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METHODS OF APPROACH IN TEACHING TAXONOMY[1]

By Professor K. M. WIEGAND

NEW YORK STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY

SOME years ago a questionnaire addressed to taxonomists, plant workers and educators indicated quite clearly a belief that there exists at present a dearth of taxonomists, of taxonomic teaching and also a lack of appreciation of the subject. While the replies to these questionnaires easily indicated the need for taxonomy in the various fields of plant study, and in biology in general, the reasons for the apparent failure of the subject were not so apparent. In fact, many reasons were given and with varying emphasis. I was at that time a member of the committee issuing the questionnaire and have been much interested in the matter ever since.

[1] Read before the Systematic Section of the Botanical Society of America at Pittsburgh, December, 1934.

It is undeniable that taxonomy has been unpopular for the last several decades. Among the many contributory reasons often mentioned are the following: (1) Lack of available instruction; (2) deficiencies in type of instruction; (3) lack of openings for employment in the profession; (4) lack of well-paying positions as an ultimate goal; (5) dearth of students with a "taxonomic mind"; (6) reputation of taxonomy as an unimportant branch of botany; (7) lack of appreciation of one's taxonomic work by others; (8) lack of sympathy with the unstable condition of nomenclature and group limits; (9) difficulty of pursuing taxonomy away from taxonomic centers; (10) a more detailed training to become a good teacher of taxonomy than is necessary in other branches of botany. These

reasons are varied enough to suit any one. When boiled down they mostly lead to a single one, a lack of appreciation of the importance of taxonomy. This, however, seems to be an incorrect view-point if we judge from the replies to the questionnaire that were received from every branch of so-called "applied" botany—agronomy, pomology, vegetable gardening, forestry, horticulture, plant breeding, plant pathology, etc., and also from persons interested in general culture.

There is no doubt that the general upheaval in nomenclature has reacted unfavorably on the popularity of taxonomy. Those who can not see in this a step in the transition to a more accurate and scientific nomenclature, and most non-taxonomists can not, must necessarily be prejudiced by the apparent wanton activities of the nomenclatorialists. Likewise the widely divergent practices concerning group limits have reacted unfavorably on the non-taxonomist. The "splitters" and "lumpers" certainly have had something to do with dampening the enthusiasm of the student.

But a more important reason is historical. Taxonomy was the earliest phase of botany to receive development. Until about 1890, in this country, it was almost the only phase to receive attention. Then came to the front physiology, morphology and particularly ecology, each representing a very interesting and important mass of new information about plants and, what is more important, presenting new points of view. These fields became at once popular. The pendulum swung to the opposite extreme, taxonomy was taboo. The old botany was looked upon as trivial, unimportant and dealing with the dry-bones of plants. The taxonomist lost caste and indeed had difficulty in maintaining his own self-respect. Like most cases of this sort the pendulum swung too far. Its correct position when at rest should be somewhere between the two extremes. It is now apparently in the process of swinging back to this mean, but as yet the movement has not gone far, though the swing has undoubtedly begun.

But another factor is playing an important part in helping to create the erroneous evaluation of taxonomy, namely, a wrong understanding of what this branch of botany really includes. A very common impression, expressed in varying detail, is that it concerns simply the classification of objects, in this case chiefly dead plants. The taxonomist, it is said, is continually shifting dried plants around first into one category, then another, after the manner of a picture puzzle or a game of solitaire, largely for self-entertainment and with no important objective. When not shifting plants he shifts names for amusement, having developed in connection with his plant nomenclature a new and entertaining, though at times difficult, game. So engrossed does he seem to have become in his various games of change that the layman is willing and glad to leave him alone. I was not a little disturbed in a recent scientific meeting at a statement made by a certain speaker to the effect that in certain genetical studies he was getting minor peculiarities which, though of much real importance, were not of interest to the taxonomist who must necessarily be concerned with putting his plants in categories, and these variations did not readily fall into categories and therefore had no place in taxonomy, so that the taxonomist, not knowing what to do with them, was inclined to ignore them entirely. I was all the more disturbed since as a taxonomist over a considerable number of years I have never looked at taxonomy in this way. It is my belief also that by far the greater number of taxonomists of note have not had this point of view. At the end of each genus in our herbarium is a cover in which unusual specimens are placed that differ from the regular run of specimens for the various species. These specimens are often considered the most interesting in the whole genus, as they bring up problems in variation which are baffling as to origin and significance. Teachers of taxonomy are not wholly without blame for the distorted view-point. Apparently because of the general over-emphasis on classification, many teachers have built their courses around the present accepted classification, often with little emphasis on plants as living objects. Such courses are frequently very dry indeed.

This erroneous impression of taxonomy is doubtless due in no small part also to the two names, taxonomy and systematic botany, which have been applied to it. Originated by the early botanists who were impressed with the need for an orderly arrangement of the growing number of known plants these terms have persisted almost unchallenged, though they represent but one feature of the subject. It can not be too strongly emphasized that in this field of botany we are concerned not simply with classification but with a knowledge of the kinds of plants, their habits and peculiarities. We are concerned with a knowledge of similarities, differences, blood relationship, variation under environmental changes, genetic behavior, adaptability, environmental requirements of light, soil, etc., associations, geographical distribution and geological history. We are concerned, in fact, with knowing plants as living organisms. To be sure, the similarities, differences and relationship between individuals of any large group of objects are best made apparent through classification, but the classification is not the end sought. It is only a means to a better understanding of the kinds of objects concerned. Nomenclature, too, is only to supply us with convenient

and useful handles in dealing with plants. In human society a primitive desire of the individual, and also a very useful desire, is to know his associates. He is not concerned primarily with classifying his fellows, but desires rather to know their trade, family history, personal peculiarities and experience—and their names too as a means of identification and reference. To be sure, he soon unconsciously classifies—for he thinks of people in categories—the various trades and professions, people of various mental traits, and the like, but here again the classification is simply to aid him to a better grasp of the peculiarities of the individual. We often ask the question: "Do you know Mr. X?" And the reply frequently is, "Not really, I know him by sight only"; which implies that we unconsciously assume that "knowing a person" means more than simply the ability to call him by name. Knowing plants likewise means much more than the ability to call them by name. Looked at in this light, knowing the kinds of plants becomes very fundamental, and is both broad and deep. Thus it is too in industry. A contractor is supposed to know his materials, so also is an engineer or an architect. This does not mean the ability simply to call an object by name, but also to know its properties and how it will behave under different conditions. Why, then, should not a botanist know his materials?

The real taxonomist then, as I see it, is not interested primarily in classification or in nomenclature. He is interested in *knowing plants,* in knowing the kinds of plants.

It is very unfortunate that we possess no name for this branch of botany when viewed so broadly. A suitable term would greatly help to set us right. Professor L. H. Bailey has indeed, in designating his recently published series of papers, spoken of these as essays on the "kinds of plants," and has employed the Latin expression "gentes herbarum"; but the Latin word "gens," though otherwise fairly appropriate, has been used in so many modified ways that its use again would be very confusing. There is, however, one other Latin word that indirectly signifies race or kind, and which was used frequently by the older botanists in this sense, namely, *stirps.* This word too is easily combined with *logos,* making the word stirpology.

Stirpology then becomes the science of knowing the kinds of plants. While the beginner would not be expected to make use of much technical knowledge contained in the various scientific phases of botany with which he may not yet be acquainted, this would not be true of the specialist. He would make use of taxonomy, for the vast number of kinds of plants must be classified in order to be understood, as would be necessary with a very large number of any objects. He would also make use of phylogeny, geography, physiology, morphology, anatomy, embryology, cytology, genetics, ecology and all other angles from which plants may be viewed. Stirpology would not displace any of these phases of plant study, but simply shift the emphasis from the subject in the abstract (as for instance physiology), to its application to the individual at hand. A stirpologist would have before him a certain individual plant. He would view this as a living individual to be known from all points of view. He would be interested in its function, its structure, its history, its adjustments to its environment; but first of all he would desire to know its name and its place in the scheme of things with reference to its relatives, facts contributed by taxonomy and phylogeny.

Thus viewed, it seems to me stirpology becomes a very important and fundamental phase in the study of plants. Most of our so-called taxonomists, I believe, are more or less definitely stirpologists, not concerned with classification alone, though some may be that narrow. I present this new term with much hesitation, as our science is full of terms already, but it does seem to me to be a term very much needed.

But this is not all. The taxonomist's method of approach, as well as his view-point, has been criticized. It is quite necessary to make the subject a living one, clearly demonstrating both its practical and scientific value. Classification, nomenclature and similar formal features should not be over-emphasized, but rather should be presented as an aid in understanding the plants themselves. The view-point of knowing plants as completely as possible should be kept constantly in the foreground.

But as I see it there is another problem connected with the question of approach. One school apparently holds that greatest interest among students is created by a course in which comparative morphology, phylogeny and general classification are stressed, with group identity, nomenclature and species identification reduced to a minimum, thus giving the student a view of the value and scope of the subject as a science. The other school would proceed "psychologically," following as nearly as possible the natural sequence by which the individual acquires knowledge of a group of objects as he proceeds from childhood to maturity. It is suggested that in such ontogenetic development a person first recognizes individuals, then species, and only later, larger groups and broad generalizations. Usually his is first-hand knowledge arising from a familiarity with the actual objects, and not abstract information about them. As applied to taxonomy it would mean the stressing first of field work and identification, with information about the plants, such as habit, habitat, uses, etc., while only later would gen-

eralizations regarding relationship, group limits and classification be stressed. Where time is not restrictive, two courses, one introducing the student to the subject after the second plan, followed by a more advanced course emphasizing morphology, phylogeny, the broader groups and relationships, would seem ideal. It will probably be found that many of those advocating the first method really received their own initial interest through the second method, often in pre-college days.

The replies to our questionnaire also indicated a conviction that the psychologically proper time to interest youth in taxonomy is between the ages of 10 and 15 years. During that period young people are strongly interested in knowing things, and the collecting instinct, too, is strong. Later this interest wanes, to be replaced by more philosophical, abstract, emotional and idealistic interests. An interest in plants aroused in childhood often becomes permanent and intensified in later life. It was noted that a majority of the leading taxonomists had their introduction to the subject during this early period. The study of taxonomy should begin therefore in the upper grades and in high school. In scouting, particularly, there is an opportunity to begin the study under the most favorable conditions of outdoor programs, in summer when plants are growing. It is clear that if instruction is given at this period it must be after the second method.

In some respects I have seemed perhaps to have painted a rather gloomy view of taxonomy. While undoubtedly many of these points are serious ones, the outlook is not too dark. A spirit of optimism is found among most of those interested in the subject. The appreciation of taxonomy has greatly improved in many of our colleges. Classes show increased enrolment, and there is some indication of an increased demand for teachers. We are on the verge of an awakening, I think, to the importance of taxonomy in practical and cultural training.

OBITUARY

CHARLES LORING JACKSON[1]

BY the death on October 31, 1935, of Charles Loring Jackson, Erving professor of chemistry, emeritus, in Harvard University, American chemistry has lost one of the pioneers in chemical education and research in this country. At the time of his death he was the oldest as well as the senior officer in the university. He was born in Boston, Massachusetts, on April 4, 1847, and was a lifelong resident of that city. The son of Patrick Tracy Jackson, 2nd, a cotton manufacturer and merchant, and Susan Mary Loring, on both sides he was descended from long lines of distinguished Massachusetts citizens.

His preparation for college was obtained in private schools. In college he elected all the meager offering in chemistry of that time, and after graduation in 1867 became lecture assistant, with free tuition as his recompense, to Professor J. P. Cooke, who was still engaged in his single-handed struggle to create a chemistry department in the college. In April of the next year he was appointed "regular" assistant in chemistry, with the stipulation that Professor Cooke was to "teach him to be a chemist." Although he held this position for three years, and then, at the age of twenty-four, was appointed assistant professor, this arrangement did not entirely fulfil its promise. His time was largely occupied in teaching and running Cooke's elective course in qualitative analysis, the only course in chemistry with laboratory work at that time. In addition he served as storekeeper, "giving out the apparatus and keeping the accounts," and also to a considerable extent as janitor, "making up the reagents, filling the bottles and keeping them in order," so that his opportunities for study were restricted to odd moments which he could seize between duties. Weakened by an attack of rheumatic fever, in 1873 he decided to take a year's leave of absence for study in Europe. There at first he studied inorganic chemistry and inorganic analysis under Bunsen at Heidelberg, then organic chemistry under Hofmann at Berlin. This was a most important period in his career, for although he had never studied organic chemistry before, in a short time, as he himself states, he "lost his heart to organic chemistry and was ever after faithful to this love." The decision to devote himself to investigation in this subject resulted in his spending the following year in Berlin under Hofmann, and when he returned to Cambridge in 1875 he had the fine record of eight published papers to his credit.

In 1881 Jackson was promoted to a full professorship and from 1897 to 1912, when he resigned because of ill health, he was Erving professor of chemistry. From 1894 to 1903 he was chairman of the division of chemistry. During nearly all his service in the university he was a proctor, residing in Gray's 5 from 1868 to 1871 and in Holworthy 11 from 1871 to 1918.

As a teacher Professor Jackson is associated almost entirely with Chemistry 1. This was the first course in descriptive inorganic chemistry involving systematic individual laboratory practice for the students to be offered in Harvard College. He gave the course

[1] Minute on the life and services of Charles L. Jackson presented to the Faculty of Arts and Sciences of Harvard University.