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The Future of Automatic Identification Methods for Higher Plants*

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BACKGROUND

In order to foresee the future of any new technique we have to keep in mind the possible users and the advantages it has over other techniques.

In the case of identification of higher plants the techniques available are: the keys published in Floras, Revisions, Monographs and other similar written sources; or the "matching method", when a herbarium is available and the higher taxa (family and genus) are known; the third possibility is consultation of expert plant taxonomists. There are other procedures to identify plants (local names, photos, checklists, etc.) but they should be considered as variations of those already mentioned.

The users of the techniques available for identification of higher plants may be divided in three groups. The first is the layman who is interested in learning the name of a given plant for practical reasons, e.g. in the case of a poisonous plant or a wild flower for his garden. The second is the professional person who must know the name of the plant for his own work (e.g. an agronomist who needs to identify a weed; or a lawyer a narcotic plant, etc.). The third is the professional botanist who studies plants and must know their names; in this case I am referring not to plant taxonomists, but to other botanical scientists.

All these users will have to follow any of the identification techniques available. It is quite clear to me that the techniques available have proved to be very effective only for those areas where the necessary publications are available,

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where herbaria exist and are available and when the time of the existing experts for this purpose is not a limiting factor.

The main problem emerges when these techniques or facilities are not available. This may be the case in most parts of the world, where floras need to be described, where monographs and revisions are lacking, and where local taxonomic expertise is nil or heavily involved in other projects. Another problem we have to solve is the need for faster and more efficient methods of identification. It is obvious to many of us that this is a great problem and deserves more attention in the near future. The number of precise identifications of plants is increasing very rapidly. In Mexico last year we had more consultations at the National Herbarium than in any previous year in its history; the same can be said of the year before last. Many land-use projects, ecological studies, environmental impact statements etc. need help with plant identification but our capabilities are far behind their requests.

I do not know how general our case is, but from informal conversation with other colleagues it seems that it is a widespread situation.

For this reason it is obvious to me and my colleagues in Mexico that one top priority is the production of means of identification (Floras, Revisions, Monographs, checklists) as quickly as possible to discharge the heavy consultation load on the few individual taxonomists.

Close attention has to be given to the areas or groups of plants of economic importance, or regions that are in danger of destruction with the consequent extinction of biotypes or species.

A topic of great concern is the education of new botanists who will help to bring closer the solution of the many problems concerning the knowledge of our Flora.

For these and other reasons (Gómez-Pompa and Nevling, 1973) a computerized Flora Program of the State of Veracruz has been started to explore new, faster, and more efficient ways of producing a Flora. During the development of the program we have considered, on several occasions, the possibility of developing automatic identification facilities within our computer system.

AUTOMATIC IDENTIFICATION TECHNIQUES FOR HIGHER PLANTS

It is clear that the problem does not lie in the software for computer identification: there are programs and packages of programs available for this purpose (see chapters by Morse and Pankhurst, this volume) that have been tested on many different groups and no major problem seems to appear. It is also clear that these procedures will evolve to produce more efficiency, as it has been demonstrated

by Pankhurst (1972) in his simple but sophisticated method of data capture. It is also important to mention that hardware is not an obstacle, as every day these facilities are more and more widespread and their costs, through time-sharing, are of lesser importance.

For all these reasons we have been watching the development of the field of automatic identification for the Flora of Veracruz Program. At the same time we are testing these methods to implement future specific projects. It has been decided that our program will have some pilot projects in this line, setting some priorities according to the demand for identification. What seems more useful to our program is the use of automatic methods as an aid to key construction.

I believe that automatic identification methods for higher plants will play a secondary role, on a worldwide basis, as a general scheme for identification of plants. They may play a fundamental role in the process of speeding up the development of Floras by contributing to key construction. They should also play a fundamental role in routine identification of taxonomic groups of economic importance and of local plants of special interest (e.g. those in experimental stations, biological reserves, etc.).

The most important restriction for general use of these methods will be the amount of time available for data gathering and input into a computer system. The data may be obtained from local Floras (or monographs, etc.) which may turn out to be a duplication of effort because they already have built-in identification techniques. Furthermore, and if these publications are not available, in the process of description of a new Flora (or Monograph, etc.) for automatic identification, it may be more generally useful if the end result is a written product with identification keys; although, in this last case, it may be advisable to have the new descriptions in such a form that they can be used in automatic identification. This could be done through a computer terminal or by means of facilities to reproduce outputs to help in the identification procedures, such as the production of card decks (polyclaves) for field use, e.g. the sample shown by Pankhurst (this volume).

On the other hand, the lack of computer facilities may be a great handicap for the implementation of these methods. For this reason the techniques may be confined in the future to large institutions having heavy public demand for identifications.

In spite of all these problems it seems to me that the future of this field in the identification of higher plants will be of primary importance because of the great need for documentation of the diversity of plants in their natural environment that humankind is destroying at an alarming rate. I cannot predict the future of these methods, but I am sure that they already have their place in

the biological sciences, and that we have in our hands a valuable tool to be used intelligently.

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