

## SOME REMARKS CONCERNING THE TEACHING OF TROPICAL SYSTEMATIC BOTANY

by

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In the African tropics is a general need and, I believe, increasing demand for field and laboratory workers in forestry, agriculture, and horticulture who possess some specialized knowledge of, and training in, systematic botany. Many members of this congress are, as a part of their official duties, charged with teaching students. It may be useful to devote some time of our meeting to a consideration of tropical systematic botany as a subject matter for study and tuition.

In the Netherlands — and I presume in many other countries — students arriving at a university have no idea of the scope and possible importance of systematic botany, both to purely scientific research (geography, geology, pedology, morphology, phylogeny, etc.) and to matters of direct economic issue (crop selection and improvement, forest management, biological approach to plant-diseases, etc.).

The methods of observation and correlation which govern plant systematical research were in the past, and appear to be in the present, perfectly suitable for further progress and synthesis of botanical (biological) knowledge and for applied use in practice.

In schools where young people are educated preliminary to a study at a university, systematic botany is very rarely taught. Insofar as natural history («science») appears as an item on the program, teaching is mainly directed towards various, often rather disconnected, phenomena in the life history of animals or plants. A little anatomy, some physiology

and a bit of genetics are added. Zoology is, as regards systematics, in a slightly better position than botany, because the orders and families of animals often receive some general attention, but the larger and smaller taxa of the plant-kingdom are, as such, almost entirely neglected.

Although it is not difficult to explain this neglect — there are various reasons which need no further discussion now — it might seem desirable that a change in the attitude of teachers as regards systematic botany would make itself felt.

Modern systematics is — as always — first of all concerned with the morphology of the plant. That discipline is the base for the delimitation of taxa and I am firmly convinced that in the future, as in the past, morphology will continue to direct classification. However, the teaching of morphology obviously will not rouse a lively interest among the majority of pupils. It is, in its initial stages, purely descriptive and, moreover, deals as a rule with plants (or taxa) which the listeners do not know at all or which are unfamiliar at best. The store of knowledge and insight of beginning students simply is inadequate to appreciate and judge the possible meanings of the morphological details they are confronted with. In addition, if teachers feel at all obliged to devote some time to systematics, they will as a rule not trouble to disguise that they consider systematics of secondary importance and interest.

When students so conditioned arrive at the university, they are not inclined to choose systematics as a main subject of study. When teaching university students, one is faced with the problem how to overcome this initial indifference in addition to the usual difficulty of directing and keeping the student's interest until it is sufficiently strong to make him realize what plant systematics actually may mean to him as a field for practical and theoretical research. The present developments in Africa inevitably lead to a demand for plant-scientists with a thorough systematical training. A balanced management of the plant cover, a reasoned utilization of the potentialities of the available species as regards forestry, agriculture, industry, and medicine requires schooling in plant systematics, which means in this case a conscious effort to obtain as fully a knowledge of the plants and their way of



life, particularly as regards properties which are peculiar to the taxa under study, as can be achieved.

It might be said that the study of plant systematics first of all is based on observation. Unbiased, repeated and close observation obviously is indispensable for any student of problems connected with natural history in general and taxonomic botany offers an excellent and many-sided opportunity for training, but this point, by itself, is not a convincing argument to draw students to plant-systematics.

However, modern systematics, while recognizing the necessity for the most accurate summation and correlation of all morphological data obtainable, demands more. Not only the shape but also the functioning of the organs of a plant, its life habits and life cycle, its relations to its living and dead environment, briefly, all facts, whether morphological, geographical, anatomical, or biological in the widest sense, are desirable data to the systematist because they form part of the pattern of characteristics that delimit a taxon. To-day plant taxonomists are convinced of the logical consequence that if natural affinity is to be measured by (homologous) similarity, it is necessary to trace similarities and differences in all possible ways, in the living as well as in the dead plant. This evidently leads to a synthesis of the knowledge of each taxon and this may, on one hand, result in a more natural plant system, but certainly is also most conducive to research for non-systematical purposes.

It appears that plant systematics is the first base from which all botanical research must start—because it is necessary to have a name and a circumscription for the plant taxon under consideration—and also is the natural centre or the synthesis of all kinds of acquired information concerning each taxon.

It is easily understood that this approach to plant systematics thoroughly affects the method of teaching. During the past, say a hundred years, teaching was almost entirely directed towards a morphological picture of the several taxa students had to be told and to know about. The majority of students, even students in biology, judged these lectures to be tedious. I think their judgment was sometimes forgivable or at least understandable. At present, when teaching, the mor-

phological (descriptive) aspects may not be omitted but can be presented in a different light. Morphological training ought to be largely shifted to practical laboratory courses. As regards detailed morphological accounts of taxa not available for practical laboratory work by students, the handbooks of to-day supply well arranged and ample information. On many occasions students may be safely referred to them. Apart from these supplements to teaching, morphology can now be explained and presented to the audience in a frame of biological (functional) information. Systematics at present ought to be taught with a view to picturing the plant (taxon) as a living being, recognizable and distinguishable by its morphological characters (to be reviewed during the lecture), which are made a part of life phenomena and connected with the plant's environment.

Teaching systematics along these lines requires a much wider knowledge of the teacher than was necessary in earlier periods. It also commands the interest of the student audience far more effectively than would seem possible when delivering an address concerned only with morphological characters. Lectures of the latter kind are to be reserved for advanced botanists.

Although teaching systematics in this way can nowadays be tried and brought into practice better than before — because the outlook of systematics has changed and because the store of factual data has become so rich and diversified that a teacher may build his lecture in various ways so as to make its contents morphologically and biologically interesting — there is nothing new in this method of teaching.

LINNAEUS wrote his *Methodus*, an «appropriate introduction to any modern work on the methods and procedures» of teaching taxonomy, already in 1736 (see Karl P. SCHMIDT's translation in the 2nd volume of STEARN's facsimile edition of *Species Plantarum*, 1959). Briefly LINNAEUS advocated, when teaching, consideration of the following points:

1. Survey of names (generic, specific) for the taxon.
2. Classification, present and historical.
3. Descriptive data, differentiating between main and lesser characteristics; erroneous ideas.



4. Survey of life cycle, biological data, geography, distribution in relation to climate.
5. Relations between man and the taxon.
6. History of its discovery; amusing and pleasing historical traditions; selected poetical references.

This abridged list of Linnean advices is perfectly satisfactory guidance to the method for teaching plant systematics. At present there is one item that can be added and which is a powerful aid graphically to demonstrate the points one wishes to explain. It is the use of colour slides or dias.

The photographic technique of our day is so far advanced that it has become possible to photograph all parts of the plant in detail and in colour. Colour photographs tend to exaggerate the colours and the contrasts between colours. This is, from the teaching point of view, a distinct advantage as the photo may show the characters under discussion more clearly demarcated than when actually observed in a dissection of a living plant.

My practice is to show numerous colour slides of few plants as an aid to oral teaching. I believe that it is not very useful to show during lectures a series of colour slides made of a large number of different plants. In the memory of the onlooker they will hardly stick as clear pictures of plant characters proper to certain taxa, to be kept in mind. It seems far more preferable to me to select one or two examples in a taxon of some size or isolation (genus, family) and to follow in detail by means of a series of slides the characters of the flower, fruit, seedling, and possibly leaves, hairs, pollen, etc. Such series can be differently composed. If obtainable, the following sequence is often satisfactory: 1. plant from a distance as part of the vegetation; 2. habit, plant from a short distance; 3. flower, as a whole, preferably from various distances; 4. inflorescence (in bud, build of infl.); 5. inflorescence (in flower); 6. flower as a whole (repeated); 7. floral parts (selected details, some repeated); 8. fruit (as a whole); 9. fruit (ripe); 10. seeds (eventually detailed, section); 11. some picked details of fruit and seed (repeated); 12. leaves, stipules, bark, buds, etc.; seedling (various stages of germination).

To demonstrate the characters of a taxon a series of 20–50 slides may be devoted to one single plant. When repeating certain points by means of another slide, it is advisable to show the subject every time from a slightly different angle. This tends to emphasize the position and shape of the shown characters to the onlooking students.

It is not necessary to point out that first of all a suitable photographic equipment is required to bring this aid to teaching systematics into practice. Considerable time and effort is required of the teacher to have the photos made in the right way as no professional photographer is able to select the important details himself, or to decide on the best angle for the photo. Coöperation between a teacher and a photographer usually will yield the best results.

For teaching purposes at Wageningen, Laboratory for Plant Systematics and Geography of the University for Agriculture, section tropics and subtropics, more than 5000 colour slides are now at our disposal. It is a good start. A fully adequate set for the teaching of tropical systematic botany as a general student's course (for which I think 90 lectures annually could be sufficient), I estimate at about 4000 slides, provided that they be carefully selected from the general set.

#### DISCUSSION

J. LÉONARD — Le brillant exposé de Mr. DE WIT n'est assurément pas en dehors de nos préoccupations, nous avons à assurer notre relève!

Le professeur de systématique doit être lui-même un systématicien actif et non un théoricien. Il doit lui être possible d'intéresser les étudiants à la systématique en leur montrant combien celle-ci est devenue une science de synthèse et combien est passionnante la recherche des corrélations entre caractères de morphologie, de palynologie, d'anatomie, de cytologie, etc.

F. N. HEPPER—The presentation of the colour photographs of taxonomic details is most impressive and all possible methods should be used to interest students in taxonomy. Regrettably there is a divorce between university botanical depart-

ments and most national herbaria. It must always be remembered that a taxonomist must essentially deal with type specimens, which will for the most part be found only in the major herbaria. In order to use these he must be familiar with herbarium specimens, literature, etc. This experience should be obtained on university herbaria, but then there should be co-operation between the universities and national herbaria. Such co-operation exists at the British Museum and at Kew for a student to study during the long vacation. (There is also a special course at Edinburgh for those interested in taxonomy.) Vast numbers of taxonomists will never be produced, or for that matter are needed, but the stimulation of interest by a practical method such as this is invaluable in the training of potential taxonomists whether he eventually goes to a major herbarium or teaches in a university or school, for he in turn will teach others.

C. F. A. ONOCHIE — I am very much impressed by the beauty of the pictures shown by Dr. DE WIT. One rarely finds complete examples to illustrate lectures in taxonomy. Very often, at a certain moment, flowers or fruits required for demonstration are lacking. By photographs carefully produced we can get over this problem and I think they open up great possibilities.