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# Paul C. SILVA: Phycology in Japan: past, present, and future[1)]

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The main purposes of my two-month stay in Japan were (1) to take whatever steps were necessary and feasible to facilitate the completion of a monographic account of the green algal genus *Codium* (Japanese name: miru) as represented in Japan, a study that was begun thirty years ago but discontinued because of pressure from other commitments; and (2) to strengthen contacts between phycologists at the University of California in Berkeley and those in Japan. I believe that both purposes were fulfilled, thanks to the generosity of the Japan Society for the Promotion of Science, the careful planning and continuous attention to detail given by the host scientist (Professor Mitsuo CHIHARA), the splendid support provided by the host institution (the University of Tsukuba), and the enthusiastic cooperation and warm hospitality of numerous Japanese phycologists ranging from Kyushu to Hokkaido.

A base of operations was firmly established at the University of Tsukuba, where I was provided a convenient office, typewriter, microscope, and other required equipment and supplies. At the end of the first week, the annual meetings of the Japanese Society of Phycology were held at the University of Tsukuba, and I was kindly invited to give a special lecture. I chose to discuss the morphology, taxonomy, and phylogeny of the green algal genus *Codium* with special reference to the Japanese representatives. More than 125 phycologists attended the meetings, giving me an excellent opportunity to meet some whom I would not see again, but more importantly those whose institutions I planned to visit.

During the two-month period, three major trips were made inside Japan. The first, April 6-13, took me to Tokyo, where I visited the National Science Museum (Dr. Jiro TANAKA) and the University of Tokyo (Dr. Yasuwo FUKUYO), examining specimens of *Codium* in both institutions. I then joined a group of students at the Shimoda Marine Research Center of the University of Tsukuba, where they were taking a short course in marine algae taught by Professor CHIHARA and Dr. Yoshiaki HARA. At Shimoda, I collected with the students at two sites and had profitable discussions with the resident phycologist, Dr. Yasutsugu YOKOHAMA.

The second trip, April 20-May 1, took me to southern and western Japan. The itinerary included Kobe (Dr. Shigeru KUMANO of Kobe University and Dr. Ryozo SETO of Kobe College), Iwaya Marine Biological Station on Awaji Island (Dr. Sachito ENOMOTO, Dr. Hideo OHBA), Kyoto University (Prof. Isamu UMEZAKI, Dr. Tetsuro AJISAKA, Dr. Yoichi YOSHIDA), Kagoshima University (Emeritus Prof. Takesi TANAKA, Dr. Hiroshi ITONO, Dr. Tadahide NORO), Kagoshima Prefectural Fisheries Experimental Station (Dr. Iwao SHINMURA), and the Marine Biological Station of Shimane University at Oki Islands (Mr. Mitsuo KAJIMURA). I gave a seminar on *Codium* at Kyoto University and discussed the research of various graduate students there and at Iwaya Marine Biological Station and Kagoshima University. I collected at Hanaze near Kagoshima and at Kamo,

1) Editor's note: This report was submitted by Dr. Silva at the conclusion of a visit to Japan (March 23-May 23, 1986) sponsored by the Japanese Society for the Promotion of Science. It seemed of sufficient interest to Japanese phycologists to warrant publication in *Sôrui*, and Dr. Silva was pleased to agree.

Oki Islands.

The third trip, May 8-16, was to Hokkaido, where I visited the Department of Botany in the Faculty of Science of Hokkaido University at Sapporo (Emeritus Professors Yositeru NAKAMURA and Munenao KUROGI, Prof. Tadao YOSHIDA, Dr. Hiroshi KAWAI, Dr. Michio MASUDA), the Institute of Algological Research of the Faculty of Science of Hokkaido University at Muroran (Dr. Masakazu TATEWAKI, Dr. Kazuo KASAHARA, Dr. Taizo MOTOMURA), the Faculty of Fisheries of Hokkaido University at Hakodate (Prof. Tomitaro MASAKI, Dr. Hiroshi YABU, Dr. Yuzuru SAITO), the Usujiri Fisheries Station of the Faculty of Fisheries, Hakodate (Dr. Hirotoshi YAMAMOTO), the Hokkaido Institute of Mariculture at Shikabe (Dr. Takashi FUNANO), and the Hokkaido Hakodate Fisheries Experimental Station (Dr. Shoji KAWASHIMA). At Sapporo, I presented a seminar on the taxonomy, distribution, and ecology of the marine algae of San Francisco Bay. At Muroran, I collected with a small group of students. I discussed the research of graduate students at Sapporo, Muroran, and Hakodate.

In addition to these three trips, I spent two exceptionally profitable days at Toho University, Funabashi (Mr. Makoto YOSHIZAKI, Dr. Kazuyuki MIYAJI).

With regard to the first goal of my stay in Japan—obtaining sufficient material and distributional data to allow me to complete my study of Japanese *Codium*—it turned out that my personal collecting was useful only in a general way and that I was dependent upon existing collections, housed in various institutions and waiting to be studied. There were four treasure troves of *Codium* collections, which the curators have generously shared with me, providing more than enough material for the projected monograph: Toho University at Funabashi, the National Science Museum in Tokyo, Iwaya Marine Biological Station, and Kagoshima University. (I had previously received an unusually fine series of specimens collected by Mr. KAJIMURA from the Oki Islands and the San-in coast of Honshu.)

With regard to the second goal of my stay in Japan—strengthening professional contacts between the University of California at Berkeley and Japanese institutions—the success has been overwhelming. Berkeley has a long tradition of playing host to Japanese phycologists, extending back to the late Prof. Yukio YAMADA, who worked there in 1928 and 1929. Since World War II, fourteen Japanese phycologists have studied or conducted research at Berkeley for periods ranging from two weeks to two years. Personal contacts having been made with numerous graduate students and young faculty members during my stay in Japan, the tradition seems likely to continue.

The most time-consuming academic activity during my stay in Japan was the reviewing of manuscripts prepared by Japanese phycologists. The reviewing process included criticizing the research and its presentation as well as putting the English version into an idiomatic form. During my visit, several Japanese phycologists expressed their reluctance to submit manuscripts to international refereed journals because of anticipated language difficulties. Much research of international significance is being published in Japanese journals of very limited distribution, often in Japanese. To maximize the effectiveness of Japanese research, a national program designed to help authors prepare their manuscripts for submission to international journals not only seems warranted, but to have high priority. The difficulty of finding editors who know the subject matter in addition to knowing how to write effectively is worldwide and suggests the need for academic programs to train such personnel. Many persons are able to carry out excellent research, but few can communicate their results effectively without resorting to external help.

Japan has long been known internationally as a leading center of phycological research. The number of phycologists is impressive, being one of the highest per capita of any nation. The support of so many phycologists

is warranted in a country in which fisheries are of paramount importance and seaweeds are socially, diatetically, and economically significant. From the beginning, Japanese phycology has been largely concerned with marine macroalgae, but in the last two decades there has been diversification into microalgae, whose study has been greatly facilitated by the development of the computer and of such new techniques as transmission electron microscopy, scanning electron microscopy, microspectrophotometry, and immunological analysis. The need for research on microalgae continues to increase in proportion to the growth of the Japanese economy. The aqueous environment of Japan, both freshwater and marine, is adversely affected by industrial, commercial, agricultural, and domestic wastes. Microalgae play essential roles in ameliorating the impact of society on the water supply but at the same time can have deleterious effects (such as producing toxic red tides) that are correlated in part with human activities.

I was favorably impressed by the quantity and quality of phycological facilities in Japan. In general, the availability of state-of-the-art scientific apparatus exceeds that in the United States. Most of the buildings are fairly new and appear to be pleasant places to work, but while the marine stations are uniformly spacious, the universities tend to be cramped. Physical facilities of the Faculty of Science at Sapporo are not commensurate with the international recognition accorded the Department of Botany as a major center of research on macroalgae. Like the phycological facilities at Berkeley, they are badly in need of being replaced. (The two institutions have much in common with regard to phycology: they both offer tradition, high standards, excellent faculty and staff, and exceptionally fine libraries, but their physical facilities are substandard.)

Several aspects of phycology in Japan seem especially meritorious. First, graduate students are encouraged to take short courses or seek individual instruction from specialists in other institutions. For example, when I was at the Shimoda Marine Research Center, I met a student from Muroran (Hokkaido University Institute of Algological Research) who was spending several days with Dr. Y. YOKOHAMA learning the techniques of measuring rates of photosynthesis and respiration in macroalgae. As another example, a student from the Tokyo University of Fisheries was at Hakodate when I was there, learning cytological techniques from Dr. H. YABU. Closely related to this praiseworthy practice is the custom for professors to give short courses at universities other than their own. The ultimate result of this interchange of professors and graduate students is an extremely healthful cross-fertilization of ideas.

The second aspect of phycology in Japan that seems especially commendable is the recent development of teamwork, with a group of highly skilled specialists from various institutions collaborating in the execution of a significant piece of research. One of the manuscripts that I reviewed (by M. WATANABE, Y. TAKEDA, T. SASA, I. INOUYE, S. SUDA, T. SAWAGUCHI and M. CHIHARA) on a green dinoflagellate is an excellent example of teamwork[1)].

Still another aspect of phycology in Japan that deserves favorable notice is the extensive network of guest housing and research facilities provided by the various marine and freshwater biological stations.

In visiting the various phycological centers in Japan, I have become aware of the specter of reduced support for basic research in the intermediate if not immediate future. As in the United States, Canada, and every European country that I have visited, high-level decisions to support molecular biology unfortunately seem to entail unspoken and unwritten decisions to reduce support for basic biology proportionately. Such a policy would soon weaken the foundations that support the top-heavy mass of data accumulating from current research in molecular (rather

1) Read at the 10th Annual Meetings of the Japanese Society of Phycology held at the University of Tsukuba on March 31, 1986.

than organismal) fields. It would be a serious mistake to replace retiring faculty members in organismal biology with molecular biologists. The development of high-technology is making possible the carrying out of research at a previously unthinkable level of sophistication and importance to human welfare, but at the same time it is opening new frontiers for research in such basic fields as life-history determination, embryology, developmental and adult morphology, ecology, and taxonomy. Any administrative program designed to strengthen research and teaching in biology should attempt to improve the basic fields while simultaneously promoting the development of the most sophisticated molecular part of the spectrum.

In visiting various herbaria, I became aware of the possible usefulness of commenting on their current status and use. The main purpose of a herbarium is to house the documentation for published research. Just as the results of research should be made available to the international scientific community, so should the documentation. The herbaria of the world can be classified according to their scope: international, national, regional, and local. Local herbaria should confine their holdings to teaching collections. Specimens cited in the literature should be deposited in herbaria that traditionally lend material to other institutions for study by a qualified investigator. In no case should a cited specimen remain in a private herbarium. Phycologists are scattered at institutions throughout Japan. Most of these institutions have had no herbarium until a recently hired phycologist established a collection in his office; moreover, there is no reason to believe that these institutions will maintain their collections of algae so that they will be available to the scientific community 10, 20, or 50 years from now. I encountered several collections that were gathering dust in storage rooms, of no use to any current occupant of the building. Therefore, I should like to recommend that the Japanese Society of Phycology, by educating its members and exercising editorial control in its journal, promote the following policy:

(1) All cited specimens should be deposited in herbaria that either have a tradition for lending material to the international scientific community or lend material at the present time and have good prospects of continuing to do so in the future.

(2) When cited, specimens in private herbaria should be transferred to a herbarium as described in (1).

(3) Collections of algae housed at institutions without organized herbaria or systematic phycologists should be transferred to a herbarium as described in (1).

I have noted that specimens of algae in Japanese herbaria frequently have labels written exclusively in kanji and kana. In order that Japanese collections may be used effectively by foreign monographers, the labels should include a romanized version.

My general impression of Japan is of a nation in the front rank of scientific and technological advance, a nation whose people are bright, industrious, conscientious, polite, and hospitable. There can be no doubt that the economic miracle of modern Japan is at least partly the result of an effective national policy in scientific research and technological development.

**シルバ, P. C.: 日本における藻学—過去・現在・未来—**

日本学術振興会の招きで1986年3月23日から5月23日まで2か月間日本に滞在した。受入れは筑波大学の千原光雄教授で，主な目的は日本産管状緑藻ミル属の分類学研究の実施と日本の藻学者と研究上の交流を行うことであった。3月30日・31日に開催の日本藻類学会大会に参加して招待講演を行った後に，下記の大学及び研究機関を歴訪し，標本資料の調査研究を行うとともに研究者と意見の交換を行った。また二つの大学においてセミナーを行い，大学院生達に研究上の助言を行った。

国立科学博物館，東京大学資料館，筑波大学下田臨海実験センター，東邦大学理学部，神戸大学岩屋臨海実験所，神戸大学理学部，京都大学農学部，鹿児島大学理学部，鹿児島県立水産試験場，島根大学隠岐臨海実験所，北海道大学理学部，北海道大学海藻研究施設，北海道大学水産学部，北海道大学臼尻水産実験所，北海道立栽培

漁業総合センター。

日本は国際的に藻学研究の一つの中心として永い歴史をもつが，現在も研究は活発である。従来からの大型藻類の研究に平行して微細藻類の研究もまた活発に行われるようになっている。

各地を訪問中に幾人かの研究者から成果を国際誌に発表することの難しさの話を聞かされ，英文論文原稿の校閲を依頼された。その数は15に及び校閲に随分時間を費した。滞在中に得た知見と経験から次の諸点の実現を希望する。

1．日本の科学行政は専門分野に基本知識をもち，かつ英語または独語に堪能な編集者の育成に努力を払うべきである。

2．日本の科学行政は編集センターとも言うべきサービス機関を設立し，著者の求めに応じて欧文論文作成に助力出来る態勢をつくるべきである。

3．論文に記述された標本資料は専門分野の情報交換が可能な標本資料館（室）に保管されるべきである。

4．不必要または使用しない標本資料は，例えば国立科学博物館のような管理運営が確立している標本資料館（室）へ納入されるべきである。

5．藻学の研究には，伝統的な手法と新しい分子レベル等の手法とが平行して取り入れられるべきで，いずれか一方を進めて他方をないがしろにするやり方はとるべきでない。

（註）このノートは P.C. シルバ博士（カリフォルニア大学・バークレイ）が日本学術振興会に提出した報告文を少し修正したもので，日本の藻学者にも興味ある文と思われるので，著者の同意を得て掲載した（編集委員会）。