

EPIDENDRA, THE BOTANICAL DATABASES OF JARDÍN BOTÁNICO LANKESTER AT THE UNIVERSITY OF COSTA RICA

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Introduction

It may seem somehow out of line to present a new system of botanical databases in the context of a meeting on orchid conservation, for two main reasons. Even though botanists have been rather slow in upgrading to the use of electronic databases (with some early controversy regarding the desirability of the application of electronic data processing methods to taxonomic problems as a whole, see *i.e.* Shetler 1974), the dissemination of plant information via the web has grown steadily in recent years. So, why *another* system for electronic retrieval of botanical information? On the other hand, the role of natural history collections data is perhaps better defined today as for its two-fold relevance in research and education than with respect to the practicality of information in conservation efforts. Can a system for electronic interchange of plant information be of real use as a conservation tool?

I hope that trying to answer these two questions may explain the reasons for creating EPIDENDRA, the botanical databases system of Jardín Botánico Lankester (JBL) at the University of Costa Rica, as well as illustrate some useful characteristics of this project.

Access to the sources

For centuries, scientists have amassed information on plant life, describing and naming more than a quarter million of species on the planet. When organized in the format of floras, information included relevant data not only about morphology, but also on distribution and other aspects of plant biology. It is true that from the personal computer in his office, in any part of the world, a botanist may instantly link today to a number of powerful electronic databases, avoiding the time to correspond and to travel to

botanical libraries and herbaria in order to gather the requested information, an activity that only a few decades ago would have taken months (Allen 1993). However, it may be useful to understand which kind of information is mostly available in actual databases, and how we can improve information access.

If one accesses today the TROPICOS database, launched in 1983 by the Missouri Botanical Garden (which has been a leading institution in computerizing plant information), he can find a system dealing with tens of thousand of plant names from around the world, in many cases cross-referenced with distribution maps and other non-taxonomic information. The system is designed to provide references to plant names, basionyms and synonyms, nomenclatural types, and lists of *exsiccata* for selected regions, allowing botanists to gain ready access to the authors of names, the titles of key publications and, indirectly, to the location of type specimens. This system of references has shown its relevance in floristic projects as the Flora of North America, the Floras of Panama and Mesoamerica, the Flora of Peru and the Flora of China, and it provides daily information for researchers working with tropical floras around the world, including the staff of JBL.

To restrict the field to orchids, the database BIBLIORCHIDEA, now hosted by the Swiss Orchid Foundation and operating under patronage of the University of Basel, represents the largest orchid literature database worldwide, containing most of the existing journal articles, books and preprints on orchids with over 140,000 entries. The database offers a nearly complete system of references to the titles of publications, extending the coverage not only to the original protologues but also to different types of literature quotations (for more details, see Jenny 2007). Numerous, less “institutional” databases, mainly aimed to quick orchid identification via

electronic images, exist on the web, but the quality of the provided information is often not totally reliable, and they will not be considered for the purpose of this work.

One common character of the available tools for electronic retrieval of botanical information is that they provide a system of references, which supposes some facility in the direct access to the sources through libraries and herbaria services. This is often not the case in tropical countries, where facilities are insufficient, if not absent, and where the lack of historical libraries and the relatively "modern" herbaria represent a major obstacle for botanic research when concerned with the retrieval of historical information (Gómez-Pompa & Nevling 1988, Pupulin & Warner 2005).

Some steps in this direction have been made in recent years, through the digitalization of type specimens in several institutions. Noteworthy is the recently completed project of digitalization of the Oakes Ames Orchid Herbarium types at Harvard University. However, it is perhaps interesting to note that the first actions of this project were done in the framework of a cooperative effort between the Harvard University Herbaria and the University of Costa Rica, originally aimed to the digital imaging documentation of the types of Costa Rican Orchidaceae (Pupulin & Romero 2003).

One of the more crucial points to be resolved in order to achieve the goal of an open system for the retrieval of biological sources is the sociological impediment to data interchange, through the protection of copyrights and intellectual property, concerning ownership and ultimate usage of the information. Most of the valuable documents relative to the tropical flora are stored in institutions of the developed countries, sometimes jealous of the historical value of the owned sources. It is curious to note, as Conn (2003) did, that copyrights concerns are vigorously debated when the source collections are presented in a digital format, but not when available as physical collections *per se*. However, the recent agreements signed by the University of Costa Rica with the Harvard University Herbaria and with the Herbarium of the Royal Botanic Gardens, Kew, to digitally document the specimens and the associated data of the orchids from the Mesoamerican region, are an unquestionable step in the right direction.

Conservation data

Natural history collections have always contained a large amount of data providing biogeographic, ecological and biographical information through the labels affixed to the specimens, and they have been considered an indispensable resource for conservation policies, documenting what we do and do not know about the biota (Lane 1996). Nevertheless, while the threatened tropical biota is the major biological concerns of today's humankind, and the need for floristic research in the tropics is greater than in any other time in modern history, most of the global important collections are stored in developed countries. This has been an impediment to a vaster documentation of biological variation, which is required for a full understanding of living diversity, ecosystem dynamics and their conservation. Our question should be if the actual documentation of tropical biodiversity (or orchid biodiversity, to restrict to our concerned topic) is sufficient to help the conservation "movement", transforming floristic research into an actor in the conservation play. The actual figures point toward a negative answer. In a short review of the available records kept in six major herbaria relatively to 350 Costa Rican orchid species, Dressler (1996) found that 78% of the taxa were represented by less than 6 collections. Of those, 20% were based on a single collection, and for 74 species (21%) he can not find a single herbarium specimen in the herbaria sampled. The obvious incongruity is that we do not know the flora of the tropics enough to really orient conservation policies, mainly if we consider that only at most 15 percent of the life diversity on Earth has been apprehended by science, and new species are turning up constantly from the scattered expeditions to rich tropical areas.

The possibility to rapidly document the presence of some species in a given area via the access to reliable electronic data may be essential in influencing decision makers at any level, but once more the quality and efficiency of this documentation is directly associated to the amount of the available information. This quality must be increased not only by a continuous update of distribution records, but also providing more efficient identification and "emotive" aids, like visual databases of specimens, slides, drawings, etc., helping to match the specimen with known taxa. According to

Flecker (2000), the administration of Harvard University granted 12 million dollars to the University Library for a 5-year project aimed to build a digital library infrastructure. However, this is often not the case where funds for research and documentation are limited (as in developing countries), and the justification of scientific activity through the provision of services to the general public is probably critical.

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The past debate on biological databases has mainly focused on the best model to be used in organizing the taxonomic data from literature and other sources to avoid over-simplification and to reflect the elasticity of taxonomy as well as alternative taxonomies (see, i.e., Berendsohn 1997, Conn 2003). Even though the “unofficial” adoption of one or more of the alternative taxonomies can not be avoided in the daily work, taxonomic information may become outdated very rapidly in the tropics, and this perhaps tends to reduce taxonomic decisions in the database system to a minimum. The only alternative would be to build a system and a trained staff which avoid mistakes in the capturing and management of the information, but this would greatly increase the cost of the effort.

The main constraints to the creation and maintenance of biological databases in tropical countries have been reviewed by Gómez-Pompa and Nevling (1988) and I refer to their paper for a critical analysis. It is unfortunate to say that, with the exception of computing technology, most of these constraints have not found positive solutions. However, botanists working in tropical areas have an immense opportunity to improve our knowledge of life diversity and to provide a bridge between systematic research and the general public, incorporating to their source-based systems other data which are not accessible to their colleagues

in the first world. They include field observations on species frequency and natural variation, susceptible habitats, pollination biology, relationships with other organisms, etc. But, foremost, tropical botanists have the still unachieved chance to “portray” biodiversity for the use of the public through *in studio* work, mainly based on digital imaging. Knowing something always makes it more valuable, and only what it is valued will ultimately be saved.

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