CHAPTER I
INTRODUCTION

Brief review of literature

ECOLOGY OF PHYTOPLANKTON in freshwater ponds in India has attracted little attention in the past. Recently, a few interesting studies on some ecological aspects of algae appeared in the 'Symposium on Algology' (1959), in which Randhawa admirably summed up the present knowledge on this group of plants in India. Gonzalves and Joshi (1946) studied succession of algae in a tank in Bombay; Roy (1954) studied the periodicity of the plankton diatoms of Chilka Lake (see also, Devasundram and Roy, 1954); and Ramanadham et al. (1964) studied limnology of the same lake and observed that salinity, temperature, and currents in the lake are influenced by the flood waters of the Daya river and by the influx of sea water through the narrow mouth. Singh (R.N., 1955) studied limnological relations of Indian inland waters with special reference to water blooms. Chakervarty et al. (1959) made a quantitative study of the plankton and physico-chemical conditions of the Yamuna at Allahabad. Singh (1964) studied seasonal fluctuations in a diatom population. Sarkar and Rai (1964) investigated the plankton and related physico-chemical conditions of the Suraj Kund; and Laxminarayana (1965) studied the seasonal growth and succession of plankton algae in the Ganga. Singh (M, 1965) studied seasonal fluctuations of physico-chemical characteristics of the water and phytoplankton periodicity in a small lake in Delhi.

Zafar (1959) studied periodicity of Euglenineae in two fish ponds and observed it to be influenced by oxidizable organic matter and total ion content of water. Later (1964 a,b)
he studied inter-relationships of the physico-chemical complexes of a few fish ponds in Hyderabad and distribution of unicellular and colonial forms in the same ponds. He found that Pearsall's basic ratio of water plays a distinctively important role in distribution of algae. Recently, he (1968) summed up the distribution pattern of phytoplankton in the lakes of Hyderabad.

Misra and Singh (1968) made a preliminary study of the periphyton in a temporary pond and found that with the increase in water level the average number of species at bottom and surface did not show marked stratification but they did not find any distinct correlation between pH, total alkalinity, free CO₂, D.O., and the periphyton growth. Vasisht (1963) made a limnological study of a lake near Chandigarh; and Vyas (1969) studied phytoplankton ecology of a lake in Udaipur. He found the phytoplankton composition of oligotrophic type and that Bacillariophyceae are more abundant, Myxophyceae come next, but Chrysophyceae and Dinophyceae were almost insignificant. Diatoms had two peaks, great magnitude during October and lower one in May. Similarly, Chrysophyceae had similar peaks in December and June, respectively. Myxophyceae reached their maximum abundance in June.

In contrast to the attention paid in India, the ecology of phytoplankton has attracted wide and varied interest in other parts of the globe. In Europe, a limnological expedition of about 50 lakes by Antipova et al. (1963) is worth mentioning. They classified the lakes into three categories based on their physical situation, and also studied seasonal and annual changes in the phytoplankton. Among other recent detailed works the following are of importance: limnological studies in Sweden by Arnemo (1964) who studied physical and chemical conditions in lake Hyttodammen and Arnemo and Nauwerck (1965) who investigated qualitative and quantitative composition of phytoplankton with special regard to environmental factors in the same lake; in Quebec by Bernard (1964); a five year study on
phytoplankton by Andrievskaya (1965); effects of humic substances on phytoplankton development by Kharkevich (1960); vertical distribution of phytoplankton by Edsberg (1965); phytoplankton in lakes inundated by floods by Chernyavskaya (1963). Seasonal dynamics of phytoplankton and factors affecting their distribution have been studied by Danilov (1963) and Danoyelles (1967), respectively.

Of the recent works on distribution, dynamics, stratification, group composition, quantitative analysis, production, micronutrient as limiting factor on phytoplankton, mention may be made of Goldman (1965), Janaviciute (1966), Javornicky (1966 a,b), Kidd (1964), and Klimova (1966). Marshall (1969) observed that composition of phytoplankton did not change abruptly along the Elizabeth River (U.S.A.) instead there was a steady reduction in the number of species at successive stations upstream. Kormondy (1969), working on Sandspit ponds in Ohio (U.S.A.), found density of phytoplankton to be greater in late July to early August, and that the summer flora dominated by Chlorophyta and Cyanophyta, the fall in winter by Chlorophyta or Chrysophyta, notably diatoms, which also dominate the spring flora. Species diversity was greater in mid-summer, least in autumn and spring in all ponds, with increased diversity in older lagoon ponds and reduced diversity in older beach ponds.

Willen (1969) investigated the qualitative and quantitative composition of phytoplankton in few lakes in Sweden; in one lake he compared the phytoplanktonic flora before and after the outlet of water from a nearby power station and found that Chlorophytes and Cyanophytes predominated every year and that addition of nutritional elements and changes in thermal balance increased algal populations. Earlier (1961) he investigated seasonal and vertical distribution of phytoplankton and the related ecological aspects in a shallow lake and found that Chrysophyceae predominated during the greater part of the year; and Cyanophyceae,
desmids, and diatoms playing a secondary role in the standing crop. He (1959) also surveyed phytoplankton along the Bay of Lake Malaren in Sweden and studied their horizontal and vertical distribution as effected by hydrological factors.

Canter and Lund (1966) made an interesting study of the periodicity of planktonic desmids in a pond in England. Arnemo (1964) investigated the physical and chemical conditions and phytoplankton production in lake Hyttodammen and found that *Sagittaria sagitifolia* had a great effect on the horizontal heterogeneity of phytoplankton elements because of its power to absorb more of the nutrients found in the bottom. Further that the phytoplankton composition was numerically dominated by Chlorophyta and Cryptomonadinae, and on the basis of primary production of phytoplankton he ranked the lake somewhere between eutrophy and oligotrophy.

Lund (1957) studied algal differences vis-a-vis chemistry of water in some lakes in Britain. In 1961 he studied periodicity of u-algae in three English lakes, and compared it to the larger algae and found that the u-algae were more numerous. He (1962) studied phytoplankton of some Canadian lakes. Marshall (1965) studied the physical and chemical conditions, and annual distribution and stratification of phytoplankton in a lake in Ohio (U.S.A.) at different depths and in different seasons. He found that a rich Chrysophyte-Cyanophyte population which indicated an advanced stage of eutrophication, and a dynamic interplay of physical and chemical factors which resulted in a condition that influenced seasonal and successional patterns of development of phytoplankton.

A detailed review on limnology of ponds and lakes for the last decade is given in Appendix I.

**Aim of the investigation**

In view of the negligible work undertaken to unravel
the phytoplanktonic depths of temperate waters in this country, an exhaustive study of phytoplankton populations in Kashmir waters was undertaken. The lakes considered in the present study are the Dal and the Nagin. Microvegetation at various levels and at different seasons of the year in relation to macrovegetation present in and around the lakes were considered, together with the drifting of the plankton due to wind and surface currents along with other disturbances caused in surface waters. The effects of water temperature, both at the surface and bottom, as also the atmospheric temperature on the presence and growth of plankton was one of the parts of this investigation. The other ecological variations like rainfall, snowfall, biotic interferences, etc. were also considered. Prime importance was given to collection of plankton throughout the year and recording them quantitatively and qualitatively. Water quality and soil analysis of the lake beds was also determined with respect to their bearing on plankton populations.

For the present investigation, the period covered is October 1963 to October 1970.