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EDITORIAL

Welcome to DELTA Newsletter number 10. Response to the new incarnation of the DELTA Newsletter was overwhelmingly positive and has further encouraged the editors to bring together the latest and most informative articles and reports on descriptive taxonomic databases.

In this issue we preview the new INTKEY for Windows application due for release in the coming months. Macintosh users are not left out with an article on the HyperParasite Hypercard stack and an end user's account of using DELTA software on the Mac. Our personal profile is on Richard Pankhurst and includes a list of his publications, Mike Dallwitz has compiled a list of published works which have been based on the use of DELTA, and there are a number of articles on issues relating to the methodology of using DELTA, including a report on Australian attempts to coordinate and support taxonomic work based on this system.

We have received a number of subscriptions, mainly renewals. We are, however, conscious of the difficulties in subscribing to publications in other countries and the need to send cheques etc. in the correct currency. Unfortunately we are not in a position as yet to accept subscription payments either by credit card or personal cheque if outside Australia, and we ask that overseas subscriptions be paid by International Money Order or equivalent. To facilitate this we have increased the period of subscription to three years. Subscriptions are now due and, as a final reminder, anyone who has not subscribed in the last year, or does not do so by September this year, will no longer receive the Newsletter.

In a newsletter of this kind, it is important that subscribers become actively involved in contributing reports on their activities, project outlines, novel uses of the software, available databases or relevant meetings. Articles, suggestions on content, correspondence and technical queries and solutions will always be welcome. They may be sent as paper copy, or preferably on disk as text files or by email.

Alex R. Chapman, Terry D. Macfarlane*, Nicholas S. Lander
Western Australian Herbarium
Department of Conservation and Land Management
PO Box 104 Como, WA 6152
AUSTRALIA

Telephone +61 9 3340500 Fax +61 9 3340515 Email (via M.J. Dallwitz: INTERNET md@ento.csiro.au)

* Based at Manjimup Research Centre, Department of Conservation and Land Management, Brain Street, Manjimup, WA 6258

PERSONAL PROFILE: DR RICHARD J. PANKHURST

Richard Pankhurst, co-founder of this newsletter has long been a major contributor of ideas and inspiration in biological information and identification systems. He is the author of a number of computer programs for taxonomists which make use of the DELTA data format. Richard has supplied the following biographical sketch.

Born in the west of England on the 8th June 1940, I learnt to tell the names of British wild flowers with my parents, who were enthusiastic amateurs. From this I learnt to be curious about the differences between wild plants and to use identification keys at a very tender age. However, a natural bent towards hard science led to the study of maths and physics at school and to the University of Cambridge, where I read Natural Sciences. This actually meant mostly maths and physics again, with a little chemistry and crystallography leading to an Honours degree in 1961. My first experience with a computer was in 1960, using the University EDSAC2 computer, which read all its instructions and gave out all its results on punched paper tape.

My first job was in the British Atomic Energy Authority as a reactor physicist, but after rapid disillusionment, I moved instead to CERN in Geneva, Switzerland in 1963. My first job was then to act as a programming advisor to physicists using a mainframe computer (first an IBM 7090 and later a CDC 6600, with a massive 131K of main store!), whilst learning FORTRAN from a book. This was before there were any university courses in computing. I soon moved in to the systems programming group, and worked on one of the first display units (the central control unit of the mainframe, monochrome text only). Returning to Cambridge in 1967, I joined a research group working on

Computer Aided Design in the Cambridge Computer Laboratory. Whilst at Cambridge a meeting with Max Walters, then in the Botany Department and lecturer in plant taxonomy, led to the idea of writing a program to construct keys. This was begun in 1968 and first published in 1970.

The contact with Max Walters led to a three-year research grant in the Botany Department on computerised identification, which ran from 1971 to 1974. This was a very productive period, and many of the original versions of the PANKEY programs date from that time. These programs used a data format of their own, which had already gone through two versions and a PANKEY format mark 3 drafted by the time I met Mike Dallwitz, but the draft was abandoned in favour of DELTA, since Mike had already created something suitable. This was the beginning of a steady and amicable working understanding between us, which has never been damaged by personal or professional competitiveness or by the vagaries of scientific management. This is not to say we agree about everything! Also, communication has not been helped by being literally at the opposite ends of the world.

In 1974 I moved to London to be the curator of the British Herbarium at the British Museum (Natural History), and to carry on research in taxonomic computing at the same time. This began a long period of stability, but with rather little either by way of computing resources or of active encouragement from management. In 1984 the computing activities had displaced the curatorial duties entirely. Microcomputers were spreading by then, and the importance of databases was beginning to be seen. By then the problem was no longer a question of how to do it (computerised

identification), since those problems had been solved, but the almost total lack of data in a suitable form was what led me on to see databases as the vital research priority.

This was also the time when the possibility of colour images with identification programs was first seen, and this was realised (with some help from the Royal Botanic Gardens, Kew) with the British orchids data set and version 6 of ONLINE. Many other data sets for British flowering plants were created during this period, and the first version of the PANDORA database was written in 1986 (in dBASE3, and rapidly converted to something better).

In 1991 the continuing financial difficulties at the Natural History Museum led to a management crisis in which large numbers of scientific staff were made redundant. Concerning my own departure, I was totally amazed at the decision to cancel taxonomic computing at the Museum, since I was convinced (and still am) that computing represented the most important modern initiative in taxonomy. This was also the time when the textbook "Practical Taxonomic Computing" was published. After a short period as an



'independent consultant' I was taken on at the Royal Botanic Garden, Edinburgh, as head of the newly created taxonomic computing section. Edinburgh is committed in its strategic plan to the application of computing to its scientific projects. In February 1993 an assistant, Martin Pullan, was appointed. I am now the head of a small group and am hard at work on taxonomic databases (e.g. the Flora Europaea and IOPI), database standards (TDWG), and of

course, improved versions of PANKEY.

Looking back to the start of my work on taxonomic computing in 1970, I really believed that all taxonomists would be routinely using computers by 1975, as physicists were already doing at that time. In fact it took a very long time for adequate computing tools to reach the majority of taxonomists, and the taxonomic computing revolution is only just now

taking place. In the meantime, computers themselves have improved greatly in speed and capacity and with user-friendly software and colour graphics. Today's users have higher expectations of software, which is a challenge to DELTA programmers and rightly so, but it is several years since I heard anyone say that computers can't be used for taxonomy.

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INTKEY FOR WINDOWS

T.A. Paine

CSIRO Division of Entomology, GPO Box 1700, Canberra ACT 2601, Australia
Phone +61 6 246 4075 Fax +61 6 246 4000 Internet delta@ento.csiro.au

In the past twelve months, the DELTA group have been developing a version of INTKEY to run under Microsoft Windows. This marks a significant point in DELTA development, representing as it does, a first step towards making the DELTA system available within a modern graphical environment. While the DELTA system is undeniably powerful, its interface is somewhat outdated and has been criticised as being unfriendly and difficult to use. The move to the Windows environment is an attempt to address these problems and make the system more accessible to all who would like to take advantage of the unique array of tools that it offers. Over the next few years, the entire DELTA system will be implemented as an integrated Windows package, with expanded functionality and streamlining of processes that are currently cumbersome and error-prone.

The new INTKEY interface has the standard Windows style of a top-level menubar with associated menus and

dialogs. An alternative method of interaction is provided by a command line (as in the DOS version), where users can enter full or partial commands to achieve the same result. If only part of the command is entered, the user is automatically taken into the menu/dialog system, but unlike the DOS version, cannot return to the command line. Context-sensitive help is available at any time.

The top-level menu divides the commands into the following functional categories:

- File** (file input and output, program exit)
- Identify** (Use, Delete, Best, Separate, Lastbest, Restart)
- Attributes** (Describe, Diagnose, Differences, Similarities, Summary)
- Lists** (Characters, Taxa, Find, Illustrate)
- Settings** (Set, Display, Define, Include, Exclude, Status)
- Help** (help with commands, topics and techniques)

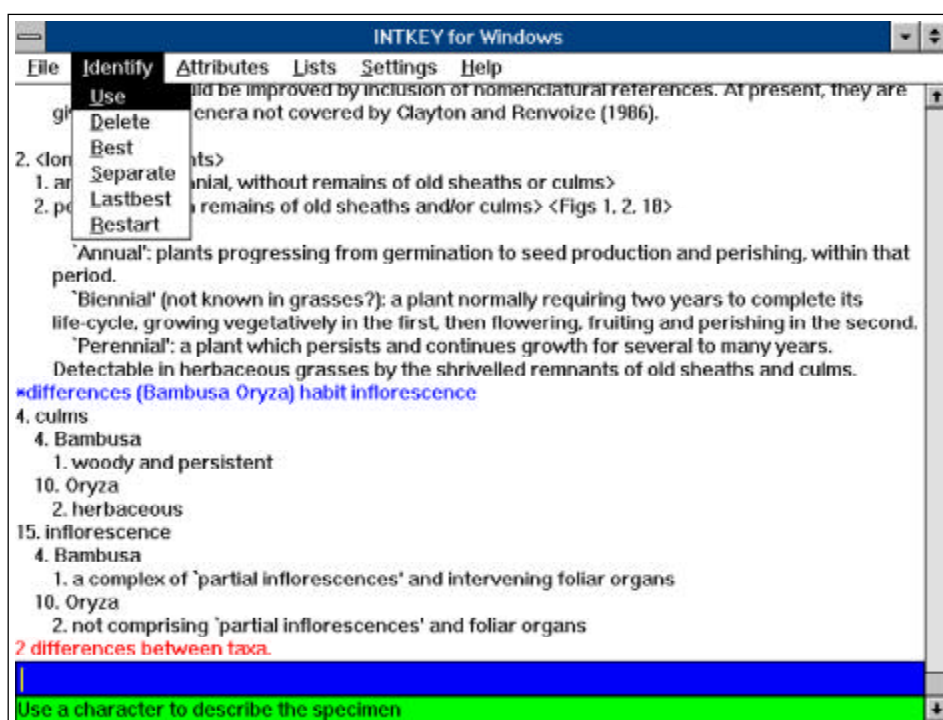


Figure 1. A Windows INTKEY screen, with the 'Identify' menu active.

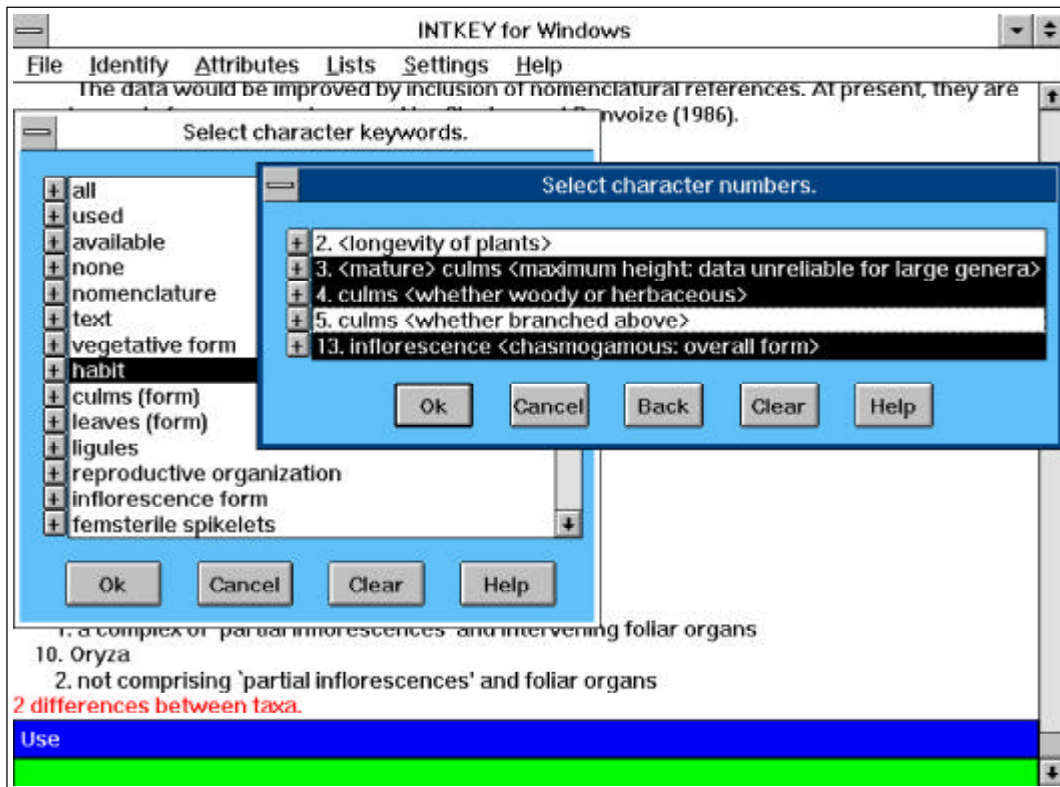


Figure 2. Character and character-keyword dialog boxes.

The keyword and character or taxon 'menus' are central to many INTKEY commands. They have been implemented somewhat differently from the DOS version. Each now appears in a listbox and alongside each entry, there is a small button with '+' on it (indicating 'more to see'). Pressing one of these or using the cursor keys and typing '+' from the keyboard will produce the next level in the menu structure.

As in the current INTKEY, characters or taxa can be selected individually or by keywords. Complicated selections can be made by moving back and forth between the keyword and character or taxon menus. For example, a keyword can be selected, and then some of its members deselected at the character or taxon level (see figure). As each menu level is activated, it is updated to show the effects of all previous selections or deselections.

Pressing the '+' button while at the character or taxon level displays a dialog box. For characters, the full character description (including states) is displayed, with buttons for displaying notes and images. For taxa, the full taxon name is displayed, with a button for displaying images.

Display of images is more flexible under Windows. All images, regardless of original resolution, will be able to be viewed, though displaying SuperVGA images on a standard VGA, will naturally result in a corresponding degradation of quality. In addition, images can be moved, resized, and scrolled, and images for different characters/taxa displayed simultaneously. Text annotation of images is another new feature. A separate utility will allow compilers of datasets to enhance their images by specifying positions for overlay of text and simple figures. INTKEY will display the annotated images.

Under DOS, INTKEY is limited to using what is available of the 640K of conventional memory. However, in Windows, this barrier no longer exists, so INTKEY will be able to handle much larger datasets than previously possible.

Current users of INTKEY will have no conversion worries. The program reads the standard INTKEY files (ICHARS and IITEMS) and is functionally equivalent to the DOS version.

PANKEY NOTES

R.J. Pankhurst

Royal Botanic Garden, Inverlieth Row, Edinburgh EH3 5LR UK
Phone +31 552 7171 Fax +31 552 0382 Internet rjp@castle.ed.ac.uk

New versions of PANKEY programs

PANKEY was originally written in FORTRAN (like CONFOR) but a long-term aim has been to translate the programs into C. This task has now been completed. The main advantages of this are that C is a more flexible programming language than FORTRAN, and that there is better memory control. With C, it is possible to write a program which 'knows' how much RAM is still available to it for storing and manipulating DELTA data, and can use what remains to best advantage. Another advantage is that, with the C version, all programs now expect precisely the same DELTA data format.

A disadvantage of programming DELTA to run under DOS on IBM PC compatible machines is that with larger DELTA data sets, it is possible to run out of RAM altogether. It is possible to run such programs under Windows 3, but this makes no difference to the total memory available, and slows everything down as well, since Windows itself uses up a good deal of the machine's resources. One PANKEY program for Windows is being tested, but there is a simpler alternative. A special version of the interactive key constructing program KCONI has been written to use extended memory.

To exploit this, the processor must be a 386 or above and have extended RAM. This is not asking much; any PC purchased within the last few years will be capable of running Windows, and will already meet these requirements. The new KCONI runs under DOS in what appears to be the normal way, except that it has much more memory available to it - up to the maximum fitted in

the machine eg. 4 or 8 Mb of RAM. Similar extended versions of DEDIT (DELTA Editor) and the expert identification program ONLIN 7 will soon be available.

DEDIT has new features; especially an interactive option for defining key states from raw range data for numerical characters. This lets you see the effect of choosing different breakpoints in the total range of variation, and to see how much information loss your choice would have. Remember, DEDIT is available FREE; just send me a 3.5 inch diskette.

Flora Europaea Database

The data entry for the revised version of Volume 1 of the Flora Europaea has been completed and checked, and the complete text of the checklist has been sent to press. A start has been made with scoring DELTA characters for the Flora.

TDWG standard descriptors for vascular plants

A draft set of 38 universally applicable characters and states has been prepared and distributed for discussion at the next TDWG meeting (Washington DC, October 1993). This has been compiled from last year's TDWG character list (without states), from the Watson and Dallwitz angiosperm database and the draft character list for the Flora North America (Alan Whittmore, Missouri Botanic Garden). The assistance of these contributors is gratefully acknowledged. Copies of the DELTA character list have been distributed; if you would like one but have not received it, let me know.

PROGRAMS FOR HANDLING LARGE DELTA DATA SETS

W. D. Clayton - Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, UK

I have written some simple programs for handling large sets of DELTA data. These are available to interested people.

NAMES Lists and numbers the names in an ITEMS file (without the checking which makes PRINTN tedious to run).

PICK Makes a subset of items, selected by number, from an ITEMS file.

MIX Puts the subset back in the main file, assuming that both files are in alphabetical order.

△

HyperParasite - A HyperCard™ Based Data Storage System for Selected Parasitic Flowering Plants *

Daniel L. Nickrent

Department of Plant Biology, Southern Illinois University
Carbondale, IL 62901, USA

The interrelationship of systematics and computer technology is continually being reaffirmed and redefined as evidenced by recent books (Pankhurst, 1991) and the emergence of increasingly sophisticated software programs such as PAUP (Swofford 1993) and MacClade (Maddison and Maddison 1992) that are making phylogenetic analyses more of an empirical endeavour. A great deal of interest centers around the use of computers to aid in the process of organism identification such as computer generated interactive keys (e.g. Pankhurst 1988) and databases for floristic projects (Allkin and Bisby 1984). The growing interest in biodiversity has spawned renewed interest in making taxonomic information both more available and enjoyable to everyone. The goals of the Expertise center for Taxonomic Identification (PO Box 4766, 1009 AT, Amsterdam, The Netherlands) are to "concentrate, preserve and promote taxonomic knowledge and provide possibilities to answer taxonomic, biogeographic, and ecological questions quickly and efficiently" (Schalk 1992). This multimedia database will contain information contributed by specialists from all over the world and will be distributed on compact disk. The original concept for ETI came from the Linnaeus Interactive Taxonomy program developed by Ken Estep (Estep 1989a, b). This program written in HyperTalk (the computer language for HyperCard™ for the Macintosh computer), is an interactive taxonomic key to zooplankton.

Linnaeus was the inspiration for the HyperCard program "Hyper Parasite" described here. Unlike Linnaeus, the overall organization is not centered around a taxonomic key, although one can access keys written in the Linnaeus format from particular spots within the program. My major objective in developing this program was to assemble the vast and scattered information on a selected group of parasitic flowering plants. I wished to use this information to 1) provide an organized system of storage and retrieval of both textual and graphical information, 2) use this information to develop character state matrices for further phylogenetic studies, 3) make the acquisition of information on these plants more accessible to others, and 4) use this stack as a vehicle of information exchange with fellow scientists. These stacks are similar to "HyperTaxonomy" written by Skov (1989a,b), but do not contain such detailed morphological, nomenclatural, collection data, and distributional information at the species level.

HyperCard

HyperCard 2.0 is a difficult software program to define. As stated by Goodman (1990), it is "a self-contained programming environment." It has elements of a programming language (HyperTalk) as well as features found in a database. Most importantly for HyperParasite, it readily handles graphic images. The basic units of a stack are called "cards," directly analogous to index cards we often see in file boxes. Unlike index cards, one can navigate quickly within the hierarchy of cards by means of "buttons" that send one to a set destination. Textual information (such as species lists, family descriptions, etc.) are contained in "fields". One can conduct searches within the field for particular words etc. HyperParasite uses only the most basic of HyperTalk commands. It can be expanded or modified easily to accommodate more sophisticated procedures. For an excellent reference to HyperCard 2.0, see Goodman(1990).

Taxonomic Coverage of HyperParasite

The selected group of parasitic plants in HyperParasite are the orders Santalales (Olacaceae, Opiliaceae, Misodendraceae, Loranthaceae, Santalaceae, Eremolepidaceae, Viscaceae and Balanophoraceae) and Rafflesiaceae and Hydnoraceae) as outlined in Cronquist's (1981) classification. The "stacks" (series of cards) contain information on one or more families depending upon size. Table 1 shows the composition of the various stacks and the degree of completion. For the above tally, cards with any amount of information are counted, however, it should

be mentioned at this point that I consider HyperParasite an ongoing database that will be constantly updated as new information accrues.

How HyperParasite Works

Upon entering HyperParasite, one encounters the introductory card. The user has the choice to go directly to a family, to a key to parasite families, references, or a glossary of terms associated with parasitic plants. The family card for the Viscaceae, for example, contains buttons for the seven genera currently recognized. The "Family Description" button activates a scrolling field that contains information on the major morphological features such as habit, roots, stems, leaves, flower parts, etc. Some families also have a button that activates a generic key, however, a key to the larger families (such as Loranthaceae) is under development. Clicking on one of the generic buttons takes the user to the genus card. The buttons and fields are standardized for all genera in HyperParasite: Distribution, Floral Features, Inflorescence, Vegetative Features, Fruits and Seeds, Host Information, and Roots/Haustoria. These cards contain graphical images (line art) that were imported using a hand-held scanner. The sources for the images is referenced on each card and have been obtained from a variety of books, journal articles, or original drawings.

The distribution cards show general geographical distributions of the genus on a world map. The map cards (as do the floral, fruit, etc. cards) contain forward and reverse buttons that allow one to quickly scan through the distributions of all genera in the family. This feature is especially useful to gain some understanding of which parasitic plants may occur in an area to be visited. The other buttons on the genus card take the user to cards containing line drawings of floral features, vegetative features, fruits, and root/haustorial features. A scrollable field containing a species list for the genus is also present on the genus card. The species are listed alphabetically, with authorities and more specific distribution information than can be gleaned from the generic distribution map. Attempts have been made to include at least a partial list of synonyms following the species list.

Table 1. Stack Composition and Degree of Completion of HyperParasite Cards

Family	Cards							
	Genera	Distrib.	Floral	Inflor.	Veg.	Fruit/ Seed	Root/ Haustoria	Degree of Completion
1. HyperParasite								
Viscaceae	7	7	6	7	7	6	5	44/49 = 90%
Eremolepidaceae	3	3	3	3	3	3	3	21/21 = 100%
Misodendraceae	1	1	1	1	1	1	1	7/7 = 100%
Opiliaceae	9	9	9	6	6	8	0	47/63 = 75%
2. Sant.Stack								
Santalaceae	32	32	20	13	19	24	5	145/224 = 65%
3. Olac.Stack								
Olacaceae	26	26	21	23	23	24	2	145/182 = 80%
4. Loranth1.Stack								
Loranthaceae A-E	25	25	16	18	14	7	3	108/175 = 62%
5. Loranth2.Stack								
Loranthaceae F-O	25	25	17	18	14	12	6	117/175 = 67%
6. Loranth3.Stack								
Loranthaceae P-Z	25	25	18	18	16	7	4	113/175 = 65%
7. Raff.Stack								
Balanophoraceae	18	18	17	17	11	10	8	99/126 = 79%
Rafflesiaceae	9	9	7	6	(2)	4	1	38/63 = 60%
Hydnoraceae	2	2	2	2	2	2	2	14/14 = 100%

How to Obtain HyperParasite and Assist in Its Completion

As shown in Table 1, several families are complete or essentially complete such as the Viscaceae, Eremolepidaceae, Misodendraceae, and Hydnoraceae. The series of cards containing Host Information are currently mostly blank. They are included to allow the user to record notes such as host preference lists or other information of this type. The cards containing information on Roots/Haustoria are the most incomplete of all the cards in the stack, mainly because this information has not been reported (e.g. in the form of illustrations) for many of these plants. At present, Hyperparasite is composed of over 1280 cards of which ca. 900 contain information (70%). The Loranthaceae is most in need of further work since only ca. 64% of these cards are complete. Quality illustrations of floral morphology of mainly Old World genera are especially needed.

Owing to the number of graphical images used, HyperParasite is somewhat demanding of storage space. The seven stacks shown in Table 1 plus the key and glossary stacks require over 5 Mbytes of disk space. Eventually, these stacks will grow large enough to require storage on compact disk. I am at present discussing the integration of HyperParasite into the ETI system for general distribution. HyperParasite is available at this time free of charge. You can obtain it by sending me 4 formatted 3.5 " high density diskettes. The stacks will be best sent as self-extracting archives. By making these stacks freely available, I hope to obtain information from colleagues that will improve and complete HyperParasite. Information about the sources (references) of quality illustrations for taxa that are currently not well represented in the stacks are especially needed.

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RUNNING DELTA ON APPLE MACINTOSH

Roberta Cowan

School of Biological and Environmental Sciences, Murdoch University, Murdoch, Western Australia 6150
Ph +61 9 360 2843 Fax +61 9 310 3505 Internet cowan@possum.murdoch.edu.au

I was introduced to DELTA by associates working at the Western Australian Herbarium. Wow! I thought what a package and so I attended my first DELTA workshop. It was here I learnt the abhorrent fact that "DELTA does not run on a Mac". "Oh no!" I cried, "I only know how to run a Mac: PC's, DOS and command lines, these are all beyond me". I did work at it and learned to use DELTA on the PC but I longed to be able to run DELTA on the Mac since I had in the interim purchased a laptop computer (Powerbook Duo). In conversation with Alex Chapman I learned that there was software written for the Mac called *SoftPC*, which allowed the Mac to run DOS-based software. I enquired of this programme and received various reports: "Yes its a saviour", "No its a dog", but undeterred I decided to ask for a demo of the software. I found that you can run DOS programmes on a Mac but you have to run them just as you do on a DOS-based machine, that is without Microsoft Windows, unless you are prepared to spend more cash on memory upgrades (see below).

The software is written by Insignia Solutions, an American company, whose "mission is simple - to provide quality, high-performance solutions which bridge the barriers to compatibility". Insignia offers four products. *Universal Soft PC* runs on a Macintosh Classic or better with System 6.0 or later, requires 2(preferably 4) Mb of memory with System 6 or 4(5) Mb with System 7, only provides CGA or EGA graphics mode and takes up 5 Mb hard disk space. *Soft PC Professional* runs on any Macintosh with 68020-40 processors, System 6.0 or later, requires 8 Mb of Macintosh memory and supports VGA graphics. It takes up 6 Mb of hard disc space, but also will not run Windows. *SoftPC With Windows* comes pre-installed with Microsoft Windows but be warned it takes a lot of memory and apparently runs Windows applications very slowly. *SoftWindows* is a new version designed to run Windows on the PowerPC platform and claims to run DOS and Windows applications at the speed of a 486 PC.

I use *Universal SoftPC* to run DELTA and Norton Commander, a DOS file management package with inbuilt editor. The latter fails if the files that need editing are too large, but there are other editors around. The keyboard of a PC is set up differently to the Macintosh and so when using any DOS applications a list of keyboard differences must be near (eg. the option key on the Duo is the Alt key on a DOS PC). I admit this can become frustrating and is the most maddening thing I have found using *SoftPC* on the Mac. My use of DELTA with the Mac is at times when a PC is not available eg. out in the field. For this reason I have not concerned myself overly that the VGA graphics are not available when using *Universal SoftPC* but for those of you who wish to use your Mac with *SoftPC Professional* there appears to be no barrier to getting good graphics. I notice very little difference in the speed of DELTA using the Mac setup I have and a 286 PC. PC users accustomed to a 486 would notice a difference. Inevitably, DOS software will run more slowly on a Mac emulating DOS than on a DOS PC given comparably configured hardware.

In conclusion, most Mac users are put off by the plain DOS interface and naturally find the Windows environment much more friendly, but will have to pay for this functionality in terms of added memory and lost hard disk space, as well as dollars.* Personally, as a user of Mac's and PC's I can report being totally happy with running DELTA in both environments. An added advantage is that I have access to other DOS applications such as Hennig 86 and can run them anywhere I have my Mac.

*Editors comment. In the short term, until most DELTA software is available as MS Windows applications, this is not an issue, as no one in their right mind would burden their machine with emulating DOS and Windows just to run a DOS-only program. Current trends towards enhanced PC hardware and operating systems should alleviate performance issues in the longer term.

PROBLEMS WITH IMAGE DISPLAY UNDER INTKEY?

N.S. Lander

A powerful facility of the interactive identification and information retrieval program INTKEY is the ability to present the user with images. These may be black and white, grey-scale or full colour images and currently must be in the compressed GIF format. Such images can be associated with taxa (eg map, habitat, taxon portrait) or with characters (eg scientific illustration, photograph, scanning micrograph).

Many DELTA users are alarmed to find that when they try to display such images they get a distorted image or even a rather cryptic error message. The following brief notes may help to rectify this frustrating state of affairs.

Are the images you are attempting to display appropriate for the equipment employed? An image of SVGA resolution will not display on a computer equipped with a VGA or EGA graphics card and monitor, for instance. As a minimum a SVGA card with 512 Kb of memory is recommended: this will be adequate for 16 colour image files of resolution 640 x 480 pixels. For displaying 256 colour images at resolutions of 1024 x 768 pixels or 32768 colours at 800 x 600 pixels, a SVGA card with 1 Mb of memory is required.

Does your graphics card require proprietary software to be loaded before running INTKEY? A case in point is the popular Trident TVGA 8916 Card which requires the utility MAMODE.EXE (provided with the card) to be loaded and the 128 kb mode engaged before running INTKEY.

Your graphics card may support the VESA standard, which offers a standard interface for programs to access your SVGA display adaptor. Thus you may have received a VESA 'Terminate and Stay Resident' (TSR) program with your VGA board. If so, you are encouraged to use it, since it more or less guarantees that INTKEY will work with your display card. However, problems will inevitably arise with particular VESA cards or with certain combinations of hardware. My own computer for instance sports a Cirrus VESA graphics card which will simply not display images under INTKEY whether or not its own VESA TSR is loaded. The answer to this problem may lie in the use of the universal VESA driver provided with the DELTA system itself, namely UNIVESA: full instructions for its use are to be found in the file UNIVESA.DOC (usually found in the DELTA home directory ie. C:\DELTA).

Manuals for graphics cards and their attendant software are notoriously difficult to read and understand, so you may need to seek some technical assistance here.

Finally, although INTKEY can address the more common graphics cards yours may well be one of the exceptions. Thus if all else fails to solve the problem proceed as follows:

1. Note the error message down.
2. Exit INTKEY.
3. Enter VGATEST at the DOS command line.
4. Note any message echoed to the screen.
5. Print the file VGATEST.RPT.
6. Send these to Mike Dallwitz together with as much information as you can glean about the graphics card installed in your computer (brand model, processor, date, etc).

A very convenient way to ascertain the data under item 6 above without actually opening the computer itself is to run the diagnostic program MSD which comes with Microsoft Windows 3.x. Clicking on the box labelled Video will produce a comprehensive report with all the information required. MSD can be called from the DOS command line.

If you lack a copy of MSD then you can often access information on your graphics card without removing the casing by using DEBUG (provided with DOS) and 'dumping' the contents of the display BIOS. This is easily achieved as follows:

1. Enter **DEBUG** at the DOS prompt. You will get a - prompt.
2. Enter **dC000:0** to display the first part of display BIOS.
3. To dump more of the BIOS, enter **d**. You may recognise the chip manufacturers name here, such as ATI, Trident, Tseng, Paradise, etc. And you may see other information such as BIOS date and version number.
4. To exit DEBUG, just enter **q**.

Useful background information on computer images may be found in the following article:

Dallwitz, M.J. (1993). An introduction to computer images. *DELTA Newsletter* 8: 7-9.

Data or Concepts - What Should We Be Coding?

Helen White

Western Australian Herbarium, CALM
Ph +61 9 334 0500 Fax +61 9 334 0515

Taxonomists all appreciate the value of examining more than one specimen when producing species descriptions. If the concept of the species is firm and is not in question, specimen data is amalgamated in some fashion to produce a species description which is then coded in DELTA format for analysis against other species. So far so good. But the inevitable exceptions, extremes and misconceptions may lead us in the future to question whether our specimens were in fact all members of the same species, or perhaps whether the group can be subdivided usefully.

If our specimen data was combined before coding in DELTA format, we can't turn to INTKEY for help in analysing our hard won data with these new ideas. However, our original work, conducted at specimen level, could also have been scored in DELTA format at specimen level. These coded specimen descriptions would all carry the accepted taxon name, but be distinguished by some unique number or code (such as a herbarium sheet number or collector's number) entered under a character created for this purpose. By adopting this latter method of scoring we could now explore the various possible recombinations of specimen information.

The following is a method for maintaining maximum flexibility when using DELTA by coding actual data at the specimen level, rather than coding current taxonomic concepts.

Individual coded specimen descriptions (contained in a file called SPITEMS) can be combined automatically by running the SPSUMM program supplied with the DELTA package (further information in *DELTA Newsletter* 8, April 1993). This program amalgamates all entries with the same taxon name, and produces a standard ITEMS file containing one entry per taxon. The SPITEMS file itself remains unchanged. Alternatively, by using INTKEY with the SPIITEMS.TMP file, also created by running SPSUMM, selected specimen items (regardless of taxon name) can be summarized to produce new items. Thus it is possible to produce coded descriptions of discrete subsets of the original species or even of a mixture of species, containing one or more specimens, and analyse them with all the tools available to the DELTA user.

To use specimen entries with INTKEY:

1. Create a source file of specimen data coded in DELTA format. This file must be called SPITEMS.
2. Type SPSUMM at the DOS prompt; this creates the files SPITEMS.TMP, SPIITEMS.TMP plus ICHARS and IITEMS.
3. Modify the intkey.ini file, to change:

*FILE TAXA IITEMS

to: *FILE TAXA SPIITEMS.TMP

4. Enter INTKEY at the DOS prompt.

As well as the increased power of analysis this method provides, consider the case of discovering that you (or your luckless minion), have encoded misidentified specimens. Imagine the painstaking effort in excising the subtly erroneous data from the combined species item. It may well be quicker to go back to the specimens and score the whole lot again. If the specimens were entered individually, a simple name change of the erroneous specimen item and a rerun of SPSUMM would show the consequences of removing this specimen from the original species.

Care needs to be taken in managing the files, with the understanding that changes made to the ITEMS file created by SPSUMM will be overwritten by the next run of the SPSUMM program if the file is not renamed. Amendments to original data need to be made in the SPITEMS file. The SPITEMS file needs to be added to maintenance directive files such as REORDER, TIDY and CHECK to keep data files compatible.

There are, of course, disadvantages in scoring at specimen rather than taxon level. Additional time is required to enter the data onto the computer. But isn't the data safer on disc than on the piece of paper you have just recorded it on? However scant the description, if it was worth recording something about a particular specimen, mightn't it be useful to know where that data came from later, and be able to interrogate that

data? And there is the potential time saving in not having to sort through those bits of paper (if you still have them) when you discover that the specimen was incorrectly labelled, or that you may be dealing with more than one taxon after all.

A shortcoming of the SPSUMM program at present is that while it works perfectly for numerical and state characters, any appended comments and all text characters will not be carried over to the new ITEMS file. They are still there in each specimen item, but it is time-consuming to amalgamate and manually transfer them across to the final item description. Future versions of the SPSUMM utility might obviate this requirement. At this stage it is suggested that this be done only on the final ITEMS file to avoid repetition of work.

Perhaps you are still shuddering at the very thought of encoding and maintaining your data at specimen level. You are not alone. However it is well worth considering this approach if your work is in a revisionary context, especially where the delimitation of taxa is still in flux. And it begs the question: shouldn't we be databasing data rather than concepts derived from that data? Δ

Helen White is a Technical Officer at the Western Australian Herbarium. She would be very pleased to provide further information about specimen based DELTA files, and would welcome your views on this article.

DELTA NEWSLETTER BACK ISSUES

Limited back issues of DELTA Newsletter numbers 1 to 8 are now available. These issues contain much useful information and advice and provide an invaluable reference to any biologist interested in the area of computer-aided taxonomy. They can be ordered individually or as a set. Please indicate which issues you require and how many of each. Each issue is a fixed price of \$5.00 each, which includes postage and handling.

Please note that extra-Australian personal cheques cannot be dealt with; instead make International Money Orders payable to **The DELTA Newsletter**.

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SPOTLIGHT ON DELTA FEATURES

A regular feature of the Newsletter. It will focus on individual features of the DELTA data format, the CSIRO DELTA programs or the PANKEY programs.

DIAGNOSES AND DELTA

For certain hard copy products one may wish to create diagnoses of taxa. These may be employed as they stand, or they might be incorporated in natural language descriptions where they can be emphasised in some way, such as by the use bold or of italics (or both). All this is readily accomplished by combining the use of INTKEY and CONFOR.

First, use INTKEY to generate an output file listing the diagnostic characters for each taxon as follows:

1. Load INTKEY
2. Create a file for output: FILE OUTPUT WORK. This opens the file "work" for output.
3. Enter: OUTPUT COMMENT *EMPHASIZE CHARACTERS.
4. Pass a diagnosis of each taxon to the output file: OUTPUT DIAGNOSE (ALL) NONE.
5. Close the output file: OUTPUT OFF.
6. Exit INTKEY.

The output file (called work here) will resemble the following (taken from the DELTA Grass Genera test data):

*EMPHASIZE CHARACTERS

- #1. 11 35 39
- #2. 16
- #3. 31 61
- #4. 15 66
- #5. 16 19 31
- #6. 19 28 31 44
- #7. 16 19 27
- #8. 65
- #9. 4 44 66
- #10. 4 60
- #11. 13 27 34
- #12. 11 56
- #13. 13 52 66
- #14. 12

Next, cut and paste the contents of this output file to a copy of the TONAT file as follows:

7. Using a text editor, cut the entire text of the output file (work) and paste it to the TONAT file.
8. Save the augmented TONAT file under a new name such as TODIAG.
9. At the DOS command line enter CONFOR TODIAG.

This will create a natural language output file (TONAT.PRT) which will include the characters diagnostic for each taxon, regardless of what characters have been pre-selected with the directives *INCLUDE CHARACTERS or *EXCLUDE CHARACTERS.

This powerful feature will be found especially useful where there are constraints on the length of descriptive text as in a Flora. In such cases an

*INCLUDE CHARACTERS

directive defining a subset of characters which is to be used for each and every taxon can be followed by an *EMPHASIZE CHARACTERS directive which ensures that diagnostic features for each taxon are also included.

Obviously, if an *EXCLUDE CHARACTERS directive which excludes all characters is used in conjunction with an *EMPHASIZE CHARACTERS directive such as that above then the resulting natural language descriptions will comprise merely diagnoses of each taxon.

Note that if these same procedures are followed with the TONATT directive file to create typeset natural language output then diagnostic characters will be rendered in italics.

Excellent examples of the use of this technique are to be found in the following monograph:

Watson, L. & M.J. Dallwitz (1992). *The Grass Genera of the World*. CAB International: Cambridge.

More notes on creating diagnoses may be found in the following article:

Dallwitz, M.J. (1989). Diagnostic descriptions from INTKEY and CONFOR. *DELTA Newsletter* 3: 8-13.

Δ N.S. Lander

REPORT OF WORKSHOP ON TAXONOMIC DATABASES, PERTH, OCTOBER 1993

T.D. Macfarlane

A two day workshop on taxonomic descriptive databases was held on 3-4 October 1993 in Perth in association with the ASBS/ANZAAS symposium Systematics, Evolution and Conservation of the Western Australian Biota. This followed on from an encouraging preliminary planning meeting held in Hobart in February 1993 (in association with the Southern Temperate Ecosystems Conference) to test the level of interest, produce agenda suggestions and recruit additional organisers.

Approximately forty people participated, representing all states and comprising staff of herbaria, museums, universities, botanic gardens and other organisations including ABRS and ERIN. A range of plant, animal and microbe specialties were represented. In addition to the meeting sessions, computer displays of databases were available: Watson & Dallwitz's Angiosperm Families using DELTA format data and INTKEY; the W.A. Herbarium's Rare and Endangered Plants of W.A. (prototype), DELTA/INTKEY, and Hyland & Whiffin's recently published Australian Tropical Rain Forest Trees using a proprietary data format and program, for DOS and Macintosh.

Eight sessions were conducted, commencing with a presentation of the results of a recent survey of existing taxonomic data sets in Australia by Helen Hewson, ABRS, a description by Leslie Watson, ANU, of angiosperm families, grass genera and other databases developed by Watson and associates at ANU, followed by an information exchange among participants.

A session on characters which was led by brief presentations from Greg Leach, Northern Territory Herbarium, and Terry Macfarlane, Western Australian Herbarium, generated lively discussion on the pros and cons of trying to define core characters for use across different databases. There was a feeling that this concept was most appropriate to project-based work, and that rather than formal character definitions being standardised, more work on character and state definitions would be useful.

A third session entitled "What do we need to build?" was introduced by Alex Chapman, W.A. Herbarium, and dealt with the idea of cooperating nationally to build a database of descriptive information for all taxa. Such a scheme would require a national coordinating body. Discussion

was supportive and extended to concepts for managing large distributed databases with numerous contributors.

The following session was addressed by Nicholas Lander, W.A. Herbarium, and was devoted to the question of which form the proposed national coordination might take, the principle having already been accepted by the meeting and Helen Hewson having earlier expressed a strong interest by ABRS to host or constitute the coordinating body. The meeting agreed that ABRS was an appropriate organisation to support cooperative and coordinated databasing through providing a secretariat and through the research funding process but that additional funding would be required. A group was nominated to prepare a resolution document for use as the basis of a funding approach to Government.

The fifth session commenced the second day and a review of custodianship issues by Arthur Chapman, ERIN, provided the basis for discussion. The minefield of legal uncertainties and commercial interests involved in copyright and intellectual property rights helped participants to focus on the mutually beneficial effects of cooperation and sharing. Questions of custodianship, its meaning and its implementation, need to be grappled with, however, and formal definitions that are being developed will need to be considered. From ownership and rights it followed naturally to the topic of the sixth session, "Where will the live data be?", which included an introduction to AARNET (INTERNET) and the use of Gopher queries by Mike Dallwitz, CSIRO, who spoke again about the Common Directory concept for maintaining references to the locations of distributed databases.

"Vision of the Future" was the title of session seven, and consisted of three addresses, two of them including demonstrations of databases. Adrian Gibbs, The Australian National University, described the achievements and special problems of the plant virus DELTA database projects which he has led and which have involved up to 250 contributors. Extensions of the project to include other types of viruses are planned. Some aspects of the database were demonstrated. Helen Hewson spoke on the recently conducted review of databasing in ABRS and discussed the possibilities of multimedia versions of the Flora of Australia, and other alternative publication approaches, including accompanying the books with disks

for INTKEY database versions. The likelihood of incorporating database requirements into research grants was also mentioned. Ebbe Nielsen, CSIRO, spoke on the future of databasing in Entomology, reporting on cooperative moves towards species list and descriptive databasing (using DELTA) by an international grouping of Directors of entomological collections and research institutions. In general, he felt that the software development was ahead of the usage by taxonomists.

For the final session, a document calling for coordination and support for taxonomic descriptive databasing produced by the nominated working group was presented and discussed. After refinement (see box at right for the text) it was then adopted by the meeting for presentation to meetings of institutional heads and ultimately for use in funding approaches to Government. Subsequent to this meeting the recommendations in the document have been endorsed by CHAFC (Council of Heads of Australian Fauna Collections), CAMD (Council of Australian Museum Directors) and CHAH (Council of Heads of Australian Herbaria).

Acknowledgements

Paul Hattersley, then of ABRS, helped plan the preliminary meeting in Hobart, and ABRS funded the organisers' travel. We also thank the people who attended that meeting for their extremely useful contributions to debate. Valuable input for the Perth workshop was received from Ebbe Nielsen, Division of Entomology, CSIRO, and from ABRS. The Department of Conservation and Land Management, Western Australia, including the W.A. Herbarium, provided support, encouragement, and meeting facilities and we particularly thank Dr Neville Marchant, Acting Director, W.A. Herbarium, for support.

This article has also been published in the *Australian Systematic Botany Society Newsletter* 78, March 1994.

Key to abbreviations

ABRS - Australian Biological Resources Survey
 ANU - Australian National University
 ANZAAS - Australian and New Zealand Association for the Advancement of Science
 ASBS - Australian Systematic Botany Society Inc.
 CSIRO - CSIRO Australia (a government research organisation)
 ERIN - Environmental Resources Information Network, Australian Nature Conservation Authority

COORDINATION OF AUSTRALIAN TAXONOMIC DESCRIPTIVE DATABASES

Mission. To coordinate, support and recommend standards for collating taxonomic descriptive databases of the entire Australian biota (including viruses, bacteria, protists, fungi, plants and animals).

Preamble. Australia is leading the world in the application of information technology to the development of taxonomic descriptive databases. This has been achieved by State and Commonwealth institutions with support from ABRS (Australian Biological Resources Study).

Recognising this, a meeting of biosystematists from State and Commonwealth institutions unanimously endorsed the development of a national taxonomic descriptive database network. The meeting also endorsed that ABRS be asked to provide executive and financial support to the network.

Structure. ABRS will host an executive office. The activities of the executive office will be guided by a Descriptive Database Advisory Committee (DDAC). The Descriptive Database Advisory Committee of five members will comprise representatives recommended by CHAH (Council of Heads of Australian Herbaria), CHAFC (Council of Heads of Australian Fauna Collections), CAMD (Council of Australian Museum Directors) and other appropriate organisations, ensuring representation from a range of systematic disciplines. Representatives will be appointed for a period of three years, with the possibility of re-appointment for one further period. The executive office will coordinate the establishment of appropriate *ad hoc* working parties as required. All activities will be endorsed by the ABRS Advisory Committee.

Role of the Executive and DDAC

- coordinate, enhance and promote the development of the DELTA descriptive database format and software
- coordinate the development, dissemination, maintenance and custodianship of descriptive databases
- coordinate and promote compatibility of datasets through the development of core character lists and glossaries
- maintain and provide information about descriptive databases
- promote training in and teaching of descriptive database methodology

Resources. In order to allow ABRS to effectively contribute to this expanded role, additional dedicated resources are essential. It is estimated that \$100,000 is required in the first year to establish the proposed structure. An estimated \$500,000 per annum is needed on a recurrent basis to achieve the stated mission.

REPORT ON DELTA WORKSHOP OCTOBER 28-31, 1993 TALLAHASSEE, FLORIDA

Dr. Ingolf Askevold

Entomology-Biocontrol Florida A & M University, Tallahassee, FL 32307, USA
Phone 904-599-3149 Fax 904-561-2221 Internet iaskevol@vm.cc.famu.edu

With the encouragement of Mike Dallwitz, I coordinated and instructed a workshop on DELTA basics at Florida A & M University recently. I attended Mike's workshop in Ottawa last year, in anticipation of this workshop, to see how Mike was running a workshop, as well as to solve some problems of my own. A report on the workshop is provided here. Mike has been extremely supportive of my endeavours to promote use of DELTA on this side of the pond, and has been extremely patient in answering all my trifling questions. Thanks very much, Mike!

The DELTA Workshop seems to have gone off quite well. I had a total of 11 registrants from all over the USA including Tallahassee, 4 from Canada. Participants were asked to have some sort of character set developed prior to the workshop, which almost everyone had, so all the fodder for rigorous error-solving sessions was provided.

Over 4 days we pretty much covered all the bases. The workshop began with some basics about DOS and wordprocessing, to ensure that everyone would be able to carry out the basic mechanics. Participants varied greatly in prior knowledge of computers and/or platform. The workshop progressed through examining the primary data files and directives, followed by running and playing with my *Bagous* weevil data set. An exercise of developing an imaginary data set about fruits was used to illustrate the process of data set development. Finally, participants worked on correcting the data sets they brought.

The most fruitful aspect, as far as I could tell, was allowing them to mess with their own character sets. This way they were able to work with something closely familiar to them. By the time everyone left, they had a data set that was running error-free for generating descriptions and keys, and they should be able to continue reasonably well on their own if they were to carry on without great delay when they got home.

Requests were made for a follow-up workshop, and invitations were extended to come to institutions to convince certain anti-DELTA hold-outs. All in all I think it was successful, and DELTA was given considerable

good coverage. The participants' own data sets, which they were to set up according to instructions, didn't turn out error free, of course, which was the point of the exercise. In particular I paid considerable attention to the logic of fixing errors in data; I believe that all sorts of possible error types were encountered among the various data sets that people brought, from which everyone benefitted.

Jim Pakaluk brought his copy of the *Coleoptera* larval expert system*, which people had a chance to peruse (save myself because I couldn't get out of the computer room long enough to examine it in Pescador's office, where he has a CD ROM).

Evenings were spent in various social functions around town, Oktoberfest that I made the beer for myself, a Saturday afternoon football game (it rained miserably), and dinners at various restaurants.

The 16 participants were:

George E. Ball, Darren A. Pollock (*U. of Alberta*);
Robert E. Roughley, Young Bok Cho (*U. of Manitoba*);
James K. Pakaluk, Tami Carlow (*Smithsonian Inst.*);
Robin M. Smith (*Texas A & M U.*);
Sharon E. Mitchell (*IAFS, Gainesville, FL*);
Jim Eldridge (*APHIS, PPQ, Atlanta, GA*);
Karen Nakasone (*Madison, WI*);
Keith Longpre (*Gunnison, CO*);
R. Wills Flowers, Charles W. O'Brien, Manuel Pescador, Michael D. Hubbard, G. Benn Marshall (*Florida A & M U.*).

My thanks to them for their attendance and active participation.

* Lawrence, J. F., Hastings, A. M., Dallwitz, M. J. and Paine, T. A. (1993). 'Beetle Larvae of the World.' CD-ROM, Version 1.0 for MS-DOS. (CSIRO Publications: Melbourne.)

Published Applications of the DELTA System

This is a listing compiled by Mike Dallwitz of all published applications of the DELTA System. Although it attempts to be comprehensive, Mike would no doubt appreciate any additions to this list to be forwarded to him.

- Aiken, S. G., and Dallwitz, M. J. (1991). *Festuca* (Poaceae) of North America: interactive identification and information retrieval. *Flora Online* 26.
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△ Compiled by M.D. Dallwitz

ALGAL DATABASES UNDER DEVELOPMENT

Tim Entwisle

National Herbarium of Victoria, Birdwood Avenue, South Yarra 3141, Australia
Phone +61 3 655 2300 Fax +61 3 655 2350
Internet Entwisle@botany.unimelb.edu.au

I have been (slowly) entering data into DELTA format for the freshwater red algal genus *Batrachospermum*. My character set includes 78 characters and I have scored and entered data for 14 items. These items include informal taxonomic groupings as well as type specimens all entered separately. At a later stage (and after playing around with INTKEY, etc.) I will combine these groupings as necessary.

My character set contains a few dubious characters and even more characters with dubious states (I am hoping to tighten it up as more items are entered - and as I become more DELTA-literate). As a part-time algal researcher, data entry is slow (and I can't help but run through INTKEY after adding every taxon) so it will be a while before a working database is available for all those freshwater algal enthusiasts.

I welcome any contact with others creating and using algal character sets.



Roberta Cowan

School of Biological and Environmental Sciences, Murdoch University, Murdoch, Western Australia 6150
Phone +61 9 360 2843 Fax +61 9 310 3505
Internet cowan@possum.murdoch.edu.au

Like Tim Entwisle I have been using DELTA as the software to database information on various algal groups. I have two major databases forming at the present time:

1. non-geniculate coralline genera (Corallinales, Rhodophyta), the data being taken from the literature (especially that of the Woelkerling group, Latrobe University) and my own work. I see this file as becoming the basis for a world generic file of the genera of the Corallinales and/or an Australian file of the species of Corallinales.
2. genera of the Rhodymeniaceae (Rhodophyta) world wide. The data is being taken at first from the yet-to-be-published Encyclopaedia of Algal Genera (section Rhodymeniaceae by Dr. Michael Guiry, Dept. of Botany, University College, Galway, Ireland); then data are being added from the various recent publications on this group and the work being done by John Huisman (Murdoch University) and myself.

I have started a number of other data base projects, for example to database the green algae of the Perth region using the published lists and floras, but these are on the back burner.

AVAILABLE WORKING DATABASES

(A space to announce or publicise available working databases, with any associated publications. Contributions welcome.)

Database name: *The Families of Flowering Plants*. ISBN 0 643 05507 X. Interactive program including CD-ROM and colour-illustrated manual.

Authors: L. Watson & M.J. Dallwitz.

Taxa (no. & scope): Angiosperm families of the world (563, narrowly defined). World-level morphological descriptions usually augmented by at least one illustration.

Characters (no. & type): 542 characters and quasi-characters. Morphology (vegetative, inflorescence, floral, fruit); seedling germination type; embryology, anther ontogeny; sieve tube plastids, nodal, leaf, stem and wood anatomy; pollen morphology and cytology, stigma type; photosynthetic pathway, phytochemistry; phytogeography and ecology; alternative classifications of Dicotyledons (superorder/subclass to Order) of Dahlgren, Cronquist and Takhtajan and into Young and Watson's Crassinucelli/ Tenuinucelli, and of Monocotyledons after Dahlgren, Clifford and Yeo.

Images: Taxon images (680 high quality b&w line drawings) from Le Maout & Decaisne (1873) and others, with some sample colour and b&w photos.

Data format: Original in DELTA format. Distributed with the INTKEY program as a package for identification or information retrieval, with illustrations, complete natural language descriptions and references, all for screen display or printing in typeset form.

Program: INTKEY.

Related publication: Watson, L. and Dallwitz, M.J. (1991). The families of angiosperms: automated descriptions, with interactive identification and information retrieval. *Australian Systematic Botany* 4: 681-695.

Price: A\$180.

Available from: CSIRO Information Services, PO Box 89, East Melbourne, Victoria, Australia 3002 (Phone +61 3 418 7217; Fax +61 3 419 0459).

Database name: *Beetle Larvae of the World*. ISBN 0 643 05506 1. Interactive program including CD-ROM and colour-illustrated manual.

Authors: J.F. Lawrence, A.M. Hastings, M.J. Dallwitz & T.A. Paine.

Taxa (no. & scope): 385 beetle groups or taxa for interactive identification to family or sub-family level. Almost all taxa have been coded from dissected specimens, the remainder from literature.

Characters (no. & type): 180 characters. Anatomical, ecological, biogeographic and other information about these families and sub-families. Most characters are multistate, with from 2-17 states; six are text-only characters.

Images: 206 (ie. 50%) taxa and 110 (60%) characters are illustrated. Identification is aided by hundreds of colour diagrams with the relevant features highlighted, and for most groups, excellent habitus drawings are provided based on representatives from different parts of the world.

Data format: Original in DELTA format. Distributed with the INTKEY program as a package for identification or information retrieval; with facilities for screen display of illustrations, complete natural language descriptions, summarised classification, references and lists of species examined.

Program: INTKEY.

Related publications: Lawrence, J. F., Hastings, A. M., Dallwitz, M. J. and Paine, T. A. (1993). 'Beetle Larvae of the World.' CD-ROM, Version 1.0 for MS-DOS. (CSIRO Publications: Melbourne.)

Price: A\$240.

Available from: CSIRO Information Services, PO Box 89, East Melbourne, Victoria, Australia 3002 (Phone +61 3 418 7217; Fax +61 3 419 0459).

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