REFERENCES

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SHORT COMMUNICATIONS[1]

FLORA OF VERACRUZ PROJECT: AN UPDATE ON DATABASE MANAGEMENT OF COLLECTIONS AND RELATED INFORMATION

Summary

The newly implemented curatorial type database system for the Flora of Veracruz project (Veracruz, Mexico) is described. The system consists of a main database containing over 80,000 entries from collections made in Veracruz, housed in several herbaria, and accessory bases containing a species checklist for Veracruz, standardized author abbreviations, and geographic localities in the state. The system permits on-line data entry or multiple access consultation, and is also used for the production of herbarium labels. Distribution maps are prepared automatically using the latitude and longitude provided by each record.

When the Flora of Veracruz was initiated in the mid-1960's (Scheinvar and Gómez-Pompa, 1969; Scheinvar et al., 1967) only a very few centers were experimenting with methods for the creation and management of curatorial type databases (e.g. Beschell and Soper, 1970; Crovello, 1967; Gómez-Pompa and Squires, 1969; MacDonald, 1966; Rogers, 1969; Squires, 1966). The Flora of Veracruz system as it operated during the initial stages of the project and its envisioned expansion was described by Gómez-Pompa and Nevling (1973), although at that time the application of electronic data processing methods to taxonomic problems was subject to controversy regarding its practicality or desirability (Shetler, 1974).

Since then great progress has been made both in computer technology for database management and in the acceptance of these methods by taxonomists. According to a recent estimate, at least nine curatorial databases currently contain more than 50,000 entries, excluding botanical gardens and arboreta (Pankhurst, 1984). Curatorial systems have been implemented throughout the world in areas as diverse as Colombia (Forero and Pereira, 1976) or South Africa (Morris and Glen, 1978; Gibbs Russell and Consalves, 1984). More specifically, in the Flora of Veracruz, the entire information processing system has been redesigned to permit greater ease in data entry, as well as more flexibility in data recovery.

As originally conceived, the Flora of Veracruz system would consist of files devoted to bibliography, collections in herbaria and species checklists. Together they would help to forward the basic objective of the project: the inventory and description of the plant species present in the Mexican state of Veracruz. Although the database pertaining to bibliography on taxa found in Veracruz is no longer actively maintained, the other two bases have been expanded and improved upon. A fourth area, which will not be presented here, is being explored through the creation of floristic databases for the automatic description and identification of plant taxa.

Currently, the main database for the Flora of Veracruz contains information from the labels of plants collected in Veracruz housed in several herbaria, and is complemented by independent databases containing a list of taxa and synonomies, author abbreviations and geographic localities within Veracruz.

Today's system (designed by L. Giddings) uses a Digital VAX-11/780 and adaptations of the Digital Form Management System. Implemented in early 1983, it permits on-line data entry, multiple access consultation, the production of specimen labels, and the automatic preparation of distribution maps.

The system complements and contributes to the formal description of the different plant families found in Veracruz. Each family is treated in a separate publication or fascicle containing dichotomous keys, illustrations, distribution maps, detailed morphological descriptions and related information.

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[1] This section is intended for short articles dealing with methodology and new techniques.

Although the fascicles are devised and printed by traditional methods, their preparation is coordinated and consistent with the computerized elements of the project.

The different aspects of the system and procedures now used in the Flora of Veracruz for handling data from herbarium labels are described in the following sections.

Collections

Label processing.—The database containing duplicate label information from approximately 80,000 different collections forms the backbone of the Flora of Veracruz system. Complete collections have been recorded and are kept up to date for the herbaria at the Instituto Nacional de Investigaciones sobre Recursos Bióticos (XAL) and the Escuela Nacional de Ciencias Biológicas (ENCB). The collections in the National Herbarium (MEXU) at the Universidad Nacional Autónoma de México are partially included, and will be completely integrated into the databank by late 1985. The Veracruz holdings in the Gray Herbarium (GH) and Arnold Arboretum (A) at Harvard University, the John G. Searle Herbarium (F) at the Field Museum of Natural History, the Herbarium of the Royal Botanic Gardens at Kew (K) and the British Museum (Natural History) Herbarium (BM) are represented in part. Future plans are to continue incorporating all new information from incoming specimens at MEXU, ENCB, and XAL.

Standard forms, essentially unchanged throughout the history of the project (see Gómez-Pompa and Nevling, 1973), are used to record the information from specimen labels. Only new collections are included in this process. When the presence of the data corresponding to a particular specimen is confirmed for the database, only the additional herbarium having a duplicate collection is noted.

The recorded information is later standardized and compared with the current checklist of species. It is then entered in the computer via a form projected onto the terminal screen. To avoid errors in both scientific names and author abbreviations, the operator may choose to consult the checklist and enter the correct name and abbreviation automatically. The system will also repeat information from the previous label if desired, and provides a unique number for each record.

A similar procedure is followed for the preparation of labels for new specimens collected in Veracruz.

The system permits the incorporation of material that has not been identified by assigning the specimens to a fictitious taxon. After the specimen has been adequately determined or if a determination has been altered, the corresponding record is recovered by its individual number or by the collector's name and number, and the necessary modifications are made. Changes on the actual specimen sheet are made by hand.

A recent innovation now permits the production of labels in upper and lower case characters on a letter quality printer. Labels may also be printed simultaneously or separately on a line printer if desired. This constitutes a major improvement in the quality of the resulting labels, which had been criticized in the past.

Consultation.—The database may be consulted on-line through a series of simple queries. As can be seen in Fig. 1, the user chooses the primary and secondary fields in the record format that are to be searched, and then specifies whether all or only certain parts of each record are to be reproduced. In addition to supplying the information requested, the system automatically maps the points corresponding to the specimen records consulted. This portion of the system operates using the information on latitude and longitude provided by most of the labels, and a digitized version of the state of Veracruz. Its implementation in July 1984 will now permit the compilation of a computer mapped Flora for Veracruz.

The database has had particular value in the preparation of preliminary checklists of the species present in certain areas (delimited by municipalities), in the preparation of complete lists of all the collections included for specific taxa, in locating potential collection sites for certain plants, and in providing generalized services to the public. The system is open to consultation by any interested scientists. Inquiries should be sent to the project base at the Instituto Nacional de Investigaciones sobre Recursos Bióticos at Xalapa, Veracruz.

Checklist

A complete checklist of the species reported for the state of Veracruz is maintained in a separate file. Both correct names and common synonyms are included in the list and are cross-referenced. Each species is assigned a code which consists essentially of the first five letters of the family name, three digits corresponding to the generic number in Dalla Torre and Harms (1900–1907) or to an arbitrarily assigned number when the genus is not included in this work, three digits designating the species, an

Las claves disponibles son:

0	Registro	(7 espacios)	11	Primaria – Secundaria	(1 espacios)
1	Clave	(14 espacios)	12	Forma Biológica	(15 espacios)
2	Familia	(7 espacios)	13	Anual – Perenne	(1 espacios)
3	Nombre Científico	(60 espacios)	14	Fruto	(7 espacios)
4	Estado	(6 espacios)	15	Flor	(7 espacios)
5	Municipio	(15 espacios)	16	Colector ó Colectores	(50 espacios)
6	Localidad	(15 espacios)	17	Colecta	(7 espacios)
7	Latitud	(10 espacios)	18	Herbario	(13 espacios)
8	Longitud	(10 espacios)	19	Apellido de Colector (ind)	(19 espacios)
9	Altitud	(10 espacios)			
10	Tipo de Vegetación	(15 espacios)			

. . . Normalmente se puede escribir ! para salir ó @ para volver a comenzar . . .
Pongase número de primera clave > 2
Pongase límite inferior de clave > Ranunculaceae
Su límite superior aceptable >

Pongase número de segunda clave > 5
Pongase límite inferior de clave > Coatepec
Su límite superior aceptable >

Los campos elegibles a escribir se presentan a continuación:

1	registro	(7 esp.)	cl.	0	2	clave	(14 esp.)	cl.	1
3	familia	(7 esp.)	cl.	2	4	género – especie	(60 esp.)	cl.	3
5	país	(3 esp.)			6	estado	(6 esp.)	cl.	4
7	municipio	(30 esp.)	cl.	5	8	localidad	(50 esp.)	cl.	6
9	mapa	(5 esp.)			10	latitud	(10 esp.)	cl.	7
11	longitud	(10 esp.)	cl.	8	12	altitud	(10 esp.)	cl.	9
13	tipo de vegetación	(15 esp.)	cl.	10	14	primar. – secund.	(1 esp.)	cl.	11
15	ambiente	(25 esp.)			16	suelo	(15 esp.)		
17	asociada	(15 esp.)			18	abundancia	(15 esp.)		
19	forma biológica	(15 esp.)	cl.	12	20	tamaño	(10 esp.)		
21	anual – perenne	(1 esp.)	cl.	13	22	fruto	(15 esp.)	cl.	14
23	flor	(15 esp.)	cl.	15	24	nombre local	(15 esp.)		
25	fecha – colecta	(10 esp.)			26	usos	(15 esp.)		
27	determinado por	(15 esp.)			28	colector	(50 esp.)	cl.	16
29	número de colecta	(7 esp.)	cl.	17	30	otros datos	(15 esp.)		
31	herbario	(13 esp.)	cl.	18	32	duplicados	(3 esp.)		

A continuación pongase los números de campos en orden de imprimirse. Pueden haber 35 en total. Se teclea retorno después de cada número. Cero sin nada termina la lista. R significa repetir los campos de la última consulta de esta sesión. T es para todos los datos en orden, y E imprime casi todos los datos en un formato especial.

> 4
género – especie
> 7
municipio
> 8
localidad
> 28
colector
> 29
número de colecta
>

Fig. 1. Sample dialog for consultation of the database on collections. The user chooses the primary and secondary fields to be searched, and then specifies whether all or only certain parts of each record are to be reproduced.

additional space for three digits identifying subspecific categories and a final three number series (not visible to the user) designating the status of the name as correct or a synonym. The list is usually generated in two versions for routine work: alphabetical order starting with family and alphabetical order directly by genus.

The entire checklist is revised annually for improvement and correction. Individual groups are modified as the corresponding families are formally treated for the Flora of Veracruz. New taxa are verified and added to the list as necessary.

In addition to providing a flexible up-to-date listing of the species known for Veracruz, the checklist serves as the standard for the spelling of scientific names both for the collections databank and for any publications of the Flora of Veracruz. At this time the list contains over 9000 correct names.

Author Abbreviations

All the full names belonging to the authors of species names and the abbreviations used in the Flora of Veracruz are contained in a small database. The over 850 names and abbreviations may be seen

or printed in complete or partial lists or may be consulted on an individual basis (for example, by soliciting the full name associated with a particular abbreviation or vice versa). Most of the abbreviations correspond to those in the Draft Index compiled at the Kew Herbarium (Halliday et al., 1980).

Localities in Veracruz

A database similar to that used for authors is maintained for all known cities, towns and named settlements in Veracruz. The map number (based on an internally used division of the Mexican national defense maps 1/100,000), localization in latitude and longitude, and climate type according to Soto (1983) is recorded for each community. The system may be used interactively to consult information about a specific locality or group of localities, but is usually used to produce complete lists by community, climate type, etc. for use by collectors.

Other Applications

The same system is also being implemented for the Flora of Yucatan and may be initiated for other regions of Mexico. In Yucatan, initial data entry and printing of herbarium labels is carried out on microcomputers. The main database is stored in the larger computer at Xalapa, Veracruz.

In Mexico, where the natural ecosystems are undergoing rapid modification and where there also exists a shortage of trained botanists within the country, the efficiency of computerized methods can be particularly important. The ability to rapidly document the presence of certain species in a given area or to provide a preliminary characterization of the vegetation can be vital in influencing governmental decision makers.

It is also important in providing services to the general public. The justification of scientific activities from a practical point of view is especially critical in a developing country where funds for research are limited. Thus a database on collections may be used to provide the specific sites where potentially useful species may be found, lists of woody plants growing in a certain area susceptible to exploitation as ornamentals, etc. The Flora of Veracruz database has even been used to investigate cases of poisoning by local plants.

We hope that the system will serve as a model for other projects within the country as well, and in that way contribute towards the creation of a national Flora.

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MICROWAVE DRYING OF HERBARIUM SPECIMENS

Summary

The authors propose the use of a microwave oven as a new rapid procedure for herbarium specimen drying. A comparison between the new method and the usual procedure is presented and discussed with regard to external appearance and morphological characteristics.

The drying of herbarium specimens is a time-consuming procedure when performed at room temperatures. For normal plants in a dry environment, 3–4 days are necessary, and succulent plants can even take two weeks. In all cases a large amount of absorbent material is used because it must be frequently changed and, consequently, much work is required.

During long drying periods, succulent plants or water-rich parts of plants can even rot and mold. Moreover, several water dependent surface reactions, such as leaf-browning or flower color changes, occur because of slow water diffusion with slow drying methods. The final appearance of the specimen can be affected by such changes.

For these reasons more rapid drying methods are desirable and, in fact, several authors studied heating devices where plants could be dried at temperature between 50 and 200°C. In particular, Loria and Menitsky (1977) proposed a conventional heater, properly ventilated, to reduce the drying time 8–12 hours, with good results.

In 1974 Hasek and Wilson proposed the use of a microwave oven as chemical sample drier and in 1975 Abu-Samra et al. experimented successfully with this device for the wet-ashing of organic samples.

Among various heaters, microwave ovens appear to be suitable heat sources because of their heating uniformity and the rapidity of drying. However, in 1983 Hill pointed out that the use of a microwave oven to treat herbarium specimens for killing infesting insects, as proposed by Hardin (1981) and Hall (1982), may cause irreparable danger and loss of information for subsequent research work because of damage to seeds. Further, Philbrick (1984) suggested other possible damage at the morphological and macromolecular level. These alterations, according to the above authors, could be a serious limitation in taxonomic or cytotaxonomic studies.

We dried several kinds of plants—*Anemone hortensis* L., *Ranunculus ficaria* L., *Trifolium medium* L., *Cyclamen europaeum* L., *Malva silvestris* L., *Malva moschata* L., *Sinapis arvensis* L., *Papaver rhoeas* L., *Daucus carota* L., *Foeniculum vulgare* Mill., *Antirrhinum majus* L., *Linaria vulgaris* Mill., and *Spinacia oleracea*—in a commercial microwave oven (Philips Cooktronic mod. 830) 2450 MHz and with variable power from 70 to 700 W.