are considered to play some part in the increase of their frost hardiness.

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Growth of Lake Victoria Phytoplankton in Enriched Cultures

IT has been stated that many of the natural waters of Africa are short of sulphates[1], and as a broad generalization this is not to be denied. However, it has also been suggested that sulphates, as well as nitrates and phosphates, are a limiting factor for plankton growth in Lake Victoria[2], and that shortage of sulphates in solution is a factor affecting the productivity of the Lake[3]. During a recent six-months stay at the East African Fisheries Research Organization Laboratory in Jinja, Uganda, a small part of my time was devoted to culture experiments, and some successful attempts were made to grow Lake Victoria phytoplankton in laboratory culture.

The phytoplankton most usually dominant in Lake Victoria is *Melosira nyassensis* var. *victoriae*, though other diatoms, including *M. granulata*, *M. italica*, *M. agassizii* and *Nitzschia acicularis*, and blue-green algae, including *Aphanocapsa elachista*, *Merismopaedia elegans* and *Lyngbya circumcreta*, are often present. *Melosira* is the most important genus and forms the major source of food, in the Lake itself, for the herbivorous fish, *Tilapia esculenta* and *T. variabilis*, and most attention was paid to *Melosira* in this investigation.

To each of thirteen clean, sterilized, plugged 250-ml. conical flasks was added a 125-ml. aliquot from a fresh, well-mixed, water sample from the Lake. One of these was treated as a control, and to each of the others was added sterile nutrient solution as follows: to cultures S_1, S_2 and S_3, 10 ml. of magnesium sulphate solutions of such concentrations as to produce culture concentrations of, respectively, 1·3, 13 and 130 mgm./l. of sulphate; to cultures P_1, P_2 and P_3, 10 ml. of dipotassium hydrogen phosphate solutions to produce, respectively, 0·874, 8·74 and 87·4 mgm./l. of phosphate; to cultures N_1, N_2 and N_3, 10 ml. of potassium nitrate solutions to produce, respectively, 1·07, 10·7 and 107 mgm./l. of nitrate. To each of a fourth series of three cultures, SPN_1, SPN_2 and SPN_3, was added a mixture of the three nutrient substances at the concentration-levels as described. In calculating these concentrations it was assumed that sulphate, nitrate and phosphate were nil in the Lake water.

Counts of algae were made, by the sedimentation method[4-6] in the original Lake sample, and for each of the thirteen cultures at intervals of six or seven days for the next three weeks. A final count was made for some of the cultures after a further four weeks.

The response of *Melosira* (mainly *M. nyassensis* var. *victoriae*) to some of these different cultures is shown in Fig. 1. No growth occurred in S_1 and S_2, and the difference between S_3 and the initial inoculation density is insignificant. It can be stated, therefore, that added sulphate had no effect on the growth of *Melosira*. Nitrate at 1·07 and 107 mgm./l. had no effect on the growth of *Melosira*, and the cultures N_1 and N_3 are not recorded in Fig. 1. Nitrate at 10·7 mgm./l. (culture N_2) apparently boosted growth initially but after a further six days many dead cells were found in the N_2 culture. On the other hand, the addition of phosphate, particularly in the most dilute form, resulted in a significant increase in *Melosira*. After a further four weeks there were more than 3,000 cells per ml. in culture P_1. *Melosira* also showed a significant increase in culture SPN_3, where all three nutrients were added at the most concentrated level. No growth occurred in SPN_1 or SPN_2; but the reason for this is unknown.

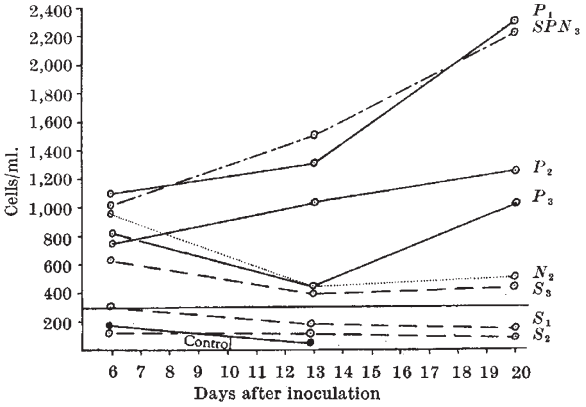

Fig. 1. Effects of added nutrients on growth of *Melosira* spp. in mixed cultures. Horizontal line, original inoculation density

None of the three species of blue-green algae investigated showed a significant increase on the addition of phosphate, nitrate or sulphate; but factors other than nutrient limitations might have been responsible for this.

The Chlorococcales present in the original inoculum, especially *Ankistrodesmus falcatus*, showed an increase in all the cultures with additional nutrients, least so for phosphate and most for nitrate at 107 mgm./l. For these forms, then, the level of sulphate concentration in Lake Victoria might be, with nitrate and phosphate, a limiting factor, and this agrees with the results of culture experiments in which test algae were used[2].

The most important genus, *Melosira*, in the Lake Victoria phytoplankton, however, is apparently not limited by the level of sulphate but is sensitive to phosphate, and hence the biological productivity of Lake Victoria, at the present time, is probably more dependent on phosphate than on sulphate.

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