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Modern Approaches to Floristics and Their Impact on the Region of SW Asia

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Abstract: Attitudes to floristics have changed considerably during the past few decades as a result of increasing and often more focused consumer demands, heightened awareness of the threats to biodiversity, information flow and overload, and the application of electronic and web-based techniques to information handling and processing. This paper will examine these concerns in relation to our floristic knowledge and needs in the region of SW Asia. Particular reference will be made to the experience gained from the Euro+Med PlantBase project for the preparation of an electronic plant-information system for Europe and the Mediterranean, with a single core list of accepted plant names and synonyms, based on consensus taxonomy agreed by a specialist network. The many challenges – scientific, technical and organisational – that it has presented will be discussed as well as the problems of handling non-taxonomic information from fields such as conservation, karyology, biosystematics and mapping. The question of regional cooperation and the sharing of efforts and resources will also be raised and attention drawn to the recent planning workshop held in Rabat (May 2002) for establishing a technical cooperation network for taxonomic capacity building in North Africa as a possible model for the SW Asia region.

Key Words: floristics, SW Asia, electronic inventory, networking, Euro+Med PlantBase

If we are to protect biodiversity, we must understand it, and to understand it, we must cooperate in a worldwide fashion. Such efforts are essential if the globalisation of Nature is to benefit our society.
Kress et al., 2002

Introduction: the international context

Although frequent resolutions have been passed by congresses and symposia during the past 50 years, drawing attention to the fundamental importance of a knowledge of the taxonomy of organisms for other branches of science and learning and for society, while at the same time lamenting the current state of taxonomic studies and the shortage of taxonomists, little effective action has been taken by governments to alleviate this situation. Recently, however, under the auspices of the Convention on Biological Diversity, the importance of taxonomy and floristic studies has been recognised by the Parties (i.e. the signatory countries), who recognised that the combination of inadequate taxonomic knowledge, the shortage of systematists and the inadequacy of sampling, collections, human resources and infrastructure constituted a 'taxonomic impediment' as regards implementation of the Convention on Biological Diversity.

Largely as a consequence of the process of implementing the Convention on Biological Diversity, the need for taxonomic knowledge as a means of underpinning biodiversity conservation is now widely accepted by governments. For example, a recent report, *What on Earth? The Threat to the Science Underpinning Conservation* (2001), issued by the UK House of Lords Select Committee on Science and Technology concluded 'Taxonomic data are fundamental to conserving biodiversity. Taxonomists are needed to provide conservationists with tools to identify and therefore monitor the prevalence of species, by indicating which species are near extinction and by indicating areas of the world with high diversity that should be conserved'. This involves continuing the inventory of plant diversity and various kinds of floristic studies as discussed below.

The Conference of the Parties (COP) has endorsed a 'Global Taxonomy Initiative' (GTI) to improve taxonomic

knowledge and capacity to further country needs and activities for the conservation, sustainable use and equitable sharing of the benefits of biodiversity. At the Sixth Meeting of the Conference of the Parties (COP) to the Convention on Biological Diversity held in The Hague in April 2002, a programme of work (Box 2) for the Global Taxonomy Initiative was agreed (Decision VI/8). Although as Blackmore (2002) points out, prospects are not good for the first and most fundamental challenge – a global inventory of life on Earth, as called for by some biologists – for plants the situation is more hopeful.

Box 1: Global Taxonomy Initiative

The GTI has been established under the Convention on Biological Diversity to underpin decision making in conservation of biological diversity, sustainable use of its components and equitable sharing of the benefits derived from the utilisation of genetic resources, by addressing:

(a) The lack of taxonomic information on the identity of components of biological diversity in many parts of the world; and

(b) The need to build capacity for taxonomic activity in all regions, but especially developing countries, including reference materials, databases, and taxonomic expertise relevant to the objectives of the Convention on Biological Diversity

A 'Global Strategy for Plant Conservation' (Decision VI/9) was also adopted at COP VI, with a set of targets for the year 2010, including [Target 1]: 'A widely accessible working list of known plant species, as a step towards a complete world flora'. Discussions are proceeding about how to achieve this target but it is certainly easier to produce a global list for plants species than for most other groups of organism, given that so many major floristic projects have been completed in recent years or are well underway (e.g. *Flora Europaea*, *Flora Mesoamericana*, *Flora of North America*, *Flora of Australia*, *Flora Malesiana*), as well as Check Lists for regions or countries such as *Med-Checklist*, *Enumeration des Plantes à Fleurs d'Afrique Tropicale* and *Catalogue of the Vascular Plants of Ecuador*, and global compilatory projects such as the Species Plantarum Project, the Global Plant Checklist Project and Species 2000.

Inventory and floristic studies are only a beginning and it has to be remembered that even for such well-studied groups as the Flowering Plants little is known of the majority of species apart from some basic facts of their morphology and localisation: for most of them, their demography, reproductive biology, breeding system, genetic variability and so on is unstudied. Yet the fact is that for many of the purposes of biodiversity assessment and conservation – for example, in the management of endangered species – information is required beyond identification and description of the species, such as data on the breeding system and demography of its populations.

Box 2: Global Taxonomy Initiative Programme of Work (source CBD, 2002)

The programme of work consists of five operational objectives:

Operational objective 1: Assess taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention.

Operational objective 2: Provide focus to help build and maintain the human resources, systems and infrastructure needed to obtain, collate and curate the biological specimens that are the basis for taxonomic knowledge.

Operational objective 3: Facilitate an improved and effective infrastructure/system for access to taxonomic information; with priority on ensuring that countries of origin gain access to information concerning elements of their biodiversity.

Operational objective 4: Within the major thematic work programmes of the Convention, include key taxonomic objectives to generate information needed for decision making in conservation and sustainable use of biological diversity and its components.

Operational objective 5: Within the work on cross-cutting issues of the Convention, include key taxonomic objectives to generate information needed for decision making in conservation and sustainable use of biological diversity and its components

However, words are not enough and what counts is action on the ground. The challenge for all of us is to ensure that these aspirations and good intentions are translated into effective action. Taxonomists and systematists of all persuasions must ask themselves just how they should react to the alarming situation regarding the continuing loss of biodiversity which is widely reported. Part of the solution depends on the availability of additional finance directly by governments or in the

case of developing countries through mechanisms such as the Global Environment Facility, and other agencies and through aid programmes. However, a significant part of the solution also lies in the hands of taxonomists themselves through more effective planning, better cooperation, better use of existing resources, better targeted projects, and more use of EDP (cf. Heywood, 2001).

Changing paradigms in taxonomy and systematics: the twin need of inventory and phylogeny

It is somewhat ironic that just as governments are beginning to recognise the basic need for alpha taxonomy, as reflected in the CBD and other instruments, the whole field of taxonomy and systematics is undergoing a major reassessment. Enormous changes have taken place in the methodology of systematics in the past 10–15 years through, on the one hand, the widespread application of cladistic methodology (whether pattern or phylogenetic) and the use of molecular characters, and on the other hand, the increasing use of electronic data processing and web-based approaches in floristic and taxonomic work. Even the herbarium has not escaped this period of change and I suspect that in 50 years' time it will be no longer recognisable either in form or in function.

The enormous advantage of molecular taxonomy is of course the high degree of 'objectivity' of the data obtained: unlike morphological characters, there is no ambiguity about their definition. DNA sequences of the chloroplast genes such as *rbcL* and *atpB,* restriction site variation and changes in intron presence or gene order provide useful characters for phylogenetic reconstruction and the data are therefore handled cladistically. Many impressive data sets are available in the literature as a perusal of journals such as *Systematic Botany* and *Plant Systematics and Evolution* will soon reveal and numerous proposals have been made for the revision of currently accepted relationships at the supraspecific level in the flowering plants such as the ordinal classification for the families of flowering plants published by the Angiosperm Phuylogeny Group (APG). While there are still serious problems of interpretation and issues such as congruence of data sets to be resolved, a great deal of light has been shed on the relationships between and within a number of families.

As a result of the increasing use of these techniques, it can be observed that a large part of taxonomists' time is spent either in the laboratory or sitting at computer screens analysing data. Moreover, it is unfortunate that in a number of the papers published in this area a great deal of information is given about techniques and methodology but relatively little about the taxonomic characteristics or biology of the plants themselves (Heywood, 1999). Indications of a putative phylogenetic relationship have become for some systematists more the focus of the research rather than the phenetic characteristics of the plants themselves.

As I have previously commented (Heywood 1999), one of the issues being debated in systematics today is how far the conceptual changes that have been widely applied at the higher taxon level, such as the theory and methodology of phylogenetic reconstruction and the acceptance of monophyly as a necessary attribute of higher taxa, coupled with the use of macromolecular characters, are applicable at the species level and below. With the development of phylogenetic theory, a number of biologists are looking at the boundary areas between hierarchic and reticulate descent relationships, since phylogenetics is a means of analysing relationships in hierarchic systems, and this boundary area therefore represents the limits of phylogenetics (Davis, 1995). Species are groups that fall into this boundary area since they do not contain subunits that are related to each other hierarchically although the relationships between species may be.

What then are we to make of the fact that there is now more confusion in the literature on species concepts than even in Darwin's day? Despite their unique role in both biological classification and biological diversity, there is no universal agreement on how to define a species and the actual named species we handle in biodiversity studies are comparable only by designation not in terms of their degree of evolutionary, genetic, ecological or phenetic differentiation (Heywood, 1994). Today there are currently at least seven or eight different species concepts in use (phenetic, biological, recognition, ecological, cladistic, pluralistic, phylogenetic and evolutionary) and no agreement has been reached on how to develop a coherent theory of systematics at the species level (see the series of papers on species concepts in *Systematic Botany* volume 20, Number 4 1995). In addition, species concepts differ from group to group and there are often

national or regional differences in the way in which the species category is deployed (Heywood, 1991) which make comparisons difficult. As May (1995) comments, 'The varying concepts in different groups, and indeed within a single group, are a major cause of uncertainty intrinsic to all aspects of biodiversity research that use the species as a standard unit.'

In the current debate over phylogenetic species and the use of cladistically defined classifications, the criticism is often levelled at conventional biological classifications that they are imprecise and poorly specified (Langer, 2001). How far is this a serious concern for user communities? Differing species concepts pose problems, as Gaston (1996) notes, from the point of view of biodiversity studies: for example, we need to ensure that for any given higher taxon, the same species concept has been applied when making comparisons of species numbers in different areas. How often is this in fact possible? The fact is that the vast majority of species have been described and recognised using morphological or phenetic criteria. In the light of present circumstances, the magnitude of the task, the availability of resources, the degree of sampling; this is the best that can be done. The answer seems to be that in many cases the level of specification needed by the different user groups is so general that this is not a serious handicap. In other cases, precise measures are needed if meaningful comparisons are to be made.

Consumer demands

One of the major changes in attitudes to taxonomy and floristics has come from increasingly explicit and specific user needs (Heywood, 2001). Taxonomists should be aware of the nature of the demands for information that are being made not only by other biologists, but by policy-makers and planners for the management for sustainability of our environment, and for meeting the demands of a growing world population for food and fuel. The kind of questions that are being asked today by governments concern not just what plant grows where, fundamental though that may be, but, for example, what are the effects going to be on biodiversity (in terms of genes, taxa, ecosystems and agroecosystems, landscapes) of changes in climate, large-scale movements of populations leading to population increase in some areas or decrease in others, and changes in global and regional agricultural and forestry policies; which species can be identified as indicators of biodiversity or ecosystem health? Increasingly, and perhaps this has always been so, taxonomy is seen by many of its users (apart from other taxonomists) as a means to an end.

So, in developing and strengthening the taxonomic base, consideration should be given to the information needs for different activities that depend on taxonomy, e.g., bioprospecting, wild harvesting of species, habitat conservation, sustainable agriculture and the sustainable use of biological resources.

SW Asian region

The SW Asia region is not unambiguously defined, either politically, biogeographically or floristically. It is largely coextensive with what is often called the Middle East or the Near East and as Frodin (2001) notes in his *Guide to the Standard Floras of the World*, it largely coincides with the area covered by Boissier in his *Flora Orientalis.* It is the crossroads where two great floristic kingdoms meet – the Holarctic and the Palaeotropical and, as Boulos et al. point out, all the major phytochoria found in SW Asia extend into surrounding regions or are in fact centred outside the region.

In terms of floristics, it is a region where despite the fact that a number of standard or even landmark Floras have been produced recently such as Flora Iranica, Flora of Turkey, Flora of Cyprus, Nouvelle Flore du Liban et de la Syrie, Flora Palaestina, Flora of Iraq, Flora of Pakistan and (in progress) and Flora of the Arabian Peninsula, much work on the taxonomy and distribution of the plants remains to be done. As Frodin (2001) points out, many of these Floras are essentially prodromi or preliminary accounts of rather poorly known territories.

A summary of the floristic data of this region was prepared for the Centres of Plant Diversity Project by Boulos et al. (1994) as shown in Table 1. It is difficult to calculate the overall total number of species for the region but according to Boulos et al. (1994) it comprises some 23,000 vascular plant species of which 6,700 are endemic to the region. On the other hand, the flora of the Middle East is estimated at 15,000 species by Heller (1991). Figures for floristic richness and endemism are given for individual countries in Table 2. These figures can be compared with 25–30,000 species for the flora of the Mediterranean region.

What then are the needs and prospects for the region? Firstly, as already mentioned, a major desideratum is to complete the inventory of the flowering

Table 1. Floristic diversity in the countries of the Near East and SW Asia (Boulos et al., 1994).

Country	Vascular plant species	Endemic species	% Endemic species
Bahrain	248	0	0.0
Egypt	2121	54	7.2
Iran	8000	1400	17.5
Iraq	3000	190	6.3
Israel	2225	165	7.4
Jordan	2100	145	7.3
Kuwait	282	0	0.0
Lebanon	2600	311	12.0
Oman	1200	73	6.1
Qatar	306	0	0.0
Saudi Arabia	2028	34	1.7
Sinai (Egypt)	984	30	3.1
Syria	3100	395	13.0
Turkey	8650	2675	30.9
United Arab Emirates	340	0	0.0
Yemen	2830	135	4.8
Socotra (Yemen)	815	230-267	28.2-32.7

Table 2. Floristic richness and endemism in SW Asian phytochoria.

Phytochorion	Area (km^2)	Vascular plant species	Endemic species	% Species endemism	Endemic genera
Irano-Turanian	2,400,000	17,000	5100	30	80
Mediterranean	175,000	3-4000	600-800	20	3-4
Somali-Masai	375,000	1800	500	28	16
Sahara-Sindian	3,600,000	1500	100	7	6
Afromontane	60,000	400	55	14	1
Euro-Siberian	160,000	4000	500	12	5
Indo-Himalayan	30,000	1200	50	4	10

plants and ferns and to ensure that the standard Floras in progress are expeditiously brought to a successful conclusion. The second requirement, in common with most other regions of the world, is to consider what system can be put in place to maintain the floristic knowledge up to date and at the same time institute a mechanism whereby associated information can be gathered and stored systematically. This leads us on to considerations of electronic approaches to floristics and taxonomy.

Electronic approaches to floristics

The application of informatics techniques to floristics is beginning to transform the way that taxonomists work in assembling, circulating and reviewing data. After a number of false starts, electronic web-based preparation and publication of floristic and taxonomic projects, in the form of continually updated information systems and databases is beginning to replace conventional time- and information-limited Floras and, to a lesser extent, monographs. This electronic approach will also greatly

expand the range of outputs possible and thereby have a significant effect on improving access to floristic data (Heywood, 2001). It will also encourage an expansion of the fields hitherto considered in floristic projects so that related areas, such as conservation data (cf. Golding & Smith, 2001), detailed mapping, phytochemistry, ecology and phytosociology and reproductive biology, will be included, either directly or by computer linkages. As an example, the Euro+Med PlantBase project will be outlined.

Euro+Med PlantBase

The Euro+Med PlantBase project is highly relevant in this context as it overlaps with the Middle East/SW Asia region. Euro+Med PlantBase is a regional initiative that involves all the countries of Europe and the Mediterranean region. The first phase has been funded by the European Community under Framework V and involves the establishment of structures, the completion of an electronic catalogue of all the flowering plants and ferns of the region, the preparation of the necessary protocols and software, the design of verified summaries ('beads') of information on karyology and biosystematics, conservation, mapping and distributions, and taxonomic revision (Fig. 1). A mechanism for the regional cooperative revision of the taxonomic status of all families, genera, species, subspecies and, where appropriate, cultivars described from the Euro-Mediterranean region has been developed. The organisation of this work will involve specialists from over 50 countries and territories within the region. This revisionary process will result in an agreed taxonomic core, which will be one of the main outputs of the project. Networks of Regional and National Centres, Associated Centres, Taxonomic Centres, Thematic Specialists and Authors have been established throughout the region (Fig. 2).

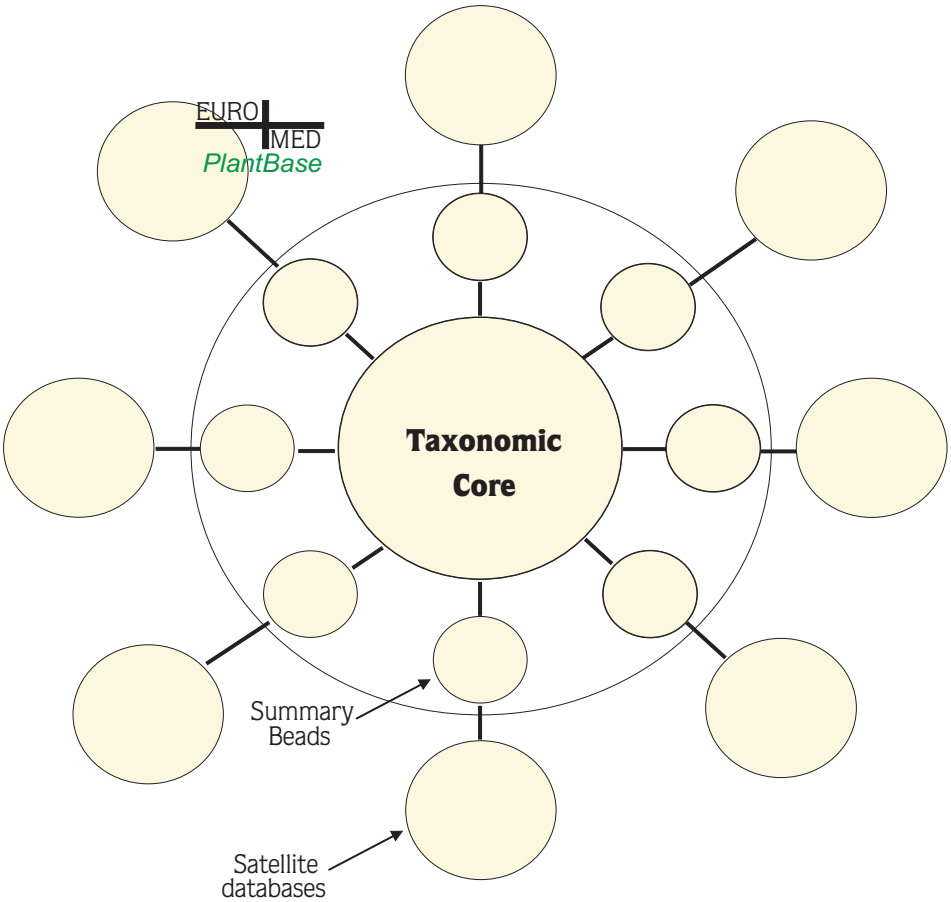

Figure 1. The basic structure of the Euro+Med Plant Base.

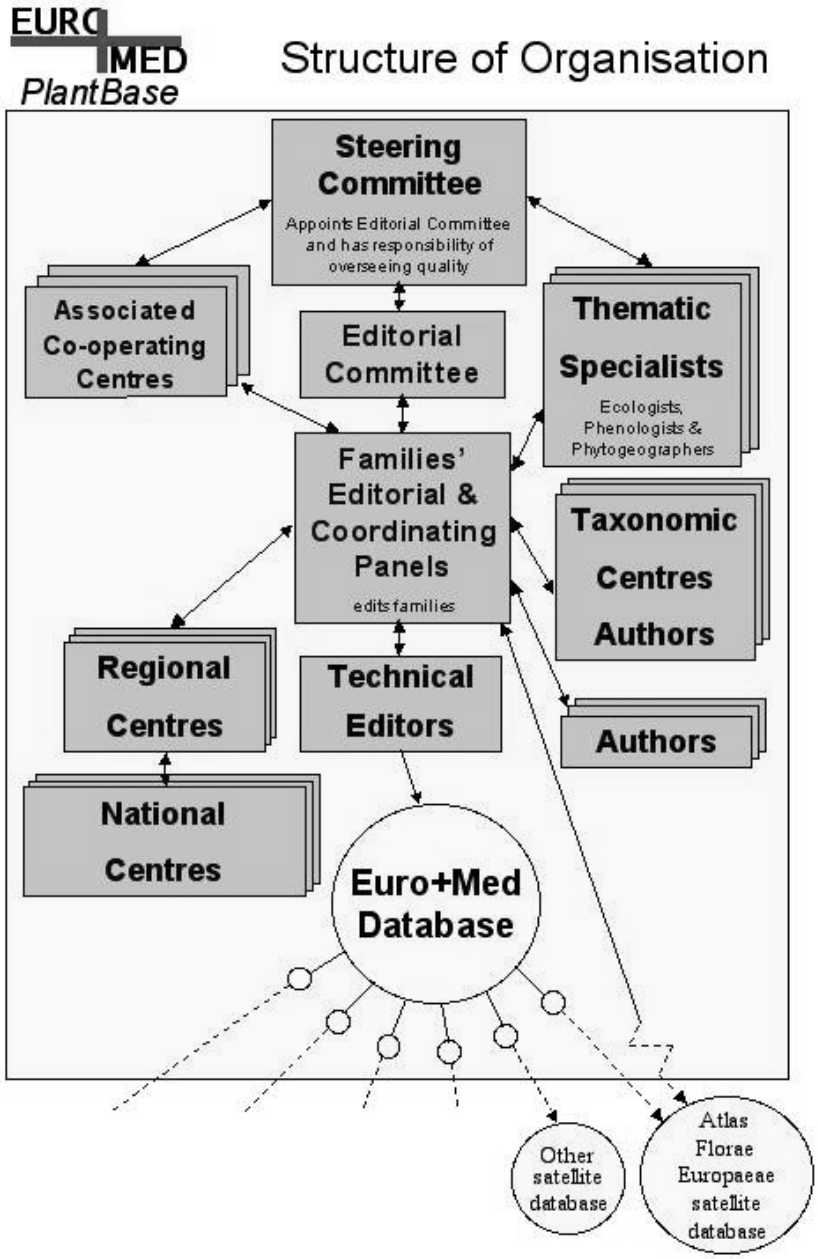

Figure 2. Structure of the Euro+Med Plant Base organization.

The idea of the Euro+Med PlantBase gradually evolved out of a number of earlier initiatives and the changing context of taxonomy and systematics. A key factor was the *Flora Europaea* project that was formulated in the post-war context and aimed at providing a modern synthesis of the enormous diversity of taxonomic information and opinions that was scattered in a 'vast accumulation of literature, published in many places and in a variety of languages, much of which is inaccessible…' The successful publication of *Flora Europaea* lead to a continental view of the flora of Europe – a synthesis and consensus, arrived at after extensive consultation through a network of regional advisers.

On a recommendation of the Joint Committee of the Nordic Science Research Councils (NOS) and of The Royal

Society of London, the Standing Committee of the European Research Councils (ESRC) decided in 1975 to propose the setting up of an ad hoc group in taxonomy. The European Science Foundation gave its full support and the ESRC ad hoc group on Biological Recording, Systematics and Taxonomy was established. A proposal on how to proceed was drawn up by Professors R B Clark and V H Heywood in consultation with The Royal Society and the Natural Environment Research Council. An Interim Report was published in 1977 and the Final Report, *Taxonomy in Europe* (eds. V.H. Heywood and R.B. Clark), in 1982.

These Reports included surveys of the then situation of systematic botany and taxonomy in Europe and recommendations for research priorities and identified a number of research priorities. These latter included for plants:

European floristic information system

Coordination of research and information on the biosystematics of European plants

Extension of the work of the Threatened Plants Committee of IUCN

Check-list of the flora of the Mediterranean basin.

It was decided to unite the first two of these proposals as Project I: European Floristic, Taxonomic and Biosystematic Documentation System (ESFEDS), of an Additional Activity in Taxonomy that was approved by the Assembly of the European Science Foundation in November 1979.

The European Taxonomic Floristic and Biosystematic Documentation System (ESFEDS) project was undertaken principally at the University of Reading and was essentially an electronic compendium of specified fields of information using *Flora Europaea* as a base-line. All the basic data, except descriptions, were extracted from *Flora Europaea* and stored in a custom-designed computerised database (Heywood et al., 1984).

A major component of the project was the design of methodologies for gathering and storing electronically additional data fields on biosystematics, phytochemistry, ecology, phytosociology, cytology, conservation status, illustrations, and literature. Substantial progress was made in this regard before the project had to be discontinued due to lack of funds. In addition, novel methods such as a user-friendly interface for presenting such information were tested.

Check-list production was one of the outputs possible from the database, and lists of taxa and synonyms, with or without additional information, could be produced for any of the 41 European territories. Lists for Albania, Bulgaria, Spitzbergen and the Azores were amongst those that were produced in a format ready for publication. *A Checklist of European Pteridophytes* was the first major updated output to be produced directly from the ESFEDS database (Derrick et al., 1987). In the Preface I wrote 'In offering this checklist to the public we feel confident that a breakthrough has been made in botanical documentation and the time brought nearer when electronically produced, continually updated information will become regularly available as part of the international biological scene'.

The data stored in the hierarchical framework were later transferred to the University of Reading mainframe computer and stored within a relational framework in ORACLE. Later the ESFEDS database was transferred to the Royal Botanic Garden Edinburgh, UK, where it was curated and transferred to PANDORA by Dr Richard Pankhurst. Data from the revised edition of volume 1 of Flora Europaea were incorporated and numerous other technical changes and corrections made to the database.

The ESFEDS database has been widely used since its completion and copies have been requested by institutions and organisations around the world. It provided an obvious starting point for the Euro+Med PlantBase and has now been superseded by the Euro+Med Database.

The essence of the E+M PlantBase is that it is an open-ended electronic database and information system that, unlike a conventional taxonomic publication such as a Flora, is not aimed at producing a single fixed output. It is true that particular outputs are envisaged in phase I of the project such as a synonymic catalogue of the European flora, a first draft catalogue of the flora of the whole of the Euro+Mediterranean region, and samples of taxonomic revisions of selected groups, but once up and running, particular outputs of various kinds and combinations of data can be requested, and of course the data extracted will be as up to date as the database itself.

It combines electronic means of data storage and handling with the essential mechanism of review by specialists of taxonomic, chorological, and other kinds of data and this will be undertaken in due course as a web-based operation. It will depend of course on the

availability of taxonomic specialists to undertake revisions at various levels, either specifically for the project, or through the normal means of publication, and the aim is that when the latter become available the information they include will be included into the database as soon as human resources permit. Thus the perennial problem of Floras and revisions becoming out of date almost as soon as they are published will be obviated.

Of course this approach to taxonomic and floristic compilation is as dependent as the more conventional approaches used hitherto on the availability of continuing finance and it is well known that in most fields of endeavour it is easier to obtain finance for designing and developing databases than for maintaining them. There is no doubt, however, that we can make a much better case for support for such Web-based taxonomic systems than the present approach of long-term, open-ended, conventional, non-electronic compilations that do not necessarily address the needs of users in a timely fashion nor present the information in as approachable a format as possible. The future of a Web portal to access hard data supplied by scientific professionals is as inevitable in the area of plant and animal systematics as it is in other fields of human endeavour.

Problems, some of them quite complex, such as intellectual property rights and access to information and reward systems for contributors to such information systems and databases have to be addressed. Open Web access to valuable content created by others, as Wilson (2001) recently pointed out, 'introduces potential problems of "authority", i.e. ownership, quality control, plagiarism and simple theft'. He goes on to say that 'The transition from traditional paths of data flow to the Web environment will involve basic changes in scientific culture. … Adaptive change required for active disciplinary engagement with the new medium will force significant redefinitions of community objectives, priorities, and also the production of new interactive protocols.' And he concludes that 'Given the long cultural lineage and rich history of plant systematics, movement across the digital threshold will be difficult and probably slow.'

The importance of networking

The Global Taxonomy Initiative draws attention to the desirability of networking and increased cooperation between individuals, institutions, organisations and countries. A recent example that may be relevant for the SW Asian area is the the proposed North African taxonomic network, NAFRINET. A proposal to North African Governments for the establishment of a North African Loop of BioNET-INTERNATIONAL, known as NAFRINET, was produced by a workshop held on 12-16 May 2002, at the Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco. It was organised by the Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco, the Euro+Med PlantBase Project and the Technical Secretariat of BioNET-INTERNATIONAL.

The Workshop was attended by a total of 30 participants: national representatives from each potential NAFRINET Member country, i.e. Algeria, Egypt, Libya, Mauritania, Morocco and Tunisia; two resource persons from the BioNET-INTERNATIONAL Technical Secretariat, UK; one person as Acting Programme Officer - Global Taxonomy Initiative (GTI) of the Convention on Biological Diversity (CBD) Secretariat, Montreal, Canada; a representative from the Secretariat of WAFRINET, the West AfricanLOOP of BioNET-INTERNATIONAL, and observers from IUCN, FAO, OPTIMA, Euro+Med PlantBase and MEDUSA.

The full costs of the workshop were covered by a grant from the UK Department for International Development (DFID).

The goals of the Workshop were to:

formulate a detailed proposal for the establishment of a Technical Cooperation Network (TCN) for taxonomic capacity building in the North African region;

debate and agree on TCN structures to best strengthen capacity building, collaboration and networking among and between member countries and their relevant institutions;

develop a strategic plan for subregional taxonomic capacity building that meets the needs of national sustainable development programmes and National Biodiversity Strategy and Action Plans including:

develop a shared vision for pooling, sharing and optimising subregional expertise, information, records, collections, infrastructure and technologies for the further enhancement of taxonomic capacity in the subregion; and draft programmes of work to meet the identified taxonomic capacity needs of regional and national development and biodiversity management plans,

including the required support for implementation of international environmental conventions, for example, the Convention on Biological Diversity (CBD), the International Plant Protection Convention (IPPC) and other initiatives such as the Global Invasive Species Programme (GISP)

The Workshop participants unanimously recommended that the Institut Agronomique et Vétérinaire Hassan II be the Network Coordinating Institute (NECI). This is also the Regional Centre for the Euro+Med PlantBase project, which looks forward to developing joint proposals with NAFRINET.

The proposals have been submitted to the governments of the NAFRINET member countries for formal approval.

Conclusion

The future development of floristic and taxonomic studies in SW Asia will be greatly influenced by the application of bioinformatics techniques and electronic Web-based systems which will make the gathering and synthesis of data more efficient and facilitate the delivery of products that are timely and tailor-made for the consumer. Such approaches should cover a range of fields such as conservation, biosystematics, plant chemistry, and distribution mapping as well as strictly taxonomic data. Effective networking will also facilitate the process.

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