

A LUCID™ KEY FOR COMMON WEEDS OF NEW ZEALAND

T.K. JAMES¹, A.F. LESLIE², A.I. POPAY³ and P.D. CHAMPION⁴

¹*AgResearch, Ruakura Research Centre, Private Bag 3123, Hamilton*

²*University of Waikato, Private Bag 3105, Hamilton*

³*Department of Conservation, PO Box 112, Hamilton*

⁴*NIWA, PO Box 11-115, Hamilton*

Corresponding author: trevor.james@agresearch.co.nz

ABSTRACT

An "Illustrated Guide to Common Weeds of New Zealand" was published by the New Zealand Plant Protection Society in 1998 and a second edition in 2004. This book has a key that uses flower colour and size, and plant form for identification of broadleaf weeds. However, when no flowers are present the only recourse is to go through the book looking at the photographs. Lucid Professional™ is a software package produced by the University of Queensland for the production of identification or diagnostic keys. The resultant Lucid™ key is a multi-access key that allows identification to begin with any of the plant's main characters. As soon as the character's state is identified, all the taxa that do not match are discarded and the process repeated until the plant is identified. The information in the second edition of the book has been converted into a Lucid™ key that contains descriptions and illustrations for 333 taxa.

Keywords: multi-access key, weed identification, weeds, Lucid™.

INTRODUCTION

The book "An Illustrated Guide to Common Weeds of New Zealand" (Roy et al. 1998) produced by the New Zealand Plant Protection Society, had its beginnings when Bruce Roy, a farmer from South Kaipara Head, brought in a card file that he wanted published. The card file consisted of a collection of weed descriptions organised into a key based on flower colour and size. This was sufficient incentive for the other authors to get involved and, after many alterations, corrections and a national search for photographs, the final endeavour was published in 1998. By late 2002 the book was nearly out of print and a decision was made to undertake a rigorous review and produce a second edition. New weeds were added, including 12 species of fern and fern allies, and a small number were deleted. Over 250 new photographs were used, many taken especially for the book, to add to or improve on the previous photographs while adding 32 pages to the book's length. The text was also reviewed and corrections made. The second edition of the book still uses the original flower colour, size and plant form key as the principal means of identification (Roy et al. 2004). This makes it difficult to identify a weed without flowers. So although the book contains information on other plant parts like leaves, stems and roots, it is not in a form that is helpful for separating species.

Previously in New Zealand multi-access keys have been produced for plant parasitic nematodes (Bell 2002) and for plant pathogenic fungi (Neilson & Stewart 2003). Each containing 30 and 175 taxa respectively, these keys contain fewer taxa than the weeds book. The objective of the work described in this paper was to investigate the use of Lucid™ software to convert all of the data in the book into a multi-access key that would use all the compiled information in a format better suited to weed identification.

DEVELOPMENT OF THE MULTI-ACCESS KEY

Lucid Professional™ is a software program designed to assist in the development of multi-access keys (Anon. 2002a). Traditional dichotomous keys follow a series of rules and questions to determine the identity of a given specimen. However, the specimen may not possess all the features required in order to identify it. This is a particular problem with plants where one of the most common identifying features is flowers and few plants flower all year round. A multi-access key, as developed in Lucid™, is essentially a database of all the features, called states, for each taxon that is included. The states are listed under headings called characters (Table 1). For each taxon entered into the database, the relevant state(s) listed under each character are given one of five different options, viz. common, rare, uncertain, commonly misinterpreted and rarely misinterpreted. An empty entry is equivalent to false.

The key uses 41 characters, which include some specifically for graminoid species so that the key could be expanded to include grass weeds without alteration to the basic structure. Each state has an example photograph that can be viewed at any time and this helps with choosing the correct state. When a state has been selected all taxa that do not have this state are removed from the remaining list of possible taxa. Any state may be selected at any time. By selecting the states of several characters it is possible to reduce the number of remaining taxa to a short list, or even to a single taxon, and thus to accurately determine the identity of a specimen even if the normal diagnostic features (for example flowers) are not present. To further increase the probability of a correct identification, Lucid™ introduces into the key the possibility of wrongly identifying a state but still getting to the correct answer. This is accomplished by scoring states as either commonly or rarely misinterpreted. The key does not discard taxa with these states but keeps them as “greyed names” at the bottom of the “Taxa remaining” list indicating that they could still be the correct taxon.

TABLE 1: Examples of characters and their states used in the key.

Plant form	Character		
	Leaf type	Leaf margin	Root type
Tree	Simple	Entire	Taproot
Shrub	Trifoliolate	Serrated	Fibrous
Vine or climber	Biternate	Lobed	Rhizomes
Grass like	Pinnate	Deeply divided	Bulbs, tubers or other
Fern or fern ally	Bipinnate		
Herb or other	Palmete		
	Absent/inconspicuous		

The characters and their states are pre-determined by the author of the key and their correct determination largely contributes to the value of the key. Too many characters and states can lead to confusion while too few might result in the taxa not being able to be separated. After compiling their own list of characters and states, the authors decided to use (with permission) the same set of characters and states as the Australian key “Suburban and Environmental Weeds” (Anon. 2002b). This would allow integration of the products at a future date to create an Australasian weed key.

Lucid™ comprises many parts of which the most important are the builder, in which keys are built, and the player, in which keys can be used to identify specimens. Once built the key and player can be transferred to a CDROM, or uploaded to a website, and distributed for use. The player serves as the functional part of the database, and is the only part that end users see (Anon. 2002a).

Two major components in creating this key were the technical and display aspects. The technical aspect involved the creation of the key (including choosing characters and states), extracting information from “An Illustrated Guide to Common Weeds of New

Zealand” and entering this into the characters and states tick boxes. In many cases this had to be checked with the “Flora of New Zealand” Volumes I, III or IV (Allan 1961; Healy & Edgar 1980; Webb et al. 1988) in order to gain the extra detail required. The information in the book is concise and simple. However, in certain areas, such as leaf shapes, there was often insufficient information for all characters and states to be identified for the key. Additional work will be required for all characters to be collected for all species.

The display aspect reflects the overall presentation of the key (Fig. 1). This involved designing the front page, creating the notes pages and supporting HTML files, choosing, cropping and displaying pictures and writing appropriate supporting text, such as the introductory page. Much of the time spent developing the key involved the transfer of individual weed information from the book to separate notes pages in the key. However, items such as the introductory page, indexes (complete with hyperlinks), instructions, photographic examples of all the states for each character, etc. had to be created from scratch as there was no equivalent in the book.

A major difficulty encountered was the conversion of the text from the book to the individual notes pages of the key. The former was in PDF format and the latter in HTML. First the PDF files were converted to MSWord format and the HTML function of MSWord used to create the HTML files. Unfortunately the resulting HTML files were large, clumsy and not useful for the key. An excellent solution to this problem was found when a computer programme was written to convert text files to HTML notes pages. The resulting program ‘makehtml.exe’ used correctly formatted text files of the book’s contents and converted it to individual, consistently formatted notes pages. These notes pages then required the insertion of the weed photographs and hyperlinks to other pages.

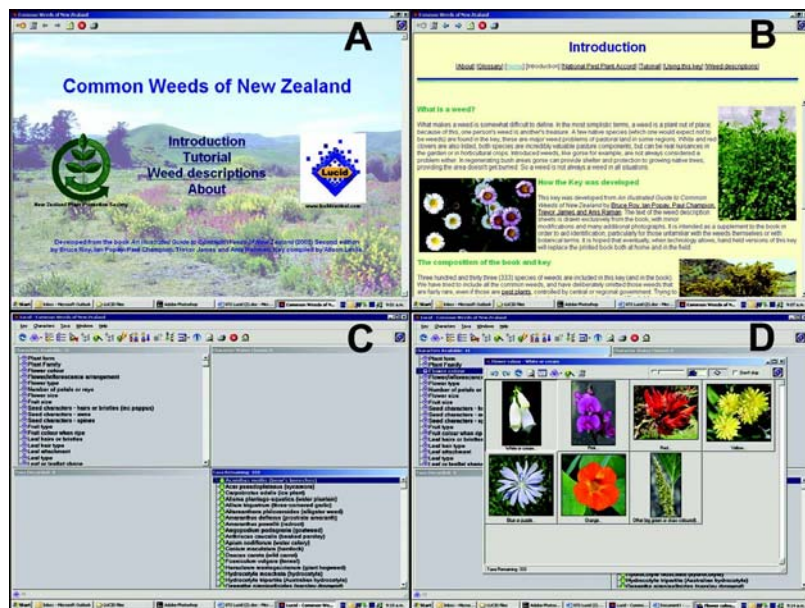


FIGURE 1: Examples of some of the key’s screens. A. Front screen, B. Introduction, C. The actual key, D. The illustrations of the states of the character “flower colour”.

One of the benefits of the key is that there is no limit (within reason) to the number of photographs that can be included for any weed. Many photographs, usually highlighting pertinent features such as seedling stage, roots, stems, leaves etc., were added.

THE FUTURE

Development of a multi-access key is a new area for the New Zealand Plant Protection Society. Obviously, it will enable the Society to publish Common Weeds of New Zealand in another medium. This may in the future result in lower publication costs, particularly if they are published exclusively as CDs. The knowledge gained could also pave the way for small publications in specialist areas that were previously deemed uneconomic due to the small size of the market. One of the advantages of a software key and CD-ROM format is that publication costs are drastically reduced, especially as once the key has been made, reproduction for supply can be on an 'as ordered' basis with no costly stocks to manage. Publishing costs could be as low as \$12–15 per CD-ROM and this includes the license fee for the Lucid Player™. Another benefit of a software-based publication is the ease and speed with which changes and corrections can be made. Changing botanical names or including better photographs or even new species, complete with notes and photographs, is not difficult and the new publication would be available immediately rather than when print stocks ran out.

Multi-access keys could also draw in a new client base for the New Zealand Plant Protection Society. The keys are ideal teaching aides and, by their nature, better identification tools than hard format publications. This would make pest identification easier and more accessible to the ordinary person.

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