourers. Dutta et al. (1981) also reported that predominantly affected group in their series of patients was of cultivators (44%) and housewives (28%).
Farmers, while at work in the fields sustain ocular trauma by vegetative matter like inflorescence of wheat or paddy, leaves, grass, straw, tail of ox or cow, and at home by kutti etc. While regarding housewives, it was evident from the history that most of the housewives sustained corneal ulcers while they were helping their menfolks in the fields.

5.4 INCIDENCE OF INFECTION IN CORNEAL ULCER CASES:

In literature only a few workers have reported the total incidence of infection in corneal ulcers. We studied 102 corneal ulcer cases, the infection was found in 45 (44.1%) cases while 57 (55.9%) cases did not show any bacterial or fungal growth.

Almost similar incidence of infection was found by Liesegang et al., (1980) in a study conducted at South Florida, where these workers could detect infection in 45.7 percent cases. However, a lower percentage of infection (31.4%) was found at Lucknow by Koul and Pratap (1975).

5.5 INCIDENCE OF BACTERIAL AND FUNGAL INFECTION IN CORNEAL ULCER CASES:

In the present study out of 102 cases bacteria and fungi could be isolated from 45 (44.1%) cases. Bacterial infection was found in 18 (17.6%) while fungal keratitis
was detected in 27(26.5%) cases. Mixed infection was not found in any case. Males were more commonly affected in both types of infection.

There is paucity of literature on isolation of bacteria by Indian workers. However, Koul and Pratap found bacterial infection in 11.4 percent and fungal infection in 31.4 percent of their cases. Our findings are almost similar to their finds. While Liesegang et al. (1980) in a study at Florida reported bacterial infection in 35.6 percent cases and fungal infection in 20.1 percent cases of corneal ulcers.

5.6 PREVALENCE OF BACTERIAL AND FUNGAL INFECTION IN CORNEAL ULCERS IN RELATION TO SOCIO-ECONOMIC STATUS:

In our study it was seen that with the lowering of socio-economic status there was increase in the incidence of corneal ulcer cases. On the similar pattern, prevalence of both bacterial and fungal infections showed an increasing trend with decreasing socio-economic status.

In lower socio-economic class bacteria could be isolated from 50 percent cases and fungi from 51.9 percent cases of corneal ulcers. Similarly Sharma et al. (1986) have reported high incidence of infection in patients coming from low status of society having poor living conditions and bad personal hygiene specially in females.
5.7. DISTRIBUTION OF BACTERIAL AND FUNGAL CORNEAL ULCERS IN DIFFERENT OCCUPATION GROUPS:

Out of 45 total infected cases, maximum number of cases (45.7%) have been found infected in the group of the farmers. It was followed by the group of housewives. 22.2 percent infection was seen in housewives.

Out of the 18 cases of bacterial infection in corneal ulcer, maximum cases were found in farmers (38.9%), followed by housewives (22.2%) and labourers (16.6%). The finding could not be compared with other workers due to the paucity of literature on this aspect.

Sharma (1981) has reported 52.5 percent fungal infection of corneal ulcers in farmers followed by 13.6 percent in housewives. The findings are comparable to our results where fungal infection was detected in 51.9 percent among farmers and 22.3 percent in the group of housewives. Fungal isolation was also more frequent in farmers and labourers in the study of Sandhu et al. (1981). Dutta et al. (1981), reported 43.7 percent of the fungal keratitis in cultivators and 37.5 percent keratomycosis in housewives. Sharma et al. (1986) reported fungal infection in 58.6 percent of farmers and labourers and found out that housewives coming from low socio-economic status of society constitute the next occupational group.
5.8.1 CORNEAL ULCERS AND THEIR INFECTION AMONG URBAN AND
RURAL POPULATIONS:

In the present study, the rural population was affected four times more commonly by ulcerative keratitis as compared to the urban population. Predominance of corneal ulcers in rural population has been documented by several workers. Ratio of corneal ulcers in urban and rural populations has been reported to be 2:3 by Chaddah and Agarwal (1978), 3:7 by Dutta et al. (1981), 1:2 by Sharma et al. (1986) and 1:3 by Koul & Pratap (1975). In our series of patients a ratio of 1:4, however is slightly deviated from the previous reports. The reason for this may be that most of our patients came from villages.

5.8.2 SEASONAL VARIATION OF BACTERIAL AND FUNGAL CORNEAL
ULCERS:

Seasonal variation in the prevalence of corneal ulcers has been studied by different Indian workers. There is paucity of literature on prevalence of bacterial infection in corneal ulcers. However, Liesegang, and Forster (1980) from Florida have reported a higher incidence of bacterial infection in the month of November. It has been reported that bacterial ulcers were more common in hot dry months, whereas the fungal corneal ulcers were more common in hot and humid months.
In the present study 42.4 percent of corneal ulcer cases had infection in the months of June and July. Taking into account the cases of fungal keratitis, two peaks were observed during June, July and September, October of the year, coinciding with the harvesting months of the two crops viz. Rabi and Khareef.

Our finding could be compared with that of Puttanna (1969) who has reported June-July and September-October as the peak months when infection was found. The peak values are found different in various parts of the country as reported by several workers. This is because of the fact that harvesting months differ in different parts of the country.

5.9. BACTERIAL KERATITIS:

5.9.1. Predisposing factors in bacterial corneal ulcers:

In our study use of corticosteroids along with broad spectrum antibiotics was found as the most important predisposing factor. Fifty percent bacterial keratitis patients gave history of use of corticosteroids along with broad spectrum antibiotics.

Cortisone may control the inflammation but it may also increase the susceptibility of the individual to micro organisms. A similar observation was made by Mitsui & Hanabusa (1955). Presence of foreign body as predisposing factor is more important in males and
trauma has more significance in the case of females in the present study. There is paucity of literature on this aspect. As such we can not compare our findings with reports of other workers.

5.9.2 Important ocular findings in bacterial corneal ulcers:

Out of the 18 cases studied the ulcer size of 15 ulcers was (83.3%) 4-5 mm in diameter. only in 3 cases the size was 2-3 mm in diameter. In most of the cases (83.3%) the position of ulcer on cornea was central or para-central and in (16.7%) cases the location was marginal or limbal. In 11 out of 18 (61.1%) cases the shape of the ulcer was circular or oval. The amount of slough was copious in most of the cases (77.8%). 16 out of 18 (88.9%) cases had moist ulcer while in 2 cases only it was cry. In most of the cases colour of the slough was yellow (61.1%). Hypopyon was present in 16.7% percent cases only and absent in the rest (83.3%) of the cases.

5.9.3 Results of direct microscopy and cultures in bacterial corneal ulcers:

In the present study 21.6 percent cases were positive by direct microscopy while only 17.6 percent cases could yield bacterial growth on culture. Probably this could be because of the fact that the inoculum would have been scanty. Due to non-availability of
reports on this aspects, the findings could not be compared.

5.9.4. Corneal ulcers with prior antibiotic therapy:

The patients who had been using antibiotics before attending our hospital showed significantly lower bacterial isolation. This may be because of inhibitory role of antibiotics on bacterial growth. This aspect has not been documented in literature.

5.9.5 Bacteria isolated:

In the present study, *Staphylococcus aureus* was found to be the major pathogen in cases of bacterial ulcerative keratitis (66.7%). However, Liesegang and Forster (1980) and Park et al. (1993) reported a lower percentage of isolation of this organism. They reported *Staphylococcus aureus* from 20.2 percent and 18 percent of cases of bacterial keratitis respectively. The difference may be due to difference in geographical location with different microflora.

*Staphylococcus epidermidis* in our series has been isolated in 16.7 percent cases. Liesegang and Forster (1980) have reported from 7.5 percent cases and Parks et al. (1993) from 36 percent cases.

In our study *Streptococcus pneumoniae* has been isolated from 13.3% cases, whereas Liesegang and Forster
(1980) have reported 7.1% cases. *Streptococcus faecalis* and *Streptococcus haemolyticus* in the present study have been found in 13.3 percent and 6.7 percent respectively, whereas Liesegang and Forster have reported 0.7 percent and 1.6 percent respectively. The difference is probably due to different geographical conditions and sample size studied.

In the present series no Gram's negative bacteria have been isolated. The probable cause is that in our hospital ciprofloxacin is very commonly used and it has been reported to be more effective in the cases of Gram's negative bacteria than the Gram's positive strains (Parks, et al., 1993). The other reason may be that 74.5 percent of our cases had been using broad spectrum antibiotics before attending the hospital.

### 5.4.6 Antibiotic therapy in bacterial ulcerative keratitis:

Ciprofloxacin was found to be the most effective antibacterial agent in our study. 88.9 percent bacterial isolates were sensitive to this drug. Our findings are comparable to those of Madhavan et al. (1992) and Parks et al., (1993) who have reported Ciprofloxacin as effective single agent in the treatment of bacterial ulcerative keratitis. Gentamycin is effective against 77.8% of the isolates. Chloromycetin and Tetracycline
are the commonest drugs prescribed by the general medical practitioners or used as self medication by the patients themselves. Hence this may be the reason that 59 percent of the organisms were found resistant to Caloromycetin and about 70% to Tetracycline. The long usage of the different drugs as studied in the present series has shown emergence of resistant strains.

5.10 FUNGAL KERATITIS OR KERATOMYCOSIS:

5.10.1 Predisposing factors in keratomycosis:

**Trauma**—In the present study trauma has been found to be the most important predisposing factor. History of trauma was traced in 14 (51.1%) cases. Our findings are comparable to Dasgupta et al. (1973) and Chaddah and Agarwal who have reported 54 percent and 60 percent cases of trauma in cases of keratomycosis. Grover et al. (1975), Dutta et al. (1981), and Sharma et al. (1986) have, however, reported higher percentage of cases of trauma.

**Antibiotics and Corticosteroids**—Use of antibiotics and corticosteroids was found to be predisposing factor in 11 (40.7%) cases in the present study. Our findings are comparable to those of Dasgupta et al. (1973) and Chaddah et al. (1978) who have reported 46 per cent and 40 per cent cases respectively. However, Sharma et al. (1986) has reported 12.6% cases
associated with use of the antibiotics and corticosteroids.

Foreign body: Was responsible to predispose 7.4 percent cases of keratomycosis in the present series. Our findings are comparable to those of Sharma et al. (1986) who have reported 5.8 percent such cases. A little higher percentage (12.5%) of cases had history of foreign body in eye as reported by Dutta et al. (1981).

5.10.2. Important ocular findings in fungal corneal ulcers:

Out of 27 cases studied the size of 15 (55.6%) ulcers was 2.3 mm. in diameter smaller than the bacterial corneal ulcers. In most of the cases (77.8%), the position of ulcer on cornea was central or para-central. In 16 out of 27 (59.3%) the shape of the ulcer was circular or oval. The amount of slough was copious in 59.3% percent cases. In majority of cases (92.6%) the ulcers were moist. In most (66.7%) of the cases the colour of the slough was white contrary to bacterial keratitis. Hypopyon was present in 66.7% cases. Koul and Pratap (1975), also reported the association of hypopyon in most of their fungal keratitis cases.
5.10.3. Direct smear and culture results:

In direct microscopic culture results there is too much diversity among the workers. Our results are more or less comparable to those of Chandr et al., (1993) not showing much difference between direct examination and culture results.

5.10.4. Fungi isolated:

In our series Aspergillus was isolated from 59.2 percent of cases. Our findings are almost comparable to those of Grover et al. (1975) and Haldar et al. (1992). Slightly lower percentage of this fungus has been reported by Puttanna, (1969) (47%), Dasgupta et al. (1973) (44.4%), Sharma et al. (1986) (48%) and Chandr et al., (1993) (40%). While a higher percentage of this isolate was found by Chaddah and Agarwal, (1978) (7%) and Dutta et al. (1981) (68.8%). In the present series three species viz. Aspergillus fumigatus (29.6%), Aspergillus flavus (18.5%) and Aspergillus niger (11.1%) have been found. Our results are comparable to those of Puttanna (1969) who has isolated these three species. However, Puttanna (1969) has isolated one additional species Aspergillus nidulans. Dutta et al. (1981) has isolated only two species viz. Aspergillus fumigatus and Aspergillus niger.
Helminthosporium, in the present study has been isolated from 3.7 percent cases of keratomycosis. Our results are comparable to those of Dasgupta et al. (1973) who have isolated the fungus from 4.4 percent of cases.

In the present series Curvularia has been isolated from 7.4 percent cases. Our results are comparable to those of Dasgupta et al., (1973), Grover et al. (1975) and Chander et al. (1993). These workers have reported isolation of 8.9 percent, 7.2 percent and 10 percent respectively from their cases of keratomycosis. However, Haldar et al. (1992) has reported slightly lower percentage of the fungus (4.7%).

In our study, 7.4 percent of Penicillium was found among the fungal isolates. Our results are comparable to those of Puttanna (1969), Chaddah and Agarwal (1978), Haldar et al. (1992) and Chander et al. (1993) who, from their cases, reported 8.8 percent, 5 percent, 6.3 percent and 4 percent of this fungus. However a higher percentage of the fungus was reported by Grover et al. (1975), Dutta et al. (1981) and Sharma et al. (1986). These workers isolated 14 percent, 18.7 percent and 15.6 percent of the fungus.

In the present study, 14.9 percent of our isolates were Fusarium solani. Our findings are comparable to
those of Dasgupta et al. (1973) (13.4%), Chaddah and Agarwal (1978) (15%) and Chander et al. (1993) (14%). However, a lower percentage of the fungus has been isolated by Puthanna et al. (1969) (8.8%), Grover et al. (1975) (7.2%) and Dutta et al. (1981) (9.4%).

7.4 percent of our isolates were Phialophora sp. Our results are comparable to those of Forster et al. (1975) who had isolated 6.3 percent Phialophora sp. from their fungal isolates. However, a smaller percentage of (2.6%) the fungus was isolated by Jones et al. (1969).

5.10.5. Antifungal agents:

Out of the three antifungal agents studied in the present series, ketoconazole was found to be most effective. 96.3 percent of the isolates were sensitive to the drug. Our findings are comparable to those of Pankajlakshmi et al. (1993) who have reported that 90 percent of the filamentous fungi were sensitive to the drug.

77.8 percent fungal isolates in the present series have been found to be sensitive to Clotrimazole.

Natamycin was the least effective drug in the present study. Only 62.9 percent of the fungi were sensitive to the drug. All the four (100%) isolates of Fusarium solani were sensitive to the drug. Our findings
are comparable to those of Jones et al. (1972) who have reported that 95.6 percent of *Fusarium solani* strains were sensitive to the drug.

In the present study the best drug for *Phialophora* was found to be Ketoconazole.

5.11 CONTROL CASES :

Healthy eyes were studied as a control group and both bacteria and fungi were isolated.

5.11.1 Bacterial Culture:-

*Staphylococcus epidermidis* and *Diphtheroids* isolated in the present study did not show confluent growth on the culture plate and colonies were scanty, hence considered non-infective.

5.11.2 Fungal Culture:

From this group one case of *Aspergillus niger* (4%), and one case of *Helminthosporium* (4%) were isolated. So fungi were isolated from 2 (8%) cases. The results are comparable to those of Wilson et al. (1969) who have reported 0-28 percent fungi in healthy outer eyes.

Wilson et al. (1969) have reported 22 isolates of fungi from healthy outer eyes. Our isolates are included in that list.