INTRODUCTION

The appearance of some environmental quality for which the exposed community has inadequate information and is capable of an appropriate response is defined as pollution (Cairns and Lonza, 1972). Healthy waters portray sufficiently low level of pollution. The native algal community contains the information necessary to neutralize the negative effects. The ability to reverse the effects of pollution or to maintain natural waters in healthy state is dependent on the capacity to understand the ecological gamut.

The relationship between microbiology and pollution control has been well documented elsewhere (Mitchell, 1978). Pollution originating from eutrophication requires indepth treatment.

Aquatic ecosystems have the ability to assimilate certain amount of waste material and bring it to near normal for the constant use and reuse of water for agricultural and municipal purposes. Such assimilative function may be altered or disrupted if the digestive capacity is exceeded. The ability of lotic water to assimilate wastes depends on capacity to transform them before they assume deleterious dimensions. Pollution input due to a spill of a hazardous material may disrupt the system and may substantially reduce assimilative capacity.

The capacity of a system to receive and assimilate spills of hazardous materials without environmental damage is governed by physical, chemical and biological conditions of the system. Introduced materials may be transported, deposited and assimilated into the system. However, not all systems can receive and assimilate the same quantity or kinds of waste material. Even within a single system, this capacity varies.
The capacity of each system to resist shock loadings of waste without significant damage is the function of complex environmental gamut. Physical factors in lotic waters such as flow, velocity, volume of water, bottom contours, rate of water change, currents, depth, light penetration, temperature etc., as well as the biological factors are basic tanets to determine ability of system to receive and assimilate waste or spills of hazardous materials.

The biological community present in a receiving system is determined partially by the physical and chemical characteristics of the system and partially by the kinds of organisms that colonise the area. Obviously, if systems vary chemically and physically, they differ in components of the biological community. Thus, the effects of potentially hazardous material may vary from system to system, as not all organisms will respond in the same way to a particular concentration of hazardous material. However, it is evidence that the biological communities are not just haphazard collection of species, thrown together just circumstantially or accidentally but they have fairly well defined sequence. While the individual components of aquatic community may vary in various environments, structure of the communities are remarkably similar in fresh-water systems of industrialized areas.

Any population consisting of various ages, sizes, sexes etc. of a single species will be some of individuals that are more sensitive to a particular type of stress. This is true for populations of humans, fish or other animals. There is usually a range of concentration, temperature etc. which the organisms may tolerate without any adverse effects. It is important to note that this is true for some very toxic materials such as cyanide but the reverse is true for most of the beneficial substances such
as table salt or vitamin A. When the concentration of application of the stress increases beyond the point tolerated by organisms, the more sensitive or weaker individuals in the population begin to respond. As the sequential stress increases more members of the population respond until finally entire population is influenced. All organisms, even comprised of a single species may respond differentially to the same kind of stress. In general, the amount of stress that effects only a relatively small number of organisms in a population goes unnoticed unless an experienced biologist happens to examine inapt changes taking place.

The environmental requirements of algae are little known. Usually, laboratory studies have been made involving relatively simple, stable conditions without interspecific competition, succession, accessory organics, or other features of more complex natural habitats. Field studies on algae are usually limited to listing species coupled with associated macroenvironmental factors (Cairns and Lonza, 1972).

Decomposable organic matter of plants and animals, and washouts from agricultural land render water unfit for drinking and bathing. Such circumstances promote the growth of algae along the river-bed as well as in the water. The thriving capacity of algae in such conditions are subject to the adaptability for change in quality of soil and periodicity, largely depending on the environmental conditions produced by the quality of the ecosystem. However, role of algae in primary production of riverine ecosystem is not major.

There is existence of literature on algal infestations in natural water-bodies, sewage and water-works systems. Algae play significant role in water supplies. Excessive growth of algae causes problems in water filtration and purification. Throughout the world difficulties due to
growth of algae in water-works systems have been witnessed in United States, United Kingdom, France, Switzerland and India. Common troubles posed in water filtration are: (1) Algae not only bring about clogging of filters but also enrich them with organic content and thereby support luxurient growth of other forms. (2) Algae produce odours, tastes and their prolific growth modifies pH and turbidity of water. (3) Algae corrode metal tanks and form pits in their walls, disintegrate concrete blocks, channels and tanks. (4) Algae harbour large number of bacteria of pathogenic nature. (5) Some of the algae are toxic and make the water unsuitable for drinking and other commercial uses. But besides such problems they also form a biological film and oxygenate water and perform Yeo-men's service in biology of waters.

Central Pollution Control Board, Delhi, India, ICAR, UNESCO and other organizations have recommended intensified research on algal pollution of water and its significance in potable waters. Role of algae in sewage waters and their utilization to benefit mankind also appears promising.

Algal sources of pollution are known (Ingram and Palmer, 1952; Palmer, 1956; 1959; 1980; Kulikova, 1960; Rai and Kumar 1980; Siddiqui, 1980; Parmasivam and Sreenivasan, 1981; Tripathi and Singh, 1983; Pandey and Tripathi, 1984; Tripathi, 1985; Wu, 1986). Algae also act as indicators of pollution (Rawson, 1956; Palmer, 1957; Cholnoky, 1958; Fogg, 1960; Brook, 1965; Patrick, 1965; Round, 1965; Vaidya, 1967; Woodwell, 1967; Ware et. al., 1968; Whitton, 1970; 1975; Moore, 1974; Keeney et al. 1976; Das et al., 1978; Hosmani and Bharati, 1980; Prasad and Singh, 1982; Kant 1983). Significance of such pollution indicators in unravelling facts for monitoring water quality has wide

Terrestrial, aquatic and aero-algal allergins have been reported from North America (Lewis and Elvin-Lewis, 1976). Aero-allergins are known to cause Allergic Rhinitis, bronchial Asthma, Hypersensitivity and Pneumonities. Algal infestation in rivers acts as stock for algal allergins.

The dynamic features of aquatic and terrestrial habitats have supported diverse algal flora. Algal flora of various localities presents interesting qualitative and quantitative variance in time and space. Literature supports excellent work on algal flora from various parts of the world. There are preliminary survey reports on algal flora of Allen Forest lake, (Ahmad, 1963 and 1972) and algae of some temporary and certain rain water reservoirs (Bitta, 1965). Nair (1965) studied algae of potable waters. Algal flora of Panki rich fields has been recorded (Shukla, 1982). Distribution of planktonic Algae of Dharwad is reported by Hedge and Sujata 1997. Marine algae of Andman and Nicobar Islands has been studied by Awasthi in 1989. Periodicity and succession of algae has also been studied by Awasthi & Shukla in 1989 at Kanpur. Periodicity and succession of algae growing in Banda (U.P.) has been studied by Tripathi and Awasthi in 2003.

Despite such reports on algal flora, there is a dearth of literature on composite algal flora and its role in self-purification of lotic waters of
Ken. Encroachments of population push the vegetation deeper outside the city. Chemical pollution due to industrial exhaust, municipal wastes, city sewage and addition of agricultural washouts into the river appear to cause vast variation in qualitative and quantitative growth, periodicity, succession and distribution of algae.

To some extent the river Ken is polluted at some places wig-Banda city, village Kanwara, Alona, Pailani, Khapthiha and Chilla town in Banda district, which are situated near the bank of this river. Pollution is caused due to discharge of urban and rural sewage, municipal waste, detergents from washing clothes, unburnt dead bodies, solid wastes cattle and human activities alongwith cremation. The fast development in recent decades of agriculture put serious strain on the river due to use of chemicals, fertilizer-pesticides, insecticides and weedicides their run-off reach in the river due to which the water quality, because degraded to some extent. Problems of pollutions of the river water has not only surfaced but begun to assume severe dimensions in certain stretches of the long course of the river.

Lotic water is subjected to multiple human uses. Biological components are integrated to physical and chemical attributes of water bodies. Urbanization breeds changes in ecological equilibrium of waters and perhaps pollutant input load into the river is growing beyond comprehension. Aquatic ecosystems have the ability to assimilate certain amount of waste material and maintain normal function. With constant use and reuse of water, the function may be allowed or disrupted if the digestive capacity is exceeded. Digestive capacity of lotic water without environmental damage is determined by the physical, chemical and biological parameters.
There has been some advance towards assessment and monitoring of aquatic environmental happenings of combined pollutants, stress and resultant responses through time. Biomonitor or bioindicators are proven with great potential in water quality assessments. Unfortunately, the work on bioindicators in India is still in nascent stage and yet to catch fancy of investigating eyes.

Historically, algae have been responsible for few problems directly affecting humans but their toxicity, capacity to impound water, retardation in growth of cultivated plants, increased loss of water, changes in colour, odour production, spread of allergenic diseases and hinderence to aquatic sports and fisheries are well known. Algal role in oxygenation of water, binding and removal of certain toxic substances are crucial for water quality improvements. As such algae not only marvel significance as bioindicators but have intrinsic value in biology of aquatic environments.

Self-purification deals with chemical composition of the water and of the sediments in flowing waters. The term 'purification' obviously means the elimination of dissolved or particulate matter with 'polluting' properties from a river. The chemical compounds present in water support ecological factors for associations of the organisms growing at any location in a water body. Self-purification, therefore, induces secondary effects such as biological and oxygen concentration gradients. Basic cause for these effects is a moving ratio between photosynthetic oxygen production and community respiration in the polluted water profile.

Theoretically, lotic waters are a continuous fermentation system of the plug-flow type in which part of biomass is in free planktonic
suspension and the rest of the part is fixed bottom benthos-biomass. The dominant properties of the system are nevertheless, clearly recognizable (a) there is no feedback of information in the system, that reactions curing at any location have no influence on future events upstream, (b) the system may be considered as a single batch reaction and the actual state of affairs in subsequent river represents stages of one and the same situation, observed at the uppermost reach as a function of the residence flow time from one point of observation to the next, (c) every flowing water reach of a suitable length may be considered as an individual batch in which the water quality is constant and the biocenosis is in large lotic waters true phytoplankton represent the major part of the biomass in the system. Continuous inoculation of a reach from an upstream location is essential for maintaining the level of concentration of organisms in the water mass.

Polluting matter subjected to self-purification may include influencing the metabolism (as substrates, inhibitors and toxicants) of the phyto or zoocenosis in a stream. Bulk of literature in the field of self-purification deals with pollutants like those utilizable substrates and the biocenological effects produced by 'saprobic' conditions. In contrast to clean flowing waters, however, the aspects of the trophic structure and the energy relationships in situations of organic pollution have not yet found an adequate exploitation, biological self-purification representing an activity of community metabolism may include ecosystem development. It must be admitted, that essential facts for quantitative considerations are unknown adequately.

Conclusively, role of algae in self-purification and pollution control of lotic waters has met causal attention in India (Venkateswarlu,
1969; Rai, 1978; Prasad and Singh, 1980; Gunale and Bal Krishnan, 1981). Algae help in oxygenation of waters thereby affecting its potability. Dissolved oxygen level is crucial in determination of water quality and has far reaching implications in pollution energetic of flowing waters. Algae as causal organisms of allergenic disease spread is of no less importance.

Few algae have been reported earlier from flowing waters (Shrivastava and Kaushik, 1966; Nigam, 1986). Phycoplankton diversity and density influences water quality in multiple ways vis-a-vis colour, turbidity and odour. Planktons are also linked with fish for their food value. In view to depict totality of algal infestation in time and space, it is prudent that both algae collected from nature and those observed in culture need be studied. Response of algae to major pollutants of Ken appears of considerable importance to unravel basic mysteries of Ken ecosystem.

The accompanying thesis presents facts on algal infestation in nature and sand culture of Ken at Banda and depicts role of algae in self-purification, pollution monitoring, water quality, disease and public health problems, and prospects of utilization of algal genetic stock in multiple ways. The basic strenth of this thesis is its presentation of factual algal profile of Ken and its biological significance. Conclusions are of both academic and applied significance and science appears harmoneously wedded to practice.