CARDCAT: A Scientific Reference Manager for IBM-Compatible Personal Computers

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ABSTRACT CARDCAT.EXE is a compiled BASIC program that manages references in a computerized card catalog (database). CARDCAT.EXE and companion files operate from the DOS command line on IBM-compatible personal computers. The program system can add, edit, or delete references, import text files of references, search for multiple text-strings in order to recall and list pertinent references, and export specified references in any journal style. More than one database can be maintained. An on-line reference manual, as well as context-sensitive help screens are included. Optional features include color, sound, password, and database type.

ALL PHASES OF ENTOMOLOGICAL RESEARCH, from the conception and design of methods and experimentation to the analysis and discussion, may benefit from literature searches of databases containing relevant references. Cataloging scientific literature covering specialized aspects of entomological research is the responsibility of each researcher. Card catalogues, consisting of sets of cards with references, help in this endeavor, but the quality and thoroughness of literature recall is largely dependent on the memory of the individual. With the advent of personal computers and database programs, it becomes possible to computerize one's personal card catalog and improve the recall efficiency of all pertinent references.

The original database programs (such as dBASE) required programming to computerize reference databases and as such, have been cumbersome and have not been widely used. More recent programs such as Ref 11, ProCite, Get-a-Ref, and Reference Manager are better suited to card catalog applications, but they were designed for general use and so may not be as appropriate as a program designed for entomological research. Also, these programs often are quite expensive.

Another facility that is only found in the more recent reference managing programs is the ability to export references that have been reformatted in the style of a specific journal. This saves time in the initial draft, as well as time if the manuscript must be resubmitted to another journal, which usually has a different style.

I have developed a program, CARDCAT.EXE, which runs on IBM-compatible computers from the DOS command line. The program is used to type in references and key words (as well as short notes) in any number of databases. The program also can import references from DOS text files and automatically inserts these into the appropriate alphabetized file. Any reference can be viewed, edited, or deleted. The reference database can be searched for any combinations of 1–3 text-strings with "OR" and "AND" type searches. Lists of key words are kept in a file for each database and can be viewed during editing. References can be marked and then reformatted into any scientific journal style and exported to a DOS text file for use with a wordprocessor. The journal styles can be edited and stored permanently in a file. Different types of abbreviations of the journal name also can be stored in various files for use in the journal style reformatting facility.

Materials and Methods

The Cardcat system operates on any type of IBM-compatible personal computer running PC-DOS or MS-DOS 2.1 or higher. A minimum of 256K RAM memory is required and both monochrome and color monitors are supported. The system is character-based so it does not require a graphic card.

The source code for the main program, CARDCAT.EXE, was written in QuickBASIC 4.0 (Microsoft®) and compiled in machine code with the Microsoft® compiler version 4.00 and overlay linker version 3.61. The size of CARDCAT.EXE is ≈180K bytes and with the companion files, the system takes up ≈240K bytes of disk space. This leaves only ≈120K for reference files or ≈250 references on a 360K byte, 5.25 inch, floppy disk. Thus, it is recommended that a 720K, 1.2 or 1.44 M disk drive be used (1,000, 2,000, or 2,500 references, respectively) or preferably a hard disk (up to 20,800 references in 10 M bytes). The program is disk-intensive so searches are much faster on computers with hard disks (≈20 s per 1,000 references). Extended memory (memory greater than the DOS 640K limit) can be used as a RAM disk using the DOS 3.x program RAMDRIVE.SYS. This speeds searches up ≈ 5-fold.

Results and Discussion

The companion files used with the main program, CARDCAT.EXE, are listed in Table 1. The name of the main program may be changed but all other files have certain restrictions on their names (Table 1). Context-sensitive help can be obtained from most parts of the program by viewing the random access file, CARDHELP. In addition, an on-line manual in the file CARDCAT.TXT contains the text of this article and can be viewed by scrolling either forward or backward. The CARDCAT.DBD file contains information as to the color, sound, and database currently in use, all of which are permanently stored but can be changed at any time.

The F-KEY#.FIL file contains the most recent F-key assignments that can be used to type Greek and mathematical symbols. This file can be revised at any time and redefines the F-keys each time the program is used. The FORMATS.JOR file contains the coded information used to format the database references to the particular journal style desired. Journal styles in this file can be revised at any time, and any number of journal styles can be included. The JOUR-

Table 1. Lists of files needed for two databases, the default (*.CAT), and any other extension name (*.OTH)

*.CAT (default database)	*.OTH (other database)
CARDCAT.EXE	CARDCAT.EXE
CARDHELP[a]	CARDHELP[a]
CARDCAT.TXT[a]	CARDCAT.TXT[a]
CARDCAT.DBD[a]	CARDCAT.DBD[a]
F-KEY#.FIL[a]	F-KEY#.FIL[a]
FORMATS.JOR[a]	FORMATS.JOR[a]
LASTAREA.WK[a]	LASTAREA.WK[a]
JOURNAL.JAB[b]	BRJOUR.JAB[b]
KEYWORDS.CAT[c]	KEYWORDS.OTH[c]
NOTES.CAT[c]	NOTES.OTH[c]
A.CAT to Z.CAT[c]	A.OTH to Z.OTH[c]

[a] File name cannot be changed.
[b] File name can be changed but not the extension.
[c] Only file name extensions can be changed.

NAL.JAB file contains the journal name abbreviations in the database and a second set of corresponding but alternative abbreviations (or full journal names) that are needed by a specific journal style. Several *.JAB files can be created to match different journal styles of abbreviating journal names.

More than one database of references can be created for different subjects (e.g., one for bark beetles and one for grasshoppers). Table 1 shows the files used in the default database (.CAT, all files are created automatically or with user input), and a second database (.OTH). The KEYWORDS.CAT file contains key words appropriate for the default database, and any number of KEYWORDS.* files are possible for each database used. The NOTES.* file may contain a message created by the user for each database used. Finally, the 26 files (A.CAT to Z.CAT) contain the alphabetized references in the default database. For first authors that begin with non-English letters such as Åhman, it is suggested that the most similar English letter precede the name (e.g. AÅhman). This allows searches and exportation of the references into a wordprocessor.

The major facilities and operation of the main program, CARDCAT.EXE, are diagrammed in Fig. 1. The arrows between boxes indicate relationships between program parts but do not necessarily denote program flow. One begins by typing "cardcat" at the DOS command line. The program loads and then checks to see if a password has been set. Color, sound, and database options are set within the CARDCAT.DBD file. The main menu displays a perpetual calendar with the current date and day of week (e.g. Monday), as well as the time. Other calendar months, past or future, can be viewed by pressing the arrow keys. There are 12 options to choose from in the main menu (Fig. 1). Most of the options are self-explanatory and simple to use while other options can be learned with some experimentation.

The ADD NEW REFERENCES to DATABASE option (Fig. 1) is used to type in references for the first time using a six-line wordprocessor. Model references are shown to indicate the style required by the database. Italicized words or phrases such as *genus species* and *journal name* are denoted by the underline "_" symbol before and after the phrase. Specific macros are required to convert the underlined phrases to italicized phrases in each type of commercial wordprocessor. A unique feature of CARDCAT.EXE is that one does not have to enter authors or date, for example, into special cells or fields as in other database managers, but instead types the reference in a common format (Author, date, title, journal, vol.: pages) known to entomologists.

The EDIT/DELETE or MARK REFERENCES option requires that one enter a text-string, which will then be searched for in the database. Beginning with the A.CAT file, the reference with the first occurrence of the text-string is then displayed along with adjacent references. The options now include editing the reference with the six-line wordprocessor, deleting the reference, searching for a new text-string, continuing the search, adding a new reference, or moving to other references in the database with the arrow keys. When moving within the database one may mark or unmark any reference so that, if marked, it can be exported to a commercial wordprocessor later.

The KEY WORDS EDITOR option can be used to enter new key words into the alphabetized list, edit or delete key words, and view the list that is stored in the file KEYWORDS.CAT. The key words editor also can be used in the six-line wordprocessor during the editing of references. When saving an edited reference, the key words list is used to find and highlight all key words in the reference.

The SEARCH FOR REFERENCES option is used to search for references in the database with a combination of search text-strings. Up to three text-strings combined with Boolean logic using either "OR" or "AND" can be searched. The program displays 1–3 references on screen and waits for keyboard input to continue the search, mark any of the displayed references, exit or repeat the search, or print any part of the screen a line at a time. The fifth option, CHANGE: DATABASE/COLOR/SOUND, has been described above and is self-explanatory.

The IMPORT of DOS/WordPerfect REFS. option is used to import references in DOS text files (of any width) that have been saved by wordprocessors or text editors. This is convenient because a familiar text editor can be used. The DOS text file can be of any length but each reference should not be longer than 480 characters as it will be formatted to 6 lines by 80 characters. There also must be a blank line between references. For example, WordPerfect can save text in a DOS text file with a width of up to 240 characters, although 70–110 is the usual range. After each reference is imported and reformatted into the database style, it can be edited further (or deleted), if necessary, before the next reference in the DOS text file is imported. The MARK/UNMARK ALL REFS. option usually is used to unmark all references in preparation for a new session. By marking all references, one could obtain a reformatted print-out of all references in a particular journal style.

The JOURNAL REFORMAT CODES EDITOR is used to develop a list of journal styles that will help in reformatting references in the database to any selected journal style. The style code for each journal is permanently saved in FORMATS.JOR but can be revised if necessary. Sample references are shown reformatted according to the current code so one must simply adjust the code appropriately according to a menu-driven list of options. Once the code is perfected it need never be changed. After establishing the appropriate code for a particular journal, one may REFORMAT MARKED REFS. and EXPORT. The program requests the output form, save to text file or print, or both. Assuming the output is to go to a DOS text file, the program requests the journal style, which must exist in the journal codes file (FORMATS.JOR), and then begins searching for marked references in the database. Marked references are reformatted in the appropriate journal style. Options include indention size (0–10 spaces), width of line (50–250 characters) and numbering of references. On screen viewing of the created DOS text file is finally shown before exiting to the main menu.

The JOURNAL ABBREVIATION EDITOR option allows alternative abbreviations for the journal names, such as the full name in capital letters. Any number of *.JAB files can be created for any possible abbreviation style needed. The REDEFINE F-KEYS option shows the available ASCII characters that can be used in the database to obtain Greek and mathematical symbols, among others, on screen. However, these characters may not print with all wordprocessor and printer combinations. The HELP or EXIT from PROGRAM option changes from one to another menu (Fig. 1, bottom middle). Here one may view all of the context-sensitive help screens, the text and

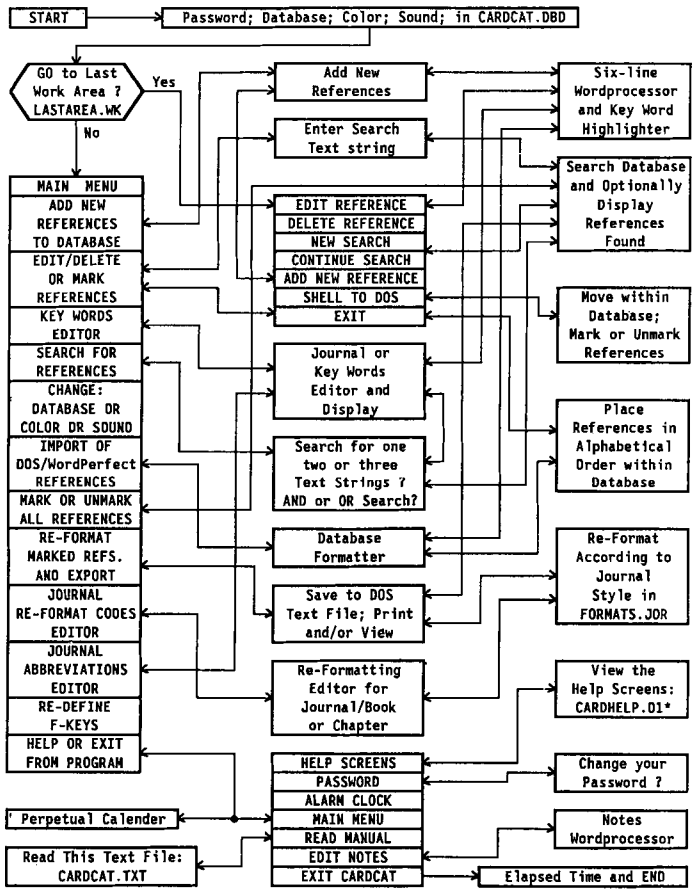

Fig. 1. Relations of program parts of CARDCAT.EXE, a reference management system for the IBM-compatible personal computer.

figure of this paper, shell to DOS, change the password, set an alarm clock, or edit the note area. A 15 line by 40 character wordprocessor is used to create and display notes for each of the databases if desired. Finally, one may exit the program with an elapsed time use message.

CARDCAT has proven its usefulness to the author and several colleagues and should be helpful to entomologists and scientists in general. The program can also be used to manage ideas, lists of things (such as slides), and other information (Howard 1988), as long as the data begin with the English letters A–Z. Thus, for example, one could list slides as A1, A2, etc., or by subject as Scolytidae 1, etc.

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