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CONTRIBUTION TO SOIL ALGAE FROM KARACHI-PAKISTAN, PART - II SEASONAL VARIATION OF THE DOMINANT SPECIES IN CROP FIELDS

Phool B. Zahid, and S. N. Arbani*
Department of Botany, University of Karachi, Karachi-75270, Pakistan

Abstract

A survey of soil algae from crop-fields was carried out during 1990-93 from various localities of karachi region. Out of 44 soil samples, fourteen species were isolated in pure cultures. It was noted that majority of the species of blue-green algae dominated the micro-flora of the crop fields. Seasonal variation in distribution and species composition were also found according to the change of temperature, light and pH of the soil.

Introduction

Karachi is situated on the southern fringe of Pakistan on the Arabian sea coast. The coastal belt region of Karachi is barren and area around it is mainly on low flat hills with intervening valleys, with calcarious soil and pleasant climate in the lower Indus. Dry river beds and water channels are also characteristics of Karachi's physical environments.

Generally the temperature is moderate however owing to maritime condition the diurnal temperature prominantly varies. May and June are the hottest months of the year with temperature as high as 45°C, while January is the coldest month with temperature as low as 4°C. The humidity usually range between 10 and 85% during December and August, however the sea breaze for the greater part of the year act like a fan, converting fierce heat of summer into cool breeze. But when it stops it gives the feeling of suffocation and uneasiness. In Karachi the rainfal in one year may be upto 7-30 inches (usually low), while the next year it may be nill. Due to inadequate supply of water the area upto hundred mile is all barren. Therefore large tracts of useful lands have not been brought under cultivation wholly due to shortage of water.

From the literature review it seems that blue green algae play an important role in the species composition of the soil, being common

*Department of Fresh Water Biology & Fisheries, University of Sindh, Jamshoro, Sindh Pakistan

and normal inhabitants of the surface layers, are usually located in the top 0.5 mm. layers of the soil, exposed or unexposed to sun light. In the paddy soils blue-green algae occur particularly as a surface scum, (Singh 1961), or under the soil as compared to other algae, because their gelatinous film absorbs water which helps in survival during dry period (Prescott 1969). The great majority of them are truly terrestrial, grow on the surface of moist soils like nursaries, crop fields and gardens etc.

Blue-green algae can modify pH, alkalinity and colour of the soil surface and having ability to fix atmospheric nitrogen improre fertility the soil (Round 1975). Sometimes its extensive growth forms mats and carpets on the surface of soil. It has the ability to bind sand and soil particles and prevent erosion. Thus by maintaining moisture supply in also the soil growth substances (Venkatraman and Neel Kartar 1967, Mishustin and shil nikova 1971).

Besides this, in blue-green algae there is a marked seasonal fluctuation in the flora. These algae appear to be more abundant in cultivated soils than in uncultivated ones, (Smith 1951). Shtina (1961) has observed that species of *Nostoc* were particularly important componant of the fertile soil. Shtina and Rozina (1966), were of the openion that Blue-green algal flora could be used as an indicator of the soil type and conditions in various habitats. Later on Schawable (1970) has suggested that blue-green algae are the first colonizers of barren areas of rocks that help in the establishment of other soil flora. He further investigated that the fertility of the rice fields in India was due to the activity of blue-green algae. Thus by maintaining moisture and supplying growth substances it also help in growth and establishment of higher plant. (Venkatraman and Neelkantan 1967, Mishustin and shil nikova 1971).

Present work is an attempt to illucidate the seasonal variations of fourteen species of blue-green algea and their domination in crop fields or cultivated land, collected, isolated and maintained as unialgal cultures. Seasonal variation among the species were studied with the consideration of the effect of natural conditions, light intensity and temperature on the growth of algae.

Material and Methods

Soil samples were collected in polythene bags from the surface about 0-15 cms deep layer in the various crop fields, such as experimental field of Plant Protection, crop fields of Malir City, nursaries and gardens of Nazimabad, North Nazimabad, North karachi, Surjani town, F.B. Area,

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Orangi town, Landhi, Korangi, Defence Society, Mymar Housing Society and Super Highway etc.

After collection, blue-green algae were isolated according to the methods described by Zahid and Farzana (1982). Fourteen unialgal and pure cultures were prepared and maintained in the culture collection of Fresh-water algae at the Department of Botany, University of Karachi.

Results of discussions

On the basis of the present data it appeared that crop fields harboured more varieties of Cyanophyecan specen relative to other algal species of subaerial and terrestrial habitat. In various crop fields of Karachi region seasonal variation was observed in occurrence of Cyanophycean species (Fig. 1-5).

Species of *Phormidium Anabaina Nostoc,* occur as gelatinous film, on the surface of soil because these algae have ability to absorb moisture which help in their survival during dry period. The genera of blue-green algae which were collected beneath the soil (1-3 cm. depth) were the species of *Lyngbya, Oscillatoria, Tolypothrix* and *Calothrix.*

It has been observed that the seasonal variation of blue-green algae in crop fields show maximum growth during winter seasion, temperature ranging between 6-25°C (Fig. 1-4) while minimum during summer season at temperature ranging between 30-45°C (Fig. No. 5). The majority of the species flourished in fertile soil crop fields, gardens and nursaries, while lesser number of algae were collected from the hilly areas of North Karachi and North Nazimabad being epilitic in nature.

It was observed that only Nitrogen fixing algae like *N. carneum N. ellipsosporum, Nostoc linkia,* (Fig. 4) grew very well in the crop fields during winter season other species showed better growth during the months of May to September. Maximum growth of *Anabaina* fertilissima was recored during the months of August, November and December (Fig. 1) Species of Calothrix *marchica* showed better growth in August and September also. *C. braunii* flourished during the months of November to January (Fig. 1). species of *Lyngbya* like, *L. hieronymusi, L. Majascula* and *L. polysiphonea* showed maximum growth in the months of October to February and minimum in June and July. (Fig. 2).

In case of *Nostoc* different species grow in different seasons. *N. ellipsosporum, and N. linckia* show moderate growth in the months of September and October while *N. carneum* grew at a maximum rate in June (Fig. No. 3).

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Alkaline and Calcarious soils are dominated by species of and *Phormidium* carrying pH 6.8-8.4. *Oscillatoria acuminate Oscillatoria, O. amonea, and O. cartiana* showed maximum growth during the months of February to August (Fig. No. 4) *Phormidium frunicola* occur maximum in December to February, while *Tolypothrix tennis* showed maximum growth in the months of July to September (Fig. No. 5).

Conclusions

In the cultivated soils around Karachi, species of blue-green algae such as, *Lyngbya, Anabaina, Calothrix* and *Nostoc,* were usually most abundant. *Tolypothrix* were common in the very wet soils. *Nostoc* species were present in about 50% of the soil samples which were collected from nursaries and gardens etc. While species of *Oscillatoria* have been found beneath the stones and pebbles in various places of Karachi. During rainy season, which generally lasts till August, the soil surface becomes covered with thick patchy growth of blue-green algae. Algae continue to grow until the end of Septembr and becomes a good soil binder. It develop slowly by the middle of October, located generally in the top 0.5 mm. layer of the soil.

In view of the above observations, we infer temperature has marked effect on the growth of Cyanophytcean species. The maximum growth of soil algae (Cyanophyceae) occur during summer season. as compared to winter season.

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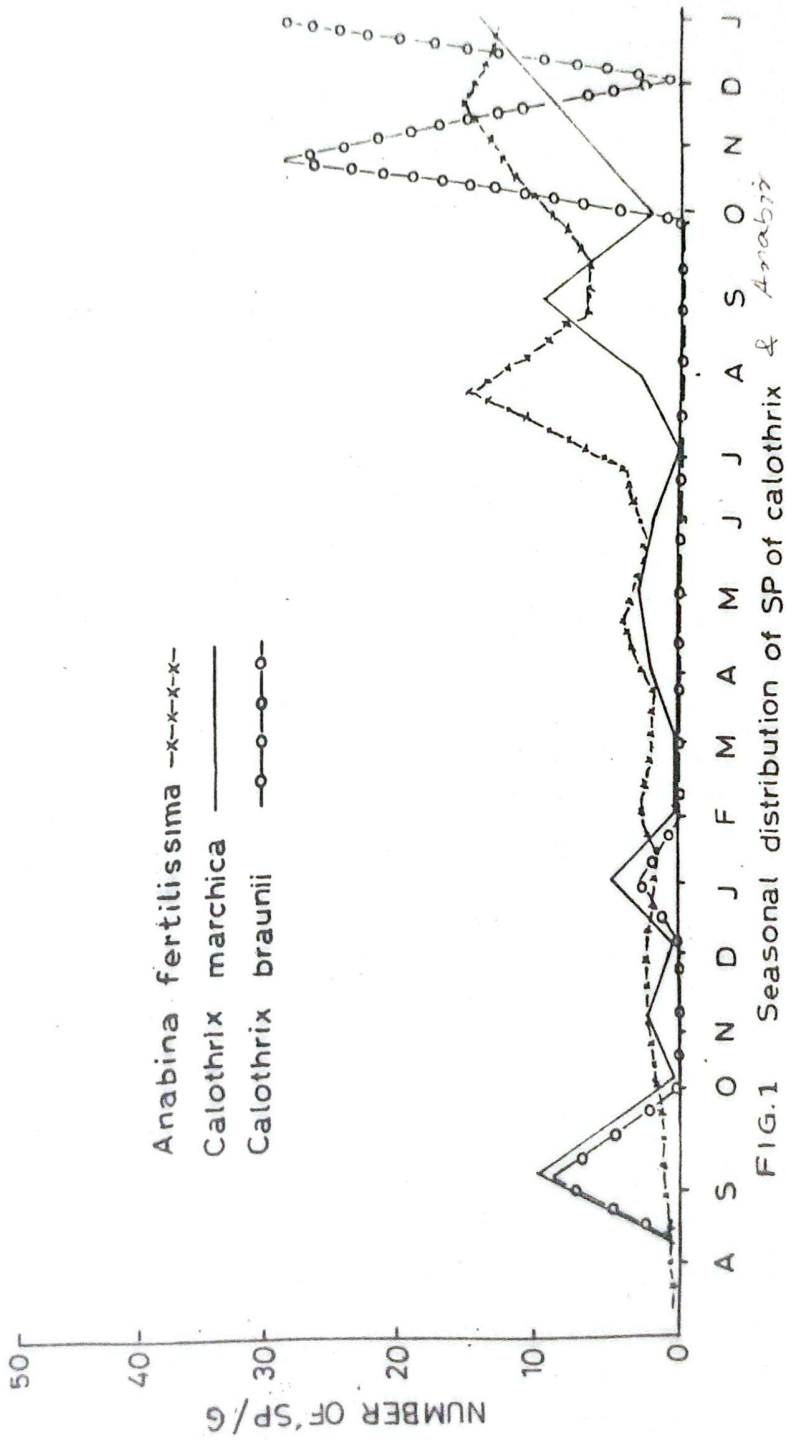

FIG.1 Seasonal distribution of SP of calothrix & Anabaena

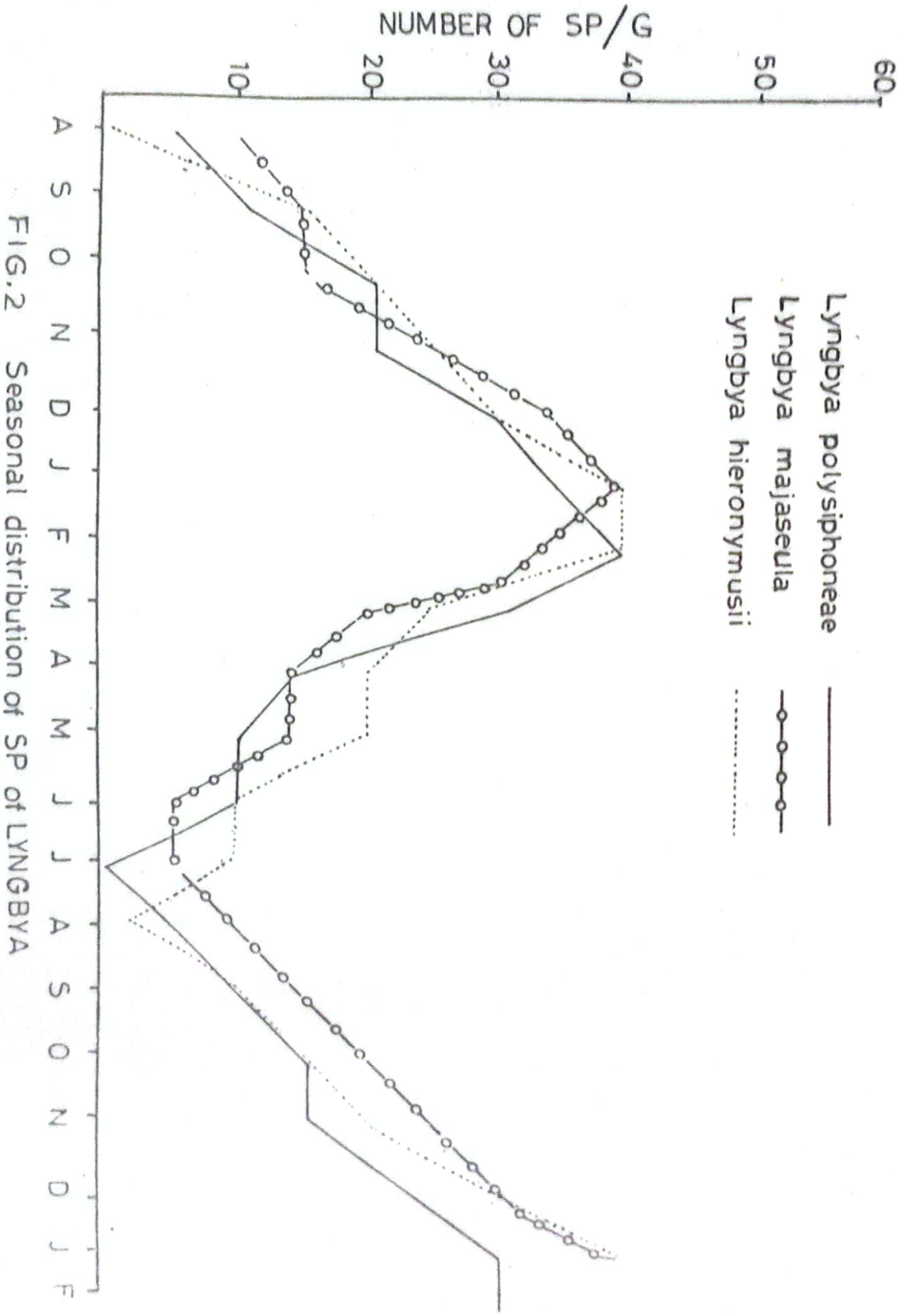

FIG.2 Seasonal distribution of SP of LYNGBYA

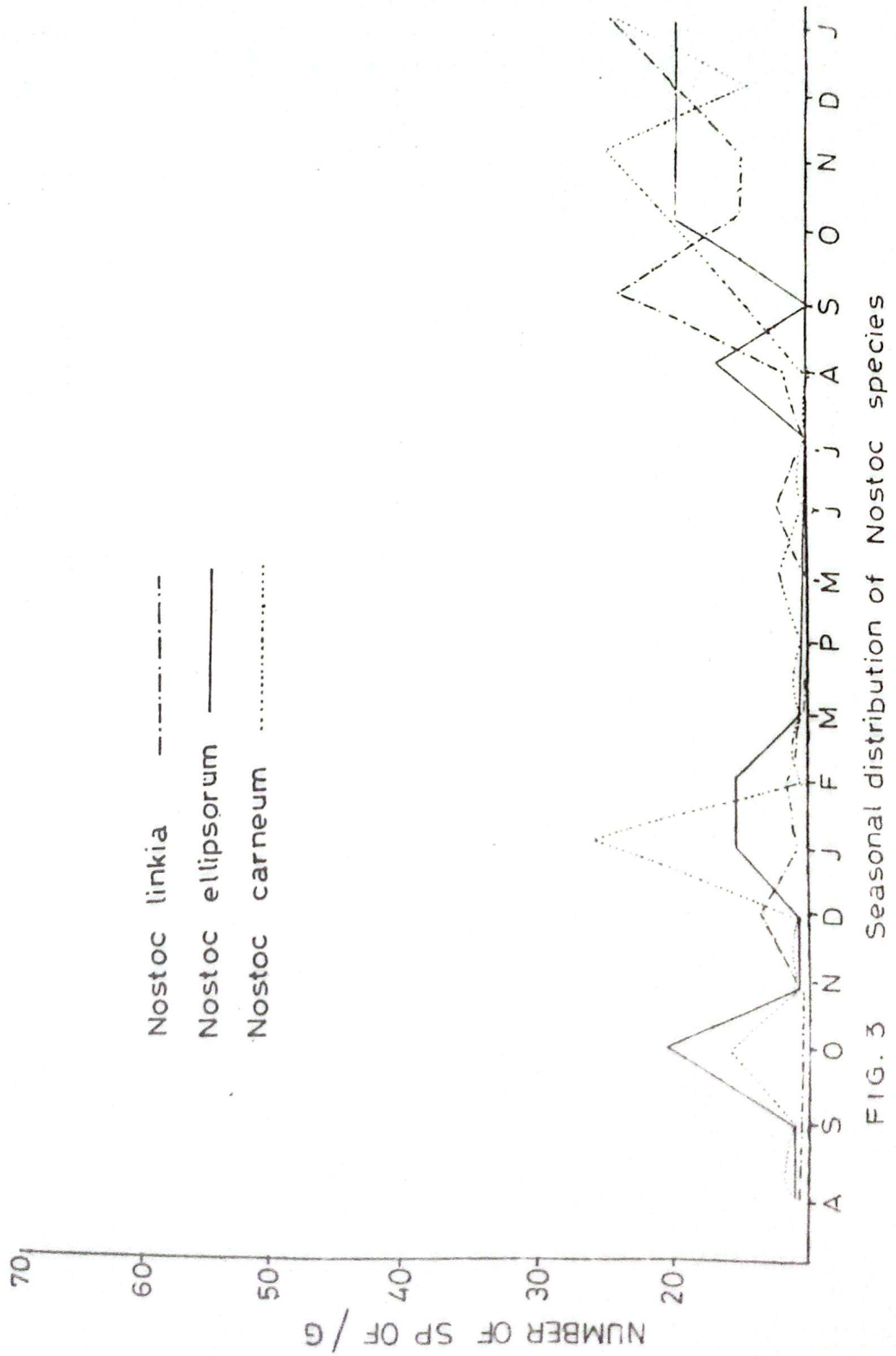

FIG. 3 Seasonal distribution of Nostoc species

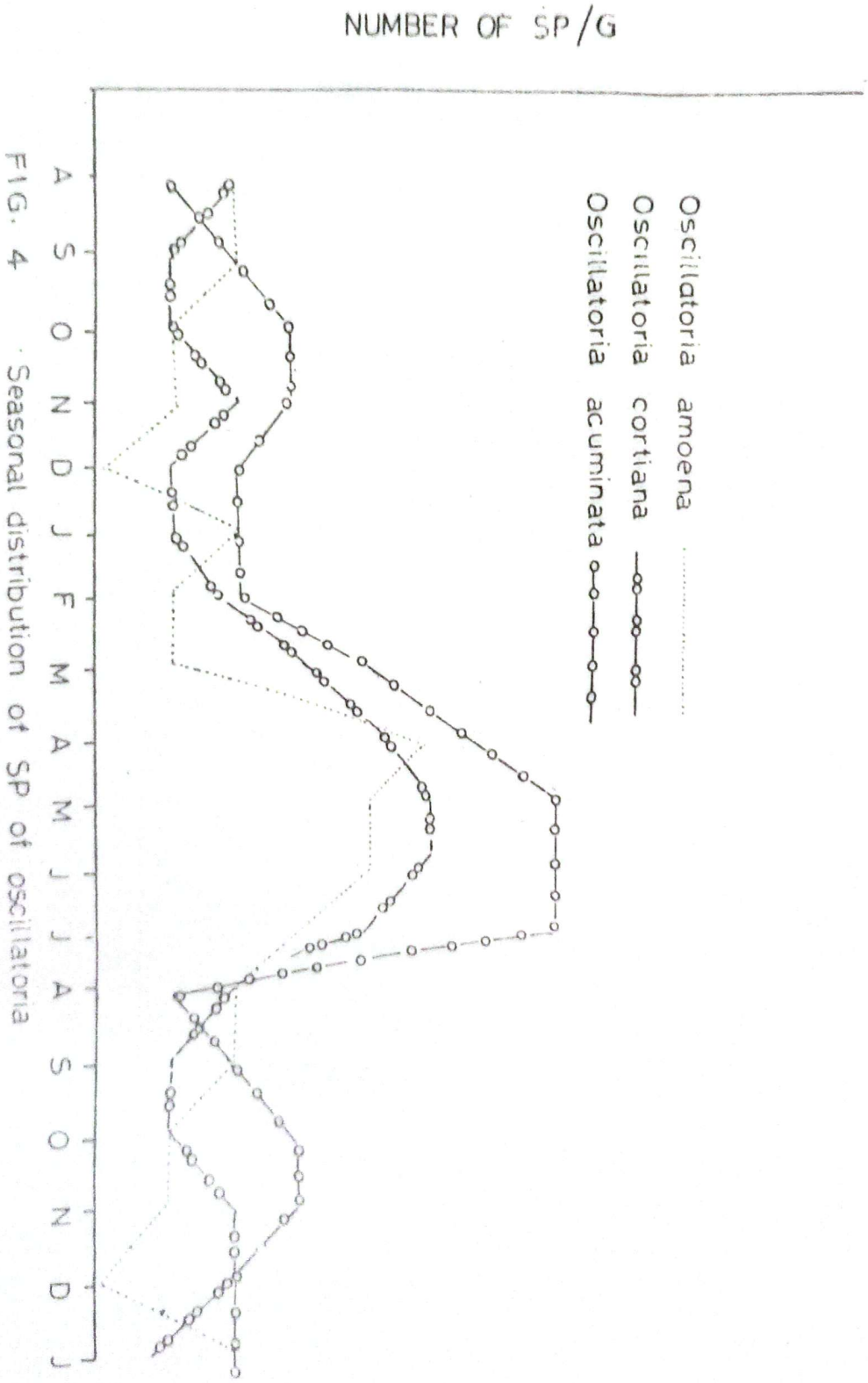

FIG. 4 Seasonal distribution of SP of oscillatoria

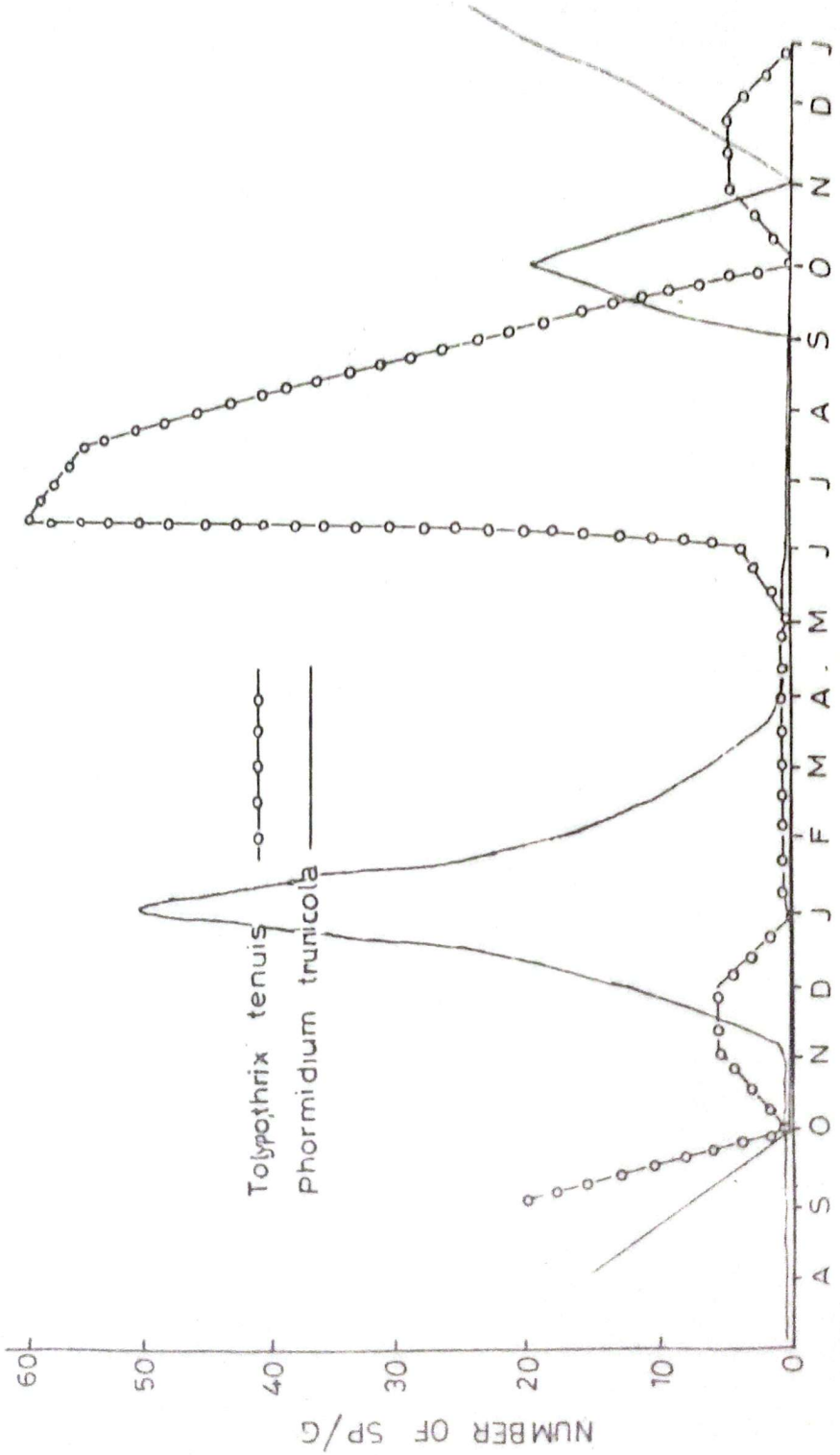

FIG.5 Seasonal variation of the species of Tolypothrix and phormidium