THE PHYCOLOGICAL SOCIETY OF AMERICA

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P. C. Silva, Editor

THE STILLWATER MEETINGS

The fifteenth annual meeting of the Phycological Society of America was held in conjunction with the A.I.B.S. convention at Oklahoma State University, Stillwater, August 28 to September 2, 1960. Sunday, August 28, an algal foray led by Dr. Imy Holt was held in Payne County, Oklahoma. Individual papers were presented at sessions Monday morning and afternoon jointly with the Phycological Section of the Botanical Society of America. Tuesday afternoon a symposium dedicated to the memory of the late Professor Gilbert Morgan Smith was held in a joint meeting with the Microbiological and Phycological sections of the Botanical Society of America and the Mycological Society of America.

MINUTES OF THE BUSINESS MEETING

The business meeting of the Phycological Society of America was called to order by the President, Dr. Richard C. Starr, at 4:00 p.m., August 29, in Room 219, Classroom Hall, with about 20 members present.

Minutes of the fourteenth annual meeting (University of Montreal) were approved as circulated to members in News Bulletin No. 38.

Old Business

Secretary's Report

The following officers were elected by mail ballot from a slate of nominees prepared by the Nominating Committee (Wm. Randolph Taylor, chairman; Ruth Patrick and E. T. Moul):

Jack Myers, University of Texas . . . . . President
Luigi Provasoli, Haskins Laboratories . . . . . Vice-President
[W. A. Daily, Butler University, continues his three-year term as Secretary-Treasurer]

As of August 20, 1960, we have 294 individual members and 14 organizational members. In addition to the 308 members, we have six subscriptions and two applicants to begin membership on January 1, 1961. During the past year, we gained 28 individual members and one organizational member. There were 15 reinstatements. Regrettably, we lost 19 members because of four deaths, 13 drops, and two resignations. Therefore, we have a net gain of 25. There are 71 members who have not paid their 1960 dues.

In order to augment the payment of dues, envelopes addressed to the Secretary-Treasurer were included with the dues notices. This apparently did not aid the program appreciably either in dues received or in the rapidity of receipt.

Treasurer's Report

Balance on hand, Aug. 15, 1959		$1,194.37
Income		
Dues		
Current	$482.00	
Back	89.00	
Future	62.25	
	$633.25	
Sale of reprints	206.50	
Interest on savings	24.08	
	$863.83	
Expenditures		
Printing and mailing of *News Bulletin*	$845.74	
Secretary-Treasurer's expenses	9.84	
Returned check	4.00	
	$859.58	
Balance on hand, Aug. 20, 1960		$1,198.62
Assets		
Checking account, Farmers Bank, Union Point, Georgia		$ 377.35
Savings account, Farmers Bank		821.27
		$1,198.62

NEW BUSINESS

Centralization of Plant Sciences

The President of the Phycological Society of America represented the Society at a meeting called by Dr. Ralph Wetmore of the Botanical Society of America. The following resolutions were passed unanimously:

1. Resolved that the representatives of the several societies here assembled recommend the implementation of the grant from the National Science Foundation to the A.I.B.S. on behalf of the Botanical Society of America for a study of the feasibility of the centralization of the plant sciences by appointing a coordinator who will explore ways and means of coordinating the activities of the several plant sciences and their professional societies;

2. Resolved that the representatives of the several societies here assembled feel it is desirable that the coordination and centralization of the plant sciences and their professional societies be effected within the framework of the A.I.B.S., if possible.

Executive Committee's Report

The sixteenth annual meeting of the Society will be held in conjunction with the A.I.B.S. convention at Purdue University, Lafayette, Indiana, August 27 to September 1, 1961.

The meeting was adjourned.

Respectfully submitted,
W. A. DAILY,
Secretary-Treasurer

ABSTRACTS OF PAPERS PRESENTED AT STILLWATER

Facultative Heterotrophy in *Bracteacoccus*

BRUCE C. PARKER
University of Texas, Austin, Texas

Twelve algae were isolated from a single sample of soil collected from the University of Texas campus and were examined for their abilities to grow heterotrophically in complete darkness in defined media containing inorganic salts and a single carbon substrate. Eight of these isolates, which constituted all of the chlorococcalean algae, were capable of heterotrophy in glucose-salts medium; the remaining isolates (2 spp. of *Chlamydomonas*, *Phormidium* sp., and an unidentified diatom) were incapable of such activity on this and several other substrates tested.

From the eight facultative, heterotrophic, chlorococcalean algae, a species of *Bracteacoccus* (Br. A-20) was selected for attempts to demonstrate facultative heterotrophic growth in media containing the original soil as the exclusive source of organic compounds. After 14 months cultivation in darkness in soil-water cultures, cell counts revealed that Br. A-20 had not increased significantly in bacteria-free culture. However, when associated with an heterotrophic bacterium also isolated from the original soil, Br. A-20 had multiplied approximately 20-fold beyond the numbers in the initial inoculum.

A third series of investigations employed bacteria-free *Bracteacoccus* in media composed of ashed and of unashed soil extract at suboptimal light intensities. Results confirmed repeatedly that Br. A-20 was enhanced appreciably in its growth and maturation in dim light when in unashed soil extract medium as compared with the ashed soil extract medium. All data were highly significant statistically. Attempts to stimulate growth similarly in the ashed soil extract with vitamin supplements were unsuccessful.

It was concluded that Br. A-20 is capable of independent, facultative photo-heterotrophy in soil or soil extract as the sole source of organic substrates. Also, the alga is capable of facultative heterotrophy in similar media when associated with a suitable obligate heterotroph. These findings are considered as possible supporting evidence for the hypothesis that some photo-autotrophic algae are facultatively heterotrophic in natural soils.

Some New Attributes Useful in Classifying Species of *Chlorococcum*

HAROLD C. BOLD AND BRUCE C. PARKER
University of Texas, Austin, Texas

Studies in the taxonomy of soil Chlorophyceae have not progressed as rapidly as anticipated because of the time-consuming procedures involved in comparing newly isolated organisms and related species available in

culture. In an attempt to expedite determination of unknown organisms, the authors have been exploring the use of supplementary attributes using sixteen species of *Chlorococcum* available to them in axenic culture. Standard conditions for growing and maintaining cultures for comparison have been devised and the following supplementary attributes have proven useful in differentiating species in the genus *Chlorococcum:* preference for ammonium versus nitrate nitrogen; color in cultures of increasing age; thickening of the outer wall layer; development of oil, either colorless or colored, with increasing age; nature of the colony on agar; growth in bacterial nutrient broth; growth in inorganic media supplemented with certain carbon compounds; and differential response to sulfathiazole and antibiotics (when high-strength Bacto Unidisks were applied to agar plates heavily seeded with algae). Wall thickening, nature of the colony and sensitivity to antibiotics have proven to be especially helpful in differentiating species of *Chlorococcum.* Use of these attributes with algae other than *Chlorococcum* have expedited their differentiation and identification.

Dormancy and Germination of *Chara* Oospores

VERNON W. PROCTOR
Texas Technological College, Lubbock, Texas

Germination requirements in four species of *Chara* were studied. Oospores of known age, harvested from plants in the field or from greenhouse cultures, were used. All attempts to germinate *C. globularis* oospores failed. Oospores of the other three species, *C. zeylanica, C. contraria,* and *C. braunii,* could be germinated without any particular difficulty. All oospores were dormant for 1-3 months after ripening. This interval could be shortened to two weeks or less by heating the freshly harvested oospores for 5-7 days at 37°C. Oospores germinated in 8-10 days at 24-26°C. in soil-water cultures. Light was not a requirement for germination.

Oospores of *C. zeylanica* gave the highest (75-95) germination percentages. The germination percentages varied considerably from collection to collection in *C. contraria.* Of the four species studied, *C. braunii* seemed best suited for further studies under the light and temperature conditions that usually prevail in most light rooms.

Growth and Respiration of a Green Alga in Spent Sulfite Liquor

THOMAS E. MALONEY AND ERNEST L. ROBINSON
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

Spent sulfite liquor (SSL) is that material which is separated from wood pulp after completion of digestion in the sulfite pulping processes. The liquor contains the dissolved constituents of wood together with the chemicals used in the process and its composition varies according to the

type of wood used and the grade of pulp manufactured. The solids content of the liquor varies from 6 to 16% and over half of the solids are lignins. Sugars (pentoses and hexoses) comprise approximately 20% of the total solids. Experiments were carried out with a green alga, *Chlorococcum* sp., in order to elucidate its metabolism in relation to SSL and the reducing sugars present in SSL.

The results indicate that the alga will grow well in low concentrations (0.57% solids) of SSL. However, SSL contains some component, other than the reducing sugars, which when present in higher concentrations, inhibits both growth and respiration of the alga. In combination, the reducing sugars, in the absence of the other SSL components, will support good growth both in the light and in the dark and are oxidized readily by the alga. Of the individual reducing sugars present in SSL, D-glucose, D-mannose, D-galactose, and D-fructose will support algal growth both in the light and in the dark, while L-arabinose will permit growth in the light only. Both D-xylose and D-galacturonic acid prevent growth in the light and in the dark.

Three of the hexoses, D-glucose, D-mannose, and D-fructose, are rapidly oxidized by the alga while D-galactose, L-arabinose, D-xylose, and D-galacturonic acid are oxidized to little or no extent.

Some Observations on the Nannoplankton in a British Columbia Inlet

R. F. SCAGEL AND J. R. STEIN
University of British Columbia, Vancouver, Canada

The oceanography of Indian Arm, an inlet about 15 miles long northeast of Vancouver, has been under study by the Institute of Oceanography at the University of British Columbia over a period of several years. The inlet has an average depth of 290 meters and in contrast to many British Columbia inlets there is relatively little fresh-water runoff from streams, hence only the surface waters (less than 5 meters) are brackish.

Although the phytoplankton of the inlet has been studied in a quantitative way, little is known of the qualitative nature of the nannoplankton. The study reported is of a preliminary nature and has been undertaken to learn something of the types of nannoplankton that are present in the inlet. The sampling period was in the winter (January to March) when the water temperatures ranged from 6 to 9°C. Samples of water were collected in plastic closing bottles at various depths at selected stations in the inlet, returned to the laboratories and concentrated for a study of the living organisms under the microscope.

The study has shown that diatoms predominate. Many of the other organisms observed were flagellated and appear to belong to the Xanthophyceae, Chrysophyceae, and Pyrrophyta. Several appear to represent undescribed species and genera. Some of each sample was inoculated into an enriched seawater mixture and cultured. The cultures were maintained at 4 or 8°C. on a 12-hour light, 12-hour dark period, receiving about 100

foot-candles intensity of light. These studies confirm the existence of entities that have not been previously described. Further investigations are proceeding in an effort to extend our knowledge of the distribution of these nannoplankton and their affinities.

Unexpected Patterns of Inheritance of Biochemical Characteristics of *Chlorella pyrenoidosa*

SELINA BENDIX AND MARY BELLE ALLEN
Kaiser Foundation Research Institute, Richmond, California

Among some fifty mutants resulting from UV irradiation of *Chlorella pyrenoidosa* are a number that are notable for their instability of certain biochemical characteristics. These mutants have been maintained in culture for three years, during which time they have continued to throw off substrains that differ from their parents with respect to any or all of the following: color, effect of light on pigmentation, effect of light on growth, and need for organic growth factors. Sectored colonies have frequently been observed, indicating that these changes occur in discrete stages and are not the result of continuous variation.

Some Effects of Algae on BOD Tests

GEORGE P. FITZGERALD
University of Wisconsin, Madison, Wisconsin

The Biochemical Oxygen Demand (BOD) test is carried out by measuring the available Dissolved Oxygen (DO) after seeding a sample of water with settled sewage and then re-analyzing for DO after 5 days incubation at 20°C. in the dark. The difference in DO can be related to the amount of organic matter available to the bacteria under these conditions.

Tests have been carried out on the effect of different concentrations of *Chlorella* (Wisconsin strain) and *Microcystis aeruginosa* (Wis. 1036) on seeded and bacteria-free BOD tests. Studies have been made of the effect of the alga's culture environment before the BOD tests, as well as the effect of the BOD dilution medium (natural waters *vs.* standard BOD dilution medium) on the activity of the algae in the BOD test.

Results of tests with *Chlorella* from bacteria-free cultures and sewage contaminated cultures indicated only about 10% differences in the activity of the algae. Also, when the amount of settled sewage seed in the BOD test was varied between 3 to 30 ml/l there was little effect on the activity of added algae. However, tests with *Chlorella* from a very dilute culture medium (300 mg dissolved salts/liter) indicated that twice as much DO was used up per unit of algae when seeded BOD tests were compared with bacteria-free BOD tests. Little effect of bacteria could be found with algae from better media.

The average activity of *Chlorella* from Myers', Allen's, and Gorham's media ranged from 0.09 to 0.16 mg O_2 used/mg dry weight/5 days when measured in seeded Standard Dilution Water. The average activity of *Microcystis* from Gorham's medium was 0.11 mg O_2/mg/5 days. Both *Chlorella* and *Microcystis* exhibited decreased activity in the BOD test with increased age of Gorham's medium cultures. When the BOD of *Chlorella* and *Microcystis* were measured alone and mixed, the BOD of the mixtures varied within the limits of variation for either alga alone and the photosynthetic capacity (DO formed by exposure to 350 ft. candles of light for 2 hours after 5 days incubation in the dark) of the mixtures was 99 to 108% of expected values.

BOD tests with either *Chlorella* or *Microcystis* followed over long periods of time indicated a gradual decrease in DO until zero DO was reached (7-12 days incubation). The photosynthetic capacity of the algae was followed before and after the bottles became anaerobic. Under anaerobic conditions, *Chlorella* continued to produce oxygen for as long as 8 days and *Microcystis* for as long as 19 days.

Communities of Algae in North Carolina Streams

G. J. SCHUMACHER
State University of New York, Harpur College, Binghamton, New York

Algal communities on quartz pebbles in North Carolina streams as revealed by studies of planted glass slides, may be summarized as follows. Diatoms are always pioneer—*Gomphonema angustatum* var. *producta* Grun. and *Gomphonema parvulum* Kütz. in the cooler mountain waters, and *Eunotia pectinalis* (Kütz.) Rabenh. in the warmer waters of the Piedmont and Coastal Plain. Along with the *Eunotia, Achnanthes lanceolata* (Bréb.) Grun. is frequent in the Piedmont, and *Tabellaria fenestrata* (Lyngb.) Kütz. and *Frustulia spp.* in the Coastal Plain. Within a 2-3 week period *Chlorosarcina conscociata* (Klebs) G. M. Smith appears in the Mountain streams, while *Protoderma viride* Kütz. and *Entophysalis rivularis* (Kütz.) Drouet become established in other areas. After 3-6 weeks, species of *Batrachospermum, Audouinella* and/or *Stigeoclonium* make their appearance and the community reaches a degree of stability.

In the plankton community of rivers, in the Piedmont or Coastal Plain, *Melosira granulata* var. *angustissima* O. Müll. is the most abundant and widespread alga at all seasons. Apparently it reaches a maximum in spring when it may approximate 600 filaments per cc. The alga secondary in abundance at all seasons is also a diatom—*Synedra ulna* (Nitzsch) Ehrenb. It is only in case of species in minor roles (numerically) that there is a marked change of numbers with the seasons. In winter, species of *Dinobryon* and *Synura* increase in number but decrease in abundance in spring. *Melosira varians* C. Ag. is common in spring and early summer. During the very warm weather of summer and early fall, blooms may appear. These are caused by *Anabaena circinalis* Rabenh., *Anabaena spiroides* var. *crassa*

Lemm. and *Anacystis cyanea* (Kütz.) Drouet & Daily. The use of the millipore membrane filter has revealed that during the summer months, *Cyclotella stelligera* Cleve & Grun. and *Melosira italica* (Ehrenb.) Kütz. should be considered important members of the river plankton community. In spring and early summer there are a number of species of considerable importance which are not true potamoplankters, but are carried into the community from the bottom by heavy rains. These include *Asterionella formosa* Hass. (from reservoirs), *Biddulphia laevis* Ehrenb. and *Hydrosera triquetra* Wallich.

Notes on the Ecology of Some Species of Algae

L. A. WHITFORD
North Carolina State College, Raleigh, North Carolina

The effects of light and of temperature on the distribution of species of algae are sometimes confused. The effect of a current is an additional factor of importance since a current increases the exchange of materials with the environment. A current above 15 cm. per second produces a steeper diffusion gradient than occurs in still water. Uptake of radio-active phosphorus (P^{32}) is twenty times as great in a current of 20 cm. per second as in still water. By means of field observations supplemented by laboratory experiments it has been proven that a single factor is limiting for a number of species of fresh-water algae, and two factors in case of others. Species known to be limited by these factors are listed below.

Microthermal species (having optimum growth below 15°C.) include *Phaeosphaera perforata* L. Whitford, *Chlorosaccus fluidus* A. Luther, *Cyclonexis annularis* Stokes, *Meridion circulare* (Grev.) C. Ag., *Actinella punctata* Lewis, and *Chaetophora incrassata* (Huds.) Hazen.

Species growing only in a current of more than 15 cm. per second include *Oedogonium kurzii* Zeller, *Audouinella violacea* (Kütz.) Hamel, *Lemanea australis* Atkinson, *Chamaesiphon incrustans* Grunow, and *Protoderma viride* Kütz.

Stigeoclonium lubricum (Dillw.) Kütz. grows only in a current at temperatures above 21°C.

A temperature below 21° C., and high light intensity are necessary for growth of *Draparnaldia platyzonata* Hazen and *Tetraspora lubrica* (Roth.) C. Ag.

Batrachospermum macrosporum Mont. and *B. vagum* (Roth.) C. Ag. are shade species, not low temperature species.

(Abstracts to be continued in next issue)

Editor's note. This issue of the News Bulletin will be the last under my editorship. It has been a privilege and a pleasure to serve the Society in this capacity during the past six years. I hope that the members will cooperate fully with our new Editor, Dr. Janet R. Stein, University of British Columbia, to make her task easier and the News Bulletin more effective.