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American Food Plants in China

PING-TI HO
Department of History
University of British Columbia

Since the problem of the introduction of American food plants into China and its significance to botanists and anthropologists have been systematically dealt with in a recent article of mine,[1] I will confine myself here to a brief historical summary of the dissemination of these food plants in China and an appraisal of their effect on China's land utilization and food production. In fact, America's contribution to Chinese agriculture has been far greater than is usually realized by historians and scientists. While it is not possible within a limited space to document the important facts and generalizations, they are based on an exhaustive examination of available Chinese local histories and standard Chinese agricultural and botanical treatises.

The place of American food plants in the history of Chinese agriculture can be better understood after the nature of two major agricultural developments in early-modern and modern China is briefly described. Historically, the core of Chinese agriculture, during the last millennium at least, has always been its cropping system, despite some improvements in agricultural implements and water-control which cannot be called major technological progress. In the absence of major technological inventions such as affected modern western agriculture, the improvement in China's food crops did more than anything else to push the agricultural frontier further from the lowlands, basins, and valleys to the relatively well-watered hills at first and then to the more arid mountains. In retrospect, the first long-range revolution in land utilization and food production in early-modern China was brought about by the development of an ever-increasing number of varieties of early-ripening and relatively drought-resistant rice, consequential to the introduction of the Champa rice from central coastal Indochina at the beginning of the eleventh century.[2] Throughout subsequent centuries the early-ripening rice was responsible for the conquest of hilly regions where the topsoil was sufficiently heavy and rainfall or spring water was adequate. With the development of some extremely early-ripening varieties, which matured between fifty and thirty days after transplantation, and their dissemination in the hitherto sub-marginal rice land during the first half of the nineteenth century, rice culture seems to have approached its saturation in China proper. But some three centuries before the apparent limit in rice culture was reached, various American food plants, such as the peanut, the sweet potato, and maize, which after 1700 were joined by the Irish potato, had been introduced into China and had begun to enable the Chinese, hitherto mainly a plain and valley folk, systematically to tackle dry hills and mountains and sandy loams too light for rice and other native cereals. If we call the conquest of relatively well-watered hills by the early-ripening rice the first revolution in land utilization in early-modern China, the conquest of a large area of dry hills and mountains, still virgin land by about 1700, and sandy soils along the southeast coast and inland rivers by these American food plants can justly be called the second revolution in China's food production. In fact, during the last two centuries when rice culture was gradually reaching its limit and beginning to suffer from the law of diminishing returns, the various dryland food crops introduced from America contributed most to the increase in national food production and made possible a continual growth of population.

The dissemination of American food plants in a country as large and varied as China was necessarily a slower and more gradual process than the late Dr. Berthold Laufer of the Field Museum of Natural History would have us believe. Thanks to the unique body of successive editions of Chinese local histories, of which more than three thousand are available in eastern United States, we can trace the main stages in the geographic propagation of these new food plants rather accurately.

So far as can be ascertained from written records, the peanut was the first American food plant introduced into China, probably by the Portuguese, who arrived in the Canton area in 1516 and subsequently traded at southern Fukien ports and Ningpo, which is within a day's voyage from Shanghai. By the 1530's peanuts were already grown in certain localities not far from Shanghai and attracted the attention of some gentry-scholars. Despite this early debut, it took more than one and a half centuries for peanuts to be extensively disseminated in the sandy loams north and south of the lower Yangtze and in the southeastern coastal provinces. Although before 1700 not a few of the coastal localities had specialized in large-scale peanut and peanut-oil production, sometimes for export to the rest of China, peanuts were not yet a common and cheap food in the southeast, as may be evidenced by the fact that they were regarded as a delicacy and served at formal banquets. By the eighteenth and early nineteenth centuries peanuts made

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[1] "The Introduction of American Food Plants into China," *American Anthropologist*, vol. 57, no. 2, Part 1, April, 1955.

[2] For a detailed discussion of the first long-range agricultural revolution in early-modern China, see my "The Early-Ripening Rice in Chinese History," which has been completed and is ready for publication.

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HARRY J. FULLER, Editor
203 Nat. Hist. Bldg., University of Illinois
Urbana, Illinois

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stematic inroads into the hitherto under-developed estern Kwangtung, including the Leichow peninsula ıd north coast of Hainan island, and other inland uthwestern provinces. On the sandy bars of the ımerous rivers and streams of Szechwan peanuts were own particularly extensively. They were also to be und in a number of localities in central Yangtze prov- ces, such as Hunan and Kiangsi. Thanks to the pea- ıt, the poor and hilly southwestern corner of Kiangsi ıd been transformed into a prosperous area of special- ed farming. In north China, however, save for very w scattered areas, peanuts remained a comparative rity down to the late eighteenth century. A scholar of ntral Yangtze testified in 1787 that "longevity nuts" ›ne of the common vulgar names for peanuts) were a nust" in any formal banquet at the nation's capital, hile today peanuts are a very common food in north hina, even for the poor. Various local histories of opei, the second largest producer of peanuts in twen- ›th-century China, took pains to explain that peanuts ›gan to be planted extensively during the latter half of ıe nineteenth century. It was not until the early twen- ›th century that the T'ai-an area, at the foot of T'ai- ıan mountain, and the localities in the lower Yellow iver alluvium in Shantung became the leading peanut- ›oducing area in China. Throughout the last three nturies peanuts have brought about a revolution in ıe utilization of sandy soils along the lower Yangtze, ıe lower Yellow River, the southeast coast, and numer- ıs inland rivers. Even in the crowded cropping system : some rice districts peanuts usually have a place in the ›tation, because peasants, without knowing the func- ›n of the nitrogen-fixing nodules of the roots of the ›anut plant, have learned that the peanut helps to ›eserve soil fertility. Peanuts are necessarily a secondary op in a large country like China, but China, excluding lanchuria, with an average annual output of 2,800,000 etric tons during 1931-1937, ranks with India as a ading peanut-producing country.

The sweet potato was first recorded in some local stories of Yunnan in the 1560's and 1570's, a fact hich suggests an overland introduction from India and urma. But, it was also independently introduced into ›astal Fukien two or three decades before it was offi- ally propagated by the governor in the famine year 594. Since then it made rapid headway in the south- stern coastal provinces. Ho Ch'iao-yüan, a scholar of ukien and the compiler of the 1629 edition of the istory of Fukien province, and the famous Christian ›ime minister and agriculturist Hsü Kuang-ch'i (1562- 533) were great enthusiasts for this new plant. Its ıusually heavy per-acre yield (only next to rice), its easant taste, keeping quality, and value as an auxiliary ›od, its relative immunity from locusts, its greater sistance to drought as compared with native Chinese ıms, and the fact that it can easily adapt itself to poorer ›ils and hence does not compete with other food crops ›r good land, are among the many advantages sys- matically pointed out by these two scholars. As the ›utheastern coastal provinces were always deficient in ›e and the people were long accustomed to Chinese ıms as a secondary food, the sweet potato suited the etary habit of the maritimers and was welcomed. It ›on became the poor man's staple. In the red rescripts : the Yung-cheng Emperor (1723-1735) officials of ıese southeastern provinces annually estimated the de- ›ee of regional sufficiency and the portion of food im- ›rts in terms of rice and sweet potato harvests. In the ghteenth century the sweet potato gradually spread to l inland Yangtze provinces, among which Szechwan as a leading producer. As China's population was in- easing rapidly after 1700, a series of imperial edicts ıd provincial circulars exhorted the northern peasants › grow sweet potatoes on a large scale, in order to stave f famine. By about 1800 sweet potatoes, in the north : well as in the southeast, had become the poor man's aple. Along the rocky Shantung coast, for instance, veet potatoes accounted for nearly half a year's food ›r the poor. The selling of roasted and boiled sweet ›tatoes by peddlers became a familiar scene in many rge northern cities, particularly Peking. During 1931- 937 China, excluding Manchuria, with an average ınual output of 18,500,000 metric tons, was easily ıe world's largest producer of sweet potatoes. Next to ce and wheat, sweet potatoes are the most important ›urce of food for the Chinese.

Like the sweet potato, maize was introduced into hina through both the overland India-Burma and ıe maritime routes before the middle of the sixteenth ntury. The overland introduction probably slightly ›eceded the maritime introduction. Owing to moun- inous terrain and relatively backward economic con- .tions, maize scored an early success in Yunnan, where- om it gradually spread to Kweichow and Szechwan. y the late eighteenth and early nineteenth centuries, ›rhaps much earlier, many mountainous districts in ıe southwest depended on maize as a primary food op. An exhaustive examination of nineteenth-century zechwan local histories reveals that maize was grown ı practically every county except the lofty mountains f the northwestern corner, with heavy concentration on ıe peripheries of the Red Basin. Despite its early ap- ›arance in coastal Fukien and Chekiang, maize re- ıained relatively neglected partly because of people's reference for rice and sweet potatoes and largely because f the fact that maize competed with native cereal plants ›r good land. Up to 1700, therefore, maize was grown ıostly in the southwest and some scattered districts in ıe southeast. In the eighteenth century, when the angtze lowlands had been entirely filled up, hundreds f thousands of migrants from the over-congested southeast found in maize the key crop with which to tackle hills and mountains of the inland Yangtze provinces. One stream of these migrants went as far as Szechwan and Yunnan, and another stream populated the whole drainage of the Han River, an area which comprises southern Shensi, western Hupei and southwestern Honan. Although the sweet potato was also grown, maize reigned supreme. By about 1800 the most of the once well-forested hills and mountains of inland Yangtze and the Han River area had been turned into maize fields. As the population of these areas grew rapidly, the Irish potato, which made its debut in northern Fukien sometime before 1700, was belatedly introduced and made possible the utilization of mountains too lofty and soils too poor for maize and sweet potatoes. By the middle of the nineteenth century a keen observer testified that "all the deep ravines and secluded mountains have been developed into thoroughfares." The ruthless onslaught on forests and consecutive intensive maize farming brought about serious soil erosion which in turn accounted for the silting of river and lake beds and more frequent inundation of the Yangtze. Although maize was early known to a few scattered districts in north China, its dissemination in the north was a very slow process. So far as can be ascertained from local records, maize was not systematically grown on the low plain of north China until relatively late in the nineteenth century, undoubtedly due to maize's keen competition for land with native cereal crops. In view of the large amount of maize produced by Hopei, Shantung and Honan provinces in modern times, there is reason to believe that during the last hundred years maize has been slowly gaining at the expense of some native cereal crops. The Irish potato, too, has been steadily making headway into the cold regions of northwestern China and Inner Mongolia. During 1931-1937 the average annual output of maize amounted to 6,500,000 metric tons. Maize thus ranks with millet and sorghum as an important dryland crop.

America's contribution to China's food production may best be shown in the changes that have taken place in the internal balance of Chinese agriculture during the last three centuries. Sung Ying-hsing, a foremost authority on traditional Chinese technology, estimated in 1637 that rice accounted for approximately 70% of China's total cereal production, an estimate which may not be an exaggeration in view of the overwhelmingly important role that early-ripening rice had played in the economy of early modern China. In 1931-1937, however, the percentage in total national plant-food production accounted for by rice dropped to 36. This was partly because of the expansion of the area under various native dryland crops, especially when rice culture was approaching its limit, and subsequentially owing to the dissemination of American food plants which in 1931-1937 contributed approximately 20% to the entire estimated plant-food production of China, excluding Manchuria. The long-range effect of American food plants on China's land utilization, food production, and population growth is too obvious to need elaborate explanation.

N. S. F. HIGHLANDS BIOLOGICAL STATION GRANTS

Eleven National Science Foundation Grants-in-Aid will be made for research at Highlands Biological Station, Highlands, North Carolina for the summers of 1956-1958. Applications for awards will be reviewed by the Board of Managers of Highlands Biological Station, and grants will be made on the merits of the research proposals and the qualifications of the applicants. The proposed research must be concerned with the fauna or flora of the Southern Appalachians and may involve any of the fields of biology. Applications will be received from any College or University, must be submitted in triplicate not later than March 1 of each year.

The following Grants will be available: four (4) postdoctoral grants of $500 each, open to advanced investigators; three (3) predoctoral grants of $400 each, open to advanced graduate students capable of engaging in independent investigations; and four (4) grants to graduate students with little experience in independent research, who must carry out their research under direct supervision of a principal investigator.

Application blanks for the above grants will be available about the end of November, 1955. Application blanks and further information concerning the grants may be obtained from the Executive Director of the Highlands Biological Station, Prof. Thelma Howell, Department of Biology, Wesleyan College, Macon, Georgia.

VASCULAR PLANTS OF THE PACIFIC NORTHWEST

The University of Washington Press announces the launching of a 25-year publishing project, *Vascular Plants of the Pacific Northwest.* This extensive flora will include keys, descriptions, and illustrations of the vascular plants of Washington, northern Oregon, Idaho north of the Snake River plains, the mountainous sections of Montana, and southern British Columbia. At least 4,000 species will be described. C. L. Hitchcock, chairman of Botany at Univ. of Washington, directs the project, which will include five volumes of at least 300 pages each. Principal contributors are A. J. Cronquist of New York Botanical Garden, Marion Ownbey of Washington State College, and John W. Thompson, curator of the Univ. of Washington Herbarium, in addition to Hitchcock. This major taxonomic project is being financed in part from funds of the Univ. of Washington, Washington State College, and New York Botanical Garden, in part from an appropriation from State of Washington Initiative Measure No. 171 (concerned with income from liquor licenses), in part by a grant from the Penrose Fund of the American Philosophical Society.

The first volume, *Compositæ*, by A. J. Cronquist, has already appeared. Forthcoming volumes, in probable order of their appearance will be *Other Gamopetalous Families, Leguminosæ Through Cornaceæ, Other Dicotyledonæ*, and *Monocotyledonæ.*

Academic Origins of American Botanists

VICTOR A. GREULACH
University of North Carolina

Botanical education has four main functions: contributing toward the general or liberal education of college students in general, providing background or service courses for students specializing in related fields such as zoology and the applied plant sciences, aiding in the preparation of high school biology teachers, and training the coming generation of botanists. This study is concerned with the last of these functions. Although Knapp and Goodrich (3) have made an extensive study of the origin of American scientists in general the present report provides more specific information about the academic origins of American botanists. A portion of this material has previously been published elsewhere (2).

The information on which this report is based was secured principally by tabulating the college or university from which each botanist listed in the seventh edition of *American Men of Science* (1) secured his bachelor's and doctor's degrees, this formidable task having been made possible by the availability of an NYA student assistant. The task was simplified by not tabulating master's degrees, though this may have been unfair to universities particularly strong at the master's level. Those listed in the volume under their botanical specialty such as plant physiology were included, but those listed as bacteriologists or applied plant scientists such as agronomists or horticulturists were not, except for plant pathologists. It is quite likely that a number of botanists was missed in going through the volume, but the number was probably not large. The 2015 botanists tabulated compare favorably with the 1381 members of the Botanical Society of America, the 2041 botanist members of the AAAS, and the 2079 botanists registered in the National Roster of Scientific and Specialized Personnel, all at the time of the study.

Of the 2015 botanists, 1939 took their bachelor's degrees at colleges in the United States or Canada, 64 at foreign institutions, while 12 listed no bachelor's degrees. For the purpose of this study, our territories and possessions were considered to be foreign. Universities in the United States and Canada provided 1640 of the doctorates and foreign universities 37. Three botanists listed no degree at all, 96 listed only a bachelor's degree, and 239 no degree higher than a master's.

Distribution by Schools. Table 1 lists all colleges and universities represented by 10 or more bachelor's degrees or two or more doctor's degrees. The 51 colleges and universities listed provided 1226, or 63% of the bachelor's degrees, while the 46 universities provided 1605, or 98%, of the doctorates. It is obvious that a very few institutions provide the bulk of our botanists. While Table 1 provides an accurate picture of the origin of our more mature botanists, it fails to provide a complete picture of the origin of all currently active botanists such as would be provided by a study based on the ninth edition of *American Men of Science*.

A tabulation of the graduates of the more productive institutions by decades revealed a marked fluctuation in productivity from one decade to another. Bachelor's degrees previous to 1900 were lumped, and then recorded by decades up through the thirties. Based on the per cent of the total degrees during a decade none of the colleges maintained a stable position, five main patterns of fluctuation emerging. One group, including Nebraska,

TABLE 1.

American universities and colleges ranked as to the number of graduates in botany

A. Bachelors in Amer. Men of Sci.		B. Doctors in Amer. Men of Sci.	
Wisconsin	72	Wisconsin	192
California	56	Chicago	176
Minnesota	55	Cornell	174
Cornell	48	Harvard	100
Nebraska	48	Minnesota	92
Michigan	41	California	84
Chicago	40	Columbia	72
Mass. State	35	Michigan	63
Illinois	34	Iowa State	52
Ohio State	33	Ohio State	51
Iowa State	33	Illinois	50
Harvard	33	Wash. U.	41
Mich. State	32	Johns Hopkins	34
Missouri	31	Pennsylvania	32
Wash. State	30	Maryland	28
Penn. State	28	Nebraska	28
Wabash	28	Toronto	28
Kansas State	27	Missouri	27
Toronto	27	Yale	25
Oregon State	25	Rutgers	23
Stanford	25	Stanford	23
Indiana	23	Iowa	18
Oberlin	23	Pittsburgh	16
Miami	21	Mich. State	14
Syracuse	21	Wash. State	14
Clemson	20	Virginia	13
Columbia	19	Duke	12
Pennsylvania	18	Indiana	11
McGill	18	U. of Wash.	11
DePauw	16	Catholic	9
Utah State	16	Penn State	9
U. of Washington	16	Texas	9
Wellesley	16	McGill	9
Purdue	15	Radcliffe	8
Smith	15	Cal. Tech.	7
West Virginia	15	Purdue	7
Colorado State	14	Geo. Wash.	7
Dartmouth	14	North Car.	6
Texas	14	Syracuse	6
Maine	13	Cincinnati	4
Queens (Canada)	13	Colorado	4
S. Dak. State	13	Louisiana	4
Vermont	13	Kansas	3
Idaho	12	Oregon State	3
Rutgers	12	Vermont	3
Maryland	12	West Virginia	3
Miss. A. & M.	12		
Saskatchewan	11		
Butler	10		
Geo. Washington	10		

Stanford, Toronto and Michigan, showed a marked and rather steady decline. A second group, including Cornell, Indiana, Iowa State, Minnesota and Kansas State had much less marked, but rather steady, declines. On the other hand the third group, consisting of Ohio State, Washington State, California, Massachusetts and Miami, showed consistent, but not marked, increases. The largest group had a definite productivity peak during one of the middle decades, usually the 1910 decade, followed by a sharp decline and in some cases a slight subsequent recovery. This group consisted of Chicago, Michigan State, Missouri, Oberlin, Oregon State, Pennsylvania State, Wabash, Wisconsin and Illinois. The final group included only Harvard and Syracuse. Harvard showed a marked drop to the 1910 decade, followed by a slight but steady recovery. Syracuse showed a marked drop from the pre-1900 period to the 1900 decade, a recovery to the 1920 decade, and a subsequent decline. The remaining colleges as a group fluctuated markedly, their per cent contribution of bachelor's degrees for the five periods being 40, 58, 45, 55, and 58 in order. The dip during the 1910 decade is associated with the peak productivity of Chicago and the other schools in its group during this period.

Among the 15 most productive universities at the doctorate level only Illinois maintained a relatively stable position as regards the per cent of the total doctorates which it awarded. Johns Hopkins, Michigan, Columbia and Harvard showed a rather steady decline, while Chicago declined to the 1930 decade and then recovered slightly during the early forties. California, Ohio State, Iowa State and Maryland showed a gradual but rather steady increase. The final group had marked productivity peaks, Cornell, Pennsylvania, and Washington of St. Louis in the 1910 decade and Wisconsin and Minnesota in the 1920 decade. Cornell also had a secondary peak in the early forties. The remaining graduate schools as a group rose sharply and steadily from only about 4% of doctorates in the 1910 decade and earlier to almost 20% in the early forties, indicating a dispersal of graduate education in botany during this period.

Anyone who is acquainted with the history of botanical education in any of the institutions mentioned above will probably be able to correlate the changes in their relative productivity of botanists during the first part of the century with changes in staff and administrative policies. However, the introduction of graduate work in botany by more and more universities from 1910 on was undoubtedly an important factor in the steady declines, percentage-wise, of the productivity of some of the pioneer graduate schools. An up-to-date tabulation including changes in productivity during the past decade would undoubtedly increase markedly the productivity ranks of such currently active institutions as Duke and California Institute of Technology.

It should be pointed out that a percentage decrease in productivity of graduates does not necessarily mean a decrease in the number of graduates, since there was a marked and steady increase in the total number of graduates with time, which undoubtedly was due both to an absolute increase and to the death of many of the earlier graduates. At the bachelor's level the increase was from 127 in the period before 1900 to 679 during the 1920 decade. At the doctor's level there were only 17 graduates before 1900 and 711 in the 1930 decade.

That a relatively small number of the American colleges provides our botanists is indicated by the fact that while there were about 800 four-year colleges at the time the study was made only 303 of them had graduates in botany listed in *American Men of Science*. Only 88 colleges produced more than five botanists at the undergraduate level. Of the 85 universities offering the Ph.D. degree in at least some sciences 68 had graduates in botany, but only 39 had more than five graduates.

It is significant that, with very few exceptions, the colleges and universities listted in Table 1 have (or at least did have during their periods of productivity) separate botany departments rather than botany courses in a biology department.

Distribution by Type of School. The distribution of graduates by type of school is shown in Table 2. It is evident that the state land grant universities, which have the land grant agricultural college associated with the main university, are the most fertile sources of botanists at the undergraduate as well as at the graduate level. At both levels they have been far more productive than all the separate state universities and land grant colleges combined. This is an indication that this type

TABLE 2.

Distribution of degrees in botany by type of institution, exclusive of Canadian institutions.

Type of institution	Undergraduate: Number of colleges: Total	Undergraduate: Number of colleges: With grad. in botany	Undergraduate: Number of colleges: With over 5 grads.	Undergraduate: Number of graduates in botany	Graduate (Ph.D.): Number of universities: Total[1]	Graduate (Ph.D.): Number of universities: With grad. in botany	Graduate (Ph.D.): Number of universities: With over 5 grads.	Graduate (Ph.D.): Number of graduates in botany
State land grant universities	26	25	23	532	17	16	10	762
State land grant colleges	22	22	18	257	9	9	5	103
State universities	19	18	11	171	11	10	7	141
Private universities[2]	59	29	12	234	34	22	14	577
Liberal arts colleges	360	145	12	410	0	0	0	0
Women's colleges	124	16	3	62	3	3	1	10
Teachers colleges	154	28	0	39	0	0	0	0
Municipal universities	12	3	0	10	4	2	0	5
TOTAL	775	288	79	1815	78	62	37	1598

[1] Number of universities offering the Ph.D. degree in at least one science.
[2] Includes institutes of technology.

of state institution is most favorable for the development of a strong program in botany. Taken as a unit, the various types of state institutions granted 53% of all bachelor's degrees in botany and 63% of all doctorates in botany.

The outstanding productivity of certain liberal arts colleges is worthy of particular note. Although only 145 of the 360 liberal arts colleges had graduates in botany, these 145 colleges granted about 23% of all bachelor's degrees in botany. Even more noteworthy is the fact that the 12 colleges which produced more than five graduates each had a total of 154 graduates, or about 39% of the liberal arts total. The twelve, in order of number of graduates, are Wabash, Oberlin, Miami, DePauw, Dartmouth, Butler, Earlham, Ohio Wesleyan, Bucknell, Ohio University, Wooster and Lebanon Valley. A striking fact is that 11 of the 12 colleges are located in Ohio, Indiana and Pennsylvania. Although Miami and Ohio Universities are technically state universities they are, or at least have been, essentially liberal arts colleges and have been considered as such throughout this study. Although no productivity index like that of Knapp and Goodrich (3) was calculated, these twelve colleges would probably outrank most of the state institutions on this basis. Some of the group are no longer productive, but others such as DePauw, Miami and Butler which are currently active would rank higher in a study based on the new *American Men of Science*. There is little doubt but that the productivity of this small group of liberal arts colleges, as contrasted with the lack of productivity of most colleges of this type, is due to outstanding and inspiring teachers of botany. However, there also seems to be a regional milieu favoring strong undergraduate botany departments and attracting and holding superior teachers.

Women's colleges, teachers colleges and municipal universities are noteworthy for their lack of productivity. Only Wellesley, Smith, Vassar, Mt. Holyoke and Radcliffe among the women's colleges have made a significant contribution, having granted 36 of the 62 degrees in this group, while all the others came from just 11 other colleges, out of a total of some 124 women's colleges in the country. The lack of productivity of municipal universities, which are located in large or medium sized cities, is paralleled by a general lack of support for botany in other types of city universities. With out few outstanding exceptions, most of the universities located in metropolitan centers are either missing from Table 1, or rank relatively low. While many private universities almost entirely ignore botany, those which do stress it have made most significant contributions to botanical education, both as regards quality and number of graduates.

Distribution by Regions. Table 3 shows that the bulk of American botanists have been educated in two regions of the country: the northeast and the middle states (Ohio, Ind., Ill., Mich., Wisc., Minn., Ia., Mo.). These two regions provided 62% of all bachelor's degrees in botany and 83% of the doctorates. However, the northeast ranked rather low on a per capita basis, while the northwest, the far west and Canada ranked high on a per capita basis, along with the middle states. The southwest was by far the most unproductive region at both the undergraduate and graduate levels, on a per capita basis as well as regards number of graduates. Both at the graduate and undergraduate levels there was a chronological trend throughout the period covered toward greater productivity in the other regions, resulting in a percentage decrease in productivity in both the northeast and the middle states. Regional differences are probably less marked now, at least on a per capita basis, than they were at the time of this study.

Summary. A relatively small number of American colleges and universities produced the bulk of the botanists listed in the seventh edition of *American Men of Science.* (1944). State land grant colleges and universities provide the backbone of botanical education at both the undergraduate and graduate levels, the state land grant universities being particularly strong, but significant contributions at both level of instruction have been made by a select group of private universities. A small group of liberal arts colleges has made a remarkable contribution at the undergraduate level though liberal arts colleges as a whole are probably less produc-

TABLE 3.

Regional distribution of degrees in botany.

Region	Number of schools in each region		Number of schools with graduates in botany		Number of schools with over 5 graduates		Number of graduates		Graduates per 10,000 students (1930)	
	Bach.	Ph.D.[1]	Bach.	Ph.D.	Bach.	Ph.D.	Bach.	Ph.D.	Bach.	Ph.D.
Northeast	225	32	84	25	23	14	501	562	14.7	16.5
Middle States	223	20	91	15	23	13	697	805	24.4	28.2
Northwest	69	5	35	4	12	1	218	36	32.9	5.4
Far West	47	8	18	8	6	5	187	146	21.2	16.5
Southwest	54	4	18	3	3	1	52	11	8.4	1.8
Southeast	157	9	43	7	12	3	160	38	12.5	2.9
Canada	25	7	14	6	9	2	124	42	30.0	10.2
Total	800	85	303	68	88	39	1939	1640	19.1	16.2

[1] Universities which granted the Ph.D. in at least one science.

tive as regards botanists than scientists in general. The majority of botanists received both their undergraduate and graduate education in either the northeast or the middle states. The middle states emerge as the strongholds of botany during the first part of the century, but there has been a consistent chronological trend toward increasing productivity in regions other than the middle states and the northeast. Marked chronological fluctuations in productivity of individual colleges and universities can probably be correlated with changes in botany department personnel and administrative policies.

LITERATURE CITED

1. Cattell, Jacques, Ed. *American Men of Science*. Seventh Edition. Lancaster: The Science Press. 1944.
2. Greulach, Victor A. *Botanical Education in Southwestern Colleges and Univerities*. Trans. Texas Acad. Sci. 30:114-120, 1948.
3. Knapp, R. H. and H. B. Goodrich. *Origin of American Scientists*. Chicago: University of Chicago Press. 1952.

Sweden Has Unique Palynological Laboratory

The world's largest collections of pollen and spore slides from plants living and extinct are at the Palynological Lab. at Bromma, near Stockholm. Professor Gunnar Erdtman, head of the Lab., is one of the pioneers in this science, which plays a very important role, for instance, in the petroleum industry and other fields of practical geology.

The Swedish collections contain, among other things, 20,000 slides of pollen of all families of flowering plants. As a pioneer in the field, Professor Erdtman received permission to botanize in some of the foremost herbaria in the world; since the new science has grown so rapidly, such permission is not often granted now for too much handling is injurious to herbarium specimens.

Pollen and spore characters often give good indication of plant relationships. They also provide science with clues to the composition of the plant world as far back as the beginning of the Paleozoic age. Pollen grains and spores from this age are found in coal strata in the earth. Besides giving valuable information for such research palynology is also important in medicine, for example, in the fields of asthmatic and allergic diseases, such as hayfever. Further as a means of merchandise control, the new science is valuable. Professor Erdtman mentions as an example that the presence of pollen grains from overseas in honey labeled domestic would prove that this was not a truthful statement.

The Palynological Laboratory possesses a number of instruments for studying pollen grains in layers thin enough for electron microscopy. The ultramicrotome can cut an object of one millimeter, or 0.04 inch, into 20,000 slices.

Professor Erdtman, who has published an extensive work in English on pollen grains of the flowering plants, is now preparing a palynological volume on conifers, ferns, and mosses.

Sweden also possesses an industrial enterprise for collection and sale of pollen. This undertaking of the brothers Gösta and Eric Carlsson, at Vegeholm, is unique insofar as they can collect and conserve live pollen in very large quantities which is 99.9 per cent pure. These large masses of pollen serve quite a different purpose than does the study of single pollen grains. Scientists, engaged in research into the chemical and medicinal properties of pollen, have shown that besides vitamins and some 20 amino acids, pollen grains contain hormones and minerals.

Scientific research everywhere has been hampered by the difficulty in obtaining sufficient quantities of pollen, but the Carlsson brothers can now furnish the required research material at prices which have been spectacularly reduced. (American-Swedish News Exchange, 630 Fifth Avenue, New York.)

ATTENTION PHYCOLOGISTS

G. W. Prescott, Michigan State University, and his associates W. E. Wade (also of Michigan State), Hannah Croasdale (Dartmouth), and A. M. Scott (New Orleans) have received a 3-year grant from National Science Foundation, beginning August 1955, for a study of North American Desmidiaceæ. Purposes of the study are: 1. to compile for publication the names of all species reported from North America, including those which are to be collected in areas not yet represented in collections; 2. to make chemical analyses of desmid and non-desmid habitats to add to knowledge of factors determining peculiar distribution of desmids; 3. to compare desmid flora of North America with that of other regions to determine generalizations concerning geographical distribution of desmids; 4. to summarize desmid literature and to bring Nordstedt's Index Desmidiacearum up to date; 5. to provide a work of interest and of use to phycologists and limnologists in the U. S. who have depended too long on European works of this kind. Dr. Prescott and associates invite collections of desmids from all regions of North America, especially those for which there are habitat notes available.

New Books

Sprague, George F.—*Corn and Corn Improvement*. Academic Press, New York.

Goodspeed, T. H.—*The Genus Nicotiana*. Chronica Botanica, Waltham, Massachusetts.

Rosendahl, C. O.—*Trees and Shrubs of the Upper Midwest*. University of Minnesota Press, Minneapolis, Minnesota.

Bailey, Irving W.—*Contributions to Plant Anatomy*. Chronica Botanica, Waltham, Massachusetts.

Wagner, Robert P. and H. K. Mitchell—*Genetics and Metabolism*. John Wiley and Sons, Inc., New York.

MESSAGE FROM THE EDITOR

During the Editor's sabbatical absence from the throttle (February through July, 1956), members of the Editorial Board of PSB will bring out the April and July numbers. All manuscripts, personal items, complaints, etc. should be addressed to Harriet Creighton, Dept. of Botany, Wellesley College, Wellesley, Mass., who will parcel out editorial chores among other members of the board. It is hoped that, because of her status as president of BotSoc, Lady Harriet will receive unquestioned obedience from the other board members.

The Editor's alter ego, the Treasurer, again bespeaks your cooperation in paying your dues as quickly as you can after your receipt of the bill for 1956 dues, so that he may complete the major portion of his quaestorial chores before his departure from the Illinois steppes in early February.

MYCOLOGICAL SOCIETY FELLOWSHIP

The Mycological Society of America announces that it will receive applications for the newly established Graduate Fellowship in Mycology. This fellowship will be awarded for 1956-57 and carries a stipend of $750. Eligible candidates must be pre-doctoral students in residence at the institution where they are registered for the Ph.D. degree.

Forms for application may be obtained after January 1st, 1956, from the Secretary-Treasurer of the Society, C. J. Alexopoulos, Department of Botany and Plant Pathology, Michigan State University, East Lansing, Michigan. Applications are due by February 15, 1956.

Committee on Research Grants:
JOHN EHRLICH,
ROBERT M. PAGE,
GLADYS E. BAKER, *Chairman*

LALOR AWARDS IN BIOLOGY AND CHEMISTRY

The Lalor Foundation Program for Faculty Summer Research has announced that it will grant 40 summer awards for 1956 to young facultymen of colleges and universities "to do fundamental research of their own choosing." For 1956, these awards will be for advanced study or research employing chemistry or physics to attack problems in biological sciences. Applicants should be 40 years of age or younger, should have research experience corresponding to the Ph.D. degree and aptitude for science teaching. The awards vary from $900 to $1,200, depending upon the applicant's marital status and site of investigation. Awards may be renewed once. The Lalor Foundation made 29 awards for the summer of 1955, 9 of which went to botanists: R. E. Alston (William and Mary College), C. Ritchie Bell (University of Illinois, now of University of North Carolina), Walter Bonner (Cornell), R. A. Lewin (National Research Council of Canada), G. H. N. Towers (McGill University), J. R. Troyer (University of Alabama), J. M. Ward (Temple University), E. R. Wayford (University of Manitoba), and C. S. Yocum (Harvard).

Young facultymen interested in applying for Lalor awards should write to the Director, Lalor Foundation, 4400 Lancaster Pike, Wilmington 5, Delaware. Final date for receipt of completed applications is January 14, 1956.

RESEARCH REQUEST

I. W. Knobloch, Dept. of Natural Science, the Basic College, Mich. State Univ., East Lansing, has received a research grant from the Society of Sigma Xi to continue his work to compile a list of hybrids reported for the plant and animal kingdoms. Dr. Knobloch would appreciate receiving both published and unpublished lists of hybrids in any group of plants or animals.

Personal

Constantine J. Alexopoulos, Professor of Botany at Michigan State Univ., has resigned that post (as of June 1956) to become Professor and Head of the Dept. of Botany, State Univ. of Iowa, effective at the beginning of the 1956 summer session. Dr. Alexopoulos returned in August 1955 from a year spent in Greece as a Fulbright Scholar at the Univ. of Athens, specializing in the collection and study of myxomycetes. Alex succeeds G. W. Martin as head of the Dept. of Botany at Iowa City.

Max Britton has resigned his professorship at Northwestern University to assume administrative direction of the Arctic Research Program of the Geography Branch of Office of Naval Research, Washington, D. C.

A. R. Davis, 8 years dean of the College of Letters and Science, Univ. of California (Berkeley), became vice-chancellor of the Berkeley division of the university on July 1, 1955.

Jean Lavorel, who recently received the doctorate from the Sorbonne, is spending a year on a Rockefeller fellowship with ~~Eugene Rabinowitch~~ and Robert Emerson at the Photosynthesis Lab. of the Univ. of Illinois.

E. C. Ogden, Albany, N. Y., City Museum, is rewriting Fassett's "Manual of Aquatic Plants."

Harry E. Ahles, Assistant to the Curator of the Herbarium, Univ. of Illinois, resigned that post on Nov. 15 to become Assistant Curator of the Herbarium, Univ. of North Carolina. One of his major professional tasks at N. Car. will be to work with A. E. Radford on the preparation of a flora of that state.

Conrad S. Yocum, recently instructor in biology, Harvard Univ., has joined the Cornell faculty as assistant professor of botany; Dr. Yocum's major interest is plant physiology. David W. Bierhorst, formerly of the Univ. of Virginia, also has been appointed assistant professor of Botany at Cornell in the area of plant morphology and anatomy.