

Australian Tropical Rain Forest Plants

Trees, Shrubs and Vines

User Guide

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INTRODUCTION

Australian Tropical Rain Forest Trees: An Interactive Identification System was published in 1993, and covered 1056 tree species in 84 families in northern Australia. Although that book was a significant milestone, we believed that our task would not be complete until we had constructed similar databases and computer-based keys for the other life forms in Australian tropical rain forests. We also wanted to improve the identification system to make it even easier to identify rain forest plants and gain substantial information about them.

Australian Tropical Rain Forest Trees and Shrubs was published in 1999, completing Step 2 in the process of producing an information system for tropical Australian rain forest plants.

The latest version, *Australian Tropical Rain Forest Plants: Trees, Shrubs and Vines*, completes Step 3 in our plan to produce an information system for Australian tropical rain forest plants. It includes 455 of the estimated 500 species of vines thought to occur in these forests. They are an interesting group of plants but sometimes difficult to collect and study. The larger vines are thought to comprise a significant part of the overall dynamics of rain forest but their contribution is not always obvious.

Significant advances continue to be made in computer technology. The hardware operates at greater speeds, the software is increasingly sophisticated, the storage capacity of hard disks increases at an exponential rate and other data storage facilities such as CDs and DVDs are increasingly commonplace. The capacity to store and retrieve data has now completely outstripped our capacity to accumulate it by careful observation and dissection of specimens with our current resources. Our efforts to make taxonomic information on northern Australian rain forests available to the wider scientific community and the population as a whole is no longer restrained by machine capacity. We live in exciting times and although we try to keep abreast of recent developments we find it difficult to avoid the conclusion that we, and the rest of the taxonomic community, are not really utilising the available technology to our best advantage.

Collection, preservation, careful dissection and observation of specimens are of great importance now, just as they were in the past. The use of voucher specimens preserved in a herbarium where all specimens are databased is vital to a large and complex project such as this one. This project will never supplant the work of the individual taxonomist revising particular groups. We need taxonomic revisions to define species limits, to elucidate species relationships and to sort out and present the nomenclature in a logical and clearcut way so that the literature pertaining to a particular species can be accessed.

The number of images included in this version is significantly greater than in the 1999 version, and includes images of seedlings. It is probably not generally appreciated just how difficult it is to produce seedlings of all the species encountered and, having done all this work, we feel it is necessary to make them available digitally for the benefit of all users. Most images included in the key were gathered by CSIRO staff as part of this research project; however, we are indebted to the following people who allowed us to use images from their private collections: Stan Breeden, Bill Cooper, Andrew Ford, Penny Goulter, Mick Godwin, Bruce Gray, Barry Jago, Andrew Small, Geoff Stocker and Heather Windsor.

Although the information in the CSIRO Atherton herbarium was generally sufficient to document the distribution of trees, shrubs and vines in Queensland and Western Australia, it was incomplete for the Northern Territory. We are therefore grateful to Greg Leach and Clyde Dunlop for providing database information on rain forest plants from the Northern Territory herbarium. In addition, our information on the distribution of Queensland plants was augmented by information from the Queensland Herbarium.

We have attempted in this version to cover most of the commonly encountered synonyms associated with the species included.

The Australian Plant Name Index

(<http://www.cpbr.gov.au/cpbr/databases/apni.html>) was a major source of nomenclatural information for this open-ended task which can never be regarded as complete. However, we hope that it will assist some users to link previous names with currently accepted names.

Once again, we are indebted to a large number of people for help and encouragement. We have received help from the staff of various state herbaria in Western Australia, Northern Territory, Queensland, New South Wales, Victoria and the Australian National Herbarium in Canberra. Our home institutions have provided the basic staffing framework for work on the key; however, this has been augmented in these stringent economic times by timely injections of additional funds from the Co-operative Research Centre for Tropical Rainforest Ecology and Management. This allowed us to employ Andrew Ford and Justin Seawright both of whom made significant contributions to this version. Without the help from this agency, this work could not have been accomplished in the timeframe. The following are thanked for the time and effort they put in to reviewing draft versions of the key, and for their valued suggestions: Jeremy Bruhl, Dale Dixon, Betsy Jackes, Laurie Jessup and Kevin Kenneally.

Finally, our colleagues in the Tropical Forest Research Centre at Atherton have also assisted in numerous ways and have tolerated our strange behaviour during our more stressful periods.

Despite careful dissection and recording of thousands of observations, we know there are gaps in our database and presumably errors in recorded observations. We therefore ask anyone who experiences problems to bring them to our attention and submit voucher specimens, so that we can check the appropriate morphological features.

GETTING STARTED

Installation options

The program and images come on two CDs:

- CD 1 (green in colour, labelled Setup) contains the installation procedure, the program and data files, and the seedling images.
- CD 2 (red in colour, labelled Images) contains the leaf, photograph and line drawing images of the adult plant.

Three installation options are provided, allowing the user to customise the extent to which the images are copied to the hard disk.

- 1 **Program only on hard disk:** the program and the data files are copied to the hard disk, but all the images are run from the CD-ROM. This uses the minimum amount of hard disk space (approximately 25 Mb). However, both CDs will be required to access all the images, and it will be necessary to swap the CDs in the CD-ROM drive if you wish to move between adult and seedling images. This option is useful where hard disk space is at a premium.
- 2 **Program, photo and leaf images on hard disk:** the program and the data files are copied to the hard disk, along with the photograph, leaf and line drawing images. This uses a larger amount of hard disk space (approximately 675 Mb) but means that the images listed are more rapidly accessed. The seedling images must be accessed from CD 1, but that is the only CD required after installation. This option is useful where the program will be used predominantly for identification of adult plants, and the seedling images will only be accessed at infrequent intervals.
- 3 **Program and all images on hard disk:** the program, data files and all images are copied to the hard disk. This uses the largest amount of hard disk space (approximately 1 Gb), but means that all images are rapidly accessible. This option is useful where hard disk space is no problem, and where rapid access to the images is required.

Note. If you leave some or all of the images on the CD-ROM drive, then change the configuration of the computer such that the drive letter of the CD-ROM drive is changed, you may need to re-install the program so that the program correctly accesses the files on the CD-ROM.

How to install the program

An installation program (setup.exe) is provided to correctly install the program and any associated files, and to place the program in the Start menu.

- 1 Place CD 1 (green in colour, labelled Setup) in the CD-ROM drive.
- 2 To start the setup program either:
 - select Start, Run, then type *d:\setup.exe* (where *d* represents your CD-ROM drive letter), or
 - browse to the CD-ROM drive and double-click on setup.exe.
- 3 The installation program will lead you through the steps necessary to install the program.
- 4 Follow the prompts to select the desired installation option (see above for details), which will then copy the selected files to the hard disk and set up the program in the Start menu, ready to run.

Screen display

The program is easiest to use when run on a computer and monitor set at SVGA resolution (800 x 600) or higher. Working with a number of different character sets and a number of possible taxa, and therefore a number of different windows, proves much easier when the monitor is set to higher resolutions.

The monitor should be set to a minimum of 256 colours. The program will display images quite adequately in this mode, although the images will be slightly improved by displaying at higher colours (millions of colours). If a trade-off is required between screen resolution and number of colours, then, provided that the minimum of 256 colours is used, the higher screen resolutions are preferable.

The rain forest key status bar, or some other part of the key, may be hidden by the Windows taskbar. In this case, you should temporarily or permanently change the properties of the taskbar.

- 1 Right-click on the taskbar, and select 'Properties'.
- 2 Click on the tab 'Taskbar options' (if necessary, depending on the version of Windows) and then unselect 'Always on top'.
- 3 Click 'Apply' and then 'OK' to close. A similar situation may apply to other taskbars, such as the Microsoft Office taskbar.

All windows in the key are moveable and re-sizeable in the usual way, however, there are four windows in which the general aspect (length:width ratio) is important. These are the distribution map, the leaf image (screen size), the photographs and the seedling image (screen size) windows. These may only be re-sized using the top, bottom or corner borders. The width of the window is automatically set to maintain the correct proportions to the window.

Points to consider when using the key

The key is designed to assist in the identification of rain forest trees, shrubs and vines in northern Australia, an area covering rain forests from Townsville to Torres Strait and westward as far as the Kimberley Region of Western Australia. It is not designed to identify plants outside this area. As far as this key is concerned, rain forest encompasses a wide variety of closed forest types in the higher rainfall areas of northern Australia. It does not include open eucalypt forests or mangrove forests, although it does include the closed forests found on sand dunes near the sea. The following commonly used terms are encompassed in our broad rain forest category: Monsoon Forest, Softwood Scrub, Vine Thicket, Gallery Forest, Scrub, Jungle and Vine Forest.

Features can be combined in any order to effect an identification, and leaf, flower, fruit, seedling, family and geographical features can be used together; bark features are available for trees and large vines, but not for shrubs and slender vines. Whatever features are being used, it is important to record only those features about which you are certain. If you are doubtful about a feature, it should not be used – **if in doubt, leave it out.**

As a seed may not have come from the plant near where it is found, it is not advisable to use the seedling characters in combination with other characters, except geographic distribution. Flower and fruit characters are generally more reliable for identification than leaf characters, which in turn are more reliable than bark characters. However, availability of characters may be more important than reliability.

Efforts should be made to reduce the number of possible species to fewer than 15, otherwise identification by checking the species descriptions or leaf and other images can become tedious. In most cases, the number of species can be reduced by adding more features. Conversely, if there are only a few possible species remaining, there is little point in adding more features of doubtful applicability to reduce the number of possibilities to one. Even when there is apparently only one possibility remaining, the descriptions and images should be checked for confirmation of the identification. It is always possible that a mistake has been made, and comparing the specimen with the additional information and the various images provided may indicate this.

Future developments and help

Information on future developments with the key, as well as hints or discussion of any problems, will be placed on the rain forest key webpage available at:

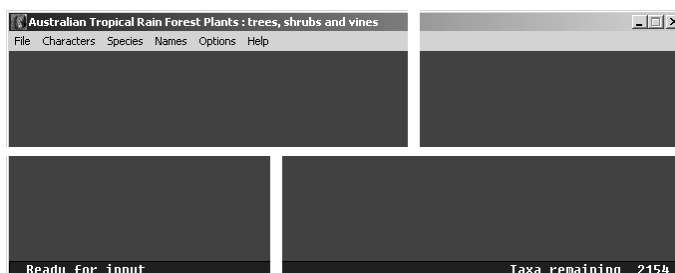
<http://www.cpbr.gov.au/cpbr/cd-keys/rfk/index.html>

The webpage will also provide links to other information about research on Australian tropical rain forest plants.

USING THE PROGRAM

This is a short introduction to using the program for identification. The more important features are explained, with a longer review of all the main features of the program given in the next section. Further information is available in the on-screen help system within the program.

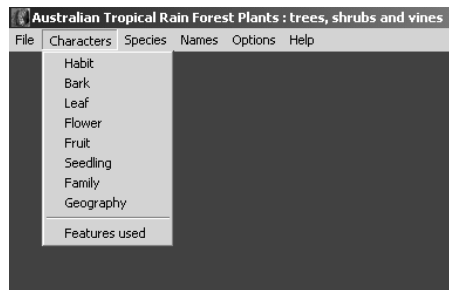
After the opening sequence, during which the data are loaded, the main window will appear. This window has a title bar and a menu bar at the top, and a status bar at the bottom. Between these is the main workspace, within which the various windows may be viewed. The menu bar at the top is used to access the main functions of the program, while the status bar at the bottom shows the current operation on the left of the screen, and the number of taxa remaining on the right.



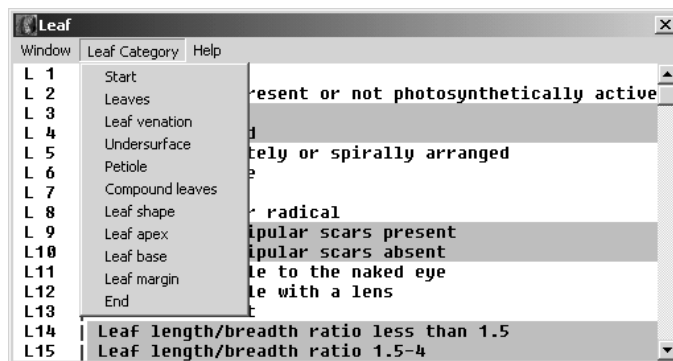
The first time that the program is used, an initial help screen is displayed. This provides a brief description of the use of the key. This help screen may be closed temporarily or permanently. However, it may be recalled at any time from the Help menu of the main window.

To start an identification, open one or more of the character windows that correspond to the specimen characters available. Select these from the character menu. Each character set (habit, bark, leaf, flower, fruit, seedling, family, geographic area) will open up a window within which the features from that character set are displayed. These character windows may be moved and re-sized as desired, to create a comfortable

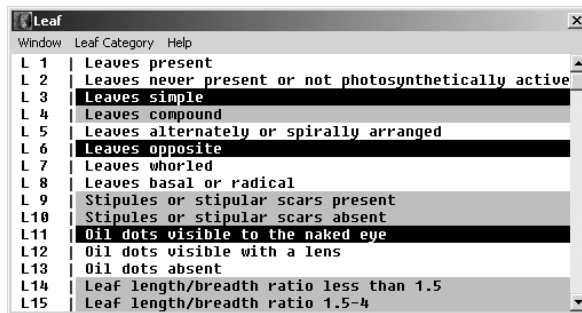
on-screen appearance. Additional character windows may be opened at any time, and the open windows may be closed if required. If any of these windows are subsequently re-opened during an identification, the window will appear in the same form as when it was closed.



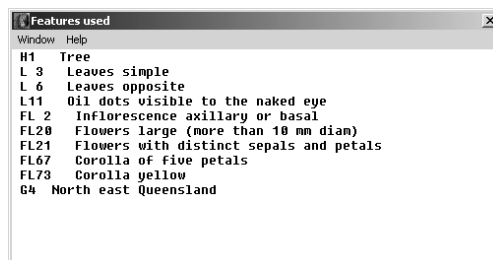
Within a character window, the features are displayed as a list. The features are blocked alternately on a white or grey background. Generally the features within a block correspond to states of a single character. It is possible to move through the list of characters by using either the scroll bar to the right of the character window, or the category menu. In the latter case, the menu shows the various categories of characters available, and will move directly to the start of any category selected.



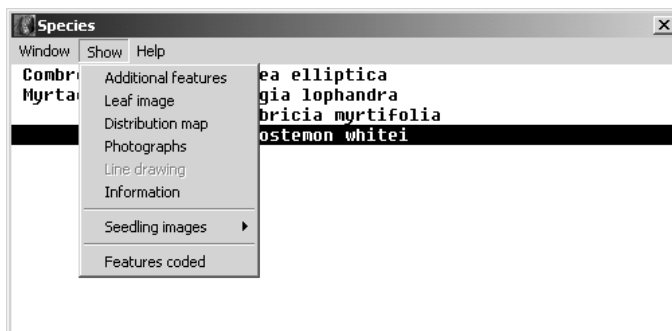
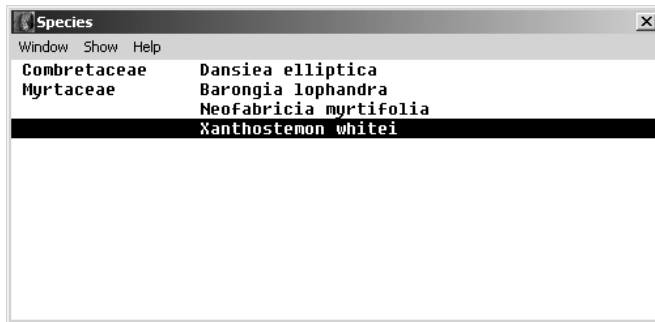
Character selection is made by left-clicking with the mouse on the text of a feature, to the right of the red vertical line. Information (help) on each feature may be obtained by left-clicking on the feature number, to the left of the red vertical line; in this position the help cursor (question mark) will appear. As each feature is selected it is highlighted, and the number of taxa remaining is updated on the status bar. The features selected for any character set will remain until a new specimen identification is started (via the File menu on the main menu bar) even if the window is closed.



The features selected across a number of different character sets may be viewed in the Features Used window, available under the Characters menu on the main menu bar. At any time, a feature that has been selected (and therefore highlighted) may be removed (de-selected) by again left-clicking on the text of the feature in the character window. Alternatively, a feature may be de-selected by left-clicking on it in the Features Used window.

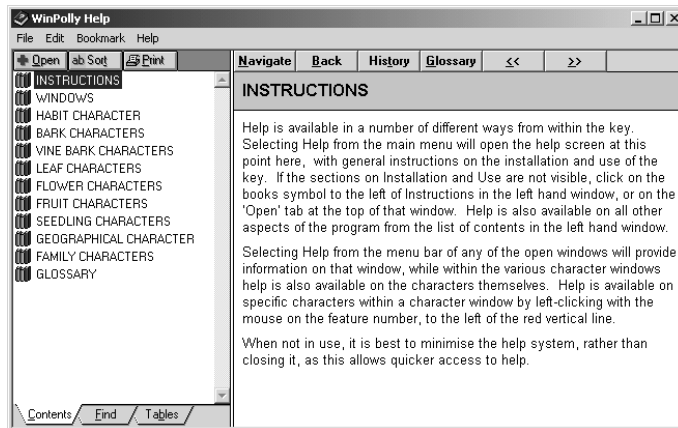


A complete list of the names of the species remaining may be seen in the Species window, available under the Species menu on the main menu bar. This list of species is automatically updated as further features are selected (or de-selected). At any stage in the identification, it is possible to obtain further information on each of the remaining species. Within the Species window, select one of the remaining species by left-clicking on its name, and thus highlighting it. This will enable the Show menu within the Species window. Note that if only one species remains, it must still be highlighted to enable the Show menu. The Show menu provides (in separate windows) access to information on additional features of the species, a leaf x-ray image, a distribution map, and in most cases one or more photographs of the species and one



or more seedling images. Line drawings are provided for some of the species, and these can be accessed under the Show window as well. Also available, under Information, is general information on the family and genus, while the Features Coded menu opens up a window with a full list of the features coded for that species. When one or more of these informational windows is open, selecting a different species name (by left-clicking on it in the Species window), will automatically update all the open windows.

Identification proceeds by observing those features clearly visible on the specimen and selecting them in the appropriate character windows. If there is any doubt about a particular feature, it should not be used. In this way, the number of taxa remaining is gradually reduced. When the number of taxa remaining is small and all the more obvious features have been selected, it is best to access the additional information on each of the remaining taxa in order to choose between them.



Help is available in a number of different ways from within the program.

- Selecting Help from the main menu will open the help screen with general instructions on the program. Help on all other aspects of

the program is available from the list of contents in the left hand window of the help screen.

- Selecting Help from any of the open windows (including the character windows) will open the help screen with information on that window; alternatively, the F1 key may be used to obtain information on the active window.
- Context-sensitive help is available on all the features. Left-clicking the feature number (to the left of the red vertical line) in a character window will open up the help screen with information on that particular feature, including line drawings of the characters where appropriate.

When not in use, the help screen should be minimised rather than closing it, as this will allow quicker access.

MAIN FEATURES AND COMMANDS

The main capabilities of the program are detailed here. More information on each topic may be found within the help system.

Main window and status bar

This window serves as the main backdrop for all other windows. The left hand side of the status bar, which is at the bottom of the window, indicates the current action, while the number of taxa remaining is displayed on the right-hand side.

The various windows that open in response to a selection in the main menu are moveable and re-sizeable. You may set up the selection, size and position of these windows in any way that suits you. You may move between windows by re-selecting them from the main menu or, more conveniently, by right-clicking on any part of the window (left-clicking in a number of the windows performs a specific action). If a window becomes hidden by other windows, it may be brought to the front by re-selecting it from the menu. The help window, if open, should be minimised when not in use.

General help is available on any window by selecting the Help menu in that window, or by pressing the F1 key while that window has the focus (has a highlighted title bar). More specific help is available in a number of windows, as detailed below.

The rain forest key status bar, or some other part of the key, may be hidden by the Windows taskbar, or by other taskbars such as the Microsoft Office taskbar. See under 'Screen display' (p.8) for information on how to correct this.

Main menu

The following facilities are available from the main menu:

File

Start New Specimen

This will clear all currently selected characters and start the identification of a new specimen. However, it will leave open all

currently selected windows, maintaining their positions. This is useful if you have set up the windows in a particular way, and wish to maintain this configuration for a series of specimens.

Note: You can save this configuration between runs from the **Save current positions** item under the **Window positions** item of the **Options** menu.

Start and Clear

This will start the identification of a new specimen, clear all currently selected characters, and close all currently open windows.

Quit

This will close all windows, and exit the program.

Characters

This will open the window for the selected character type (habit, bark, leaf, flower, fruit, seedling, family or geography). Any characters previously selected for the current specimen will be highlighted in the character window. As many of the character windows as required may be open at any one time, and their size and position may be altered at will.

All characters are routinely available, except that the Bark characters are only available if either Tree or Vine has been selected as the habit for the current specimen. The set of Bark characters for trees is different from that for vines; the appropriate set is enabled when either Tree or Vine is selected under Habit.

Note: The vine bark characters should only be used for the larger vines, with well-developed bark. The characters do not apply to the slender vines.

Within each window, the features relating to that character type are listed. Features that correspond to states of a single character are blocked alternately on a white or grey background. In most cases, only one feature would be selected from each block.

To select a feature, move the cursor to that feature and left-click on the text of that feature, to the right of the red vertical line. The feature selected will be highlighted. If you change your mind at any stage about any selected feature, move the cursor to that feature and left-click again.

The feature will be removed (de-selected) and the highlighting will cease. Every time a feature is selected or de-selected, the **Taxa remaining** total on the status bar is updated. You can move in and out of the various character windows as much as you wish; all data are retained until either the **Start New Specimen** or **Start and Clear** item is selected from the main **File** menu.

General help is available on a character type by pressing the F1 key while in that character window, or by selecting help on that character set from the **Help** menu in the character window. More specific help is available on each block of features by moving the cursor to the feature number, to the left of the red vertical line and left-clicking; the help cursor (generally a question mark) appears when the cursor is over the feature number. More detailed information on the help window is provided below.

Within a character window, it is possible to move between the features in a number of ways. The vertical scroll bar to the right of the window allows movement up and down one line at a time, one page at a time, or to any position by dragging the thumb. It is also possible to move through the list of features via the **Category** menu in the character window. A drop-down menu allows movement to a particular category of features. This is useful in some of the longer lists of features, such as the flower features where it is then possible, for example, to move directly to the 'Calyx' features or the 'Corolla' features.

Finally, the **Window** menu in the character window allows access to the **Close window** menu item. This closes the character window. The window may also be closed by clicking on the close window symbol in the title bar of the window (varying with the version of Windows that is running). However, all data are retained until a new specimen identification is started. The character window may be re-opened at any time during an identification, and it will return in the state that it was left when closed.

Features Used

This menu item under the **Characters** menu will open up the Features Used window. This lists all features currently selected from all character types. It may be opened when required, for checking purposes, or left

open continuously in one corner of the screen. As features are selected in any of the character windows, they are automatically added to the Features Used window.

In addition to showing the features currently selected, the Features Used window may be used to de-select one or more features. Left-clicking on a feature in the Features Used window will allow its de-selection. A message box will open up requesting confirmation of the deletion. Clicking on 'Yes' will delete the feature; clicking on 'No' or 'Cancel' will close the message box without deleting the feature.

The **Print features used** item under the **Window** menu in the Features Used window will print the list of features currently selected on an attached printer. The **Close features used** window will close the Features Used window.

Species

The **Species** menu on the main menu allows access to the **List** item. Selecting this will open up the Species window, which lists all remaining taxa in alphabetical order by family, genus and species. It is possible to scroll through this list using the vertical scroll bar on the right-hand side of the window.

The Species window may be opened at any stage when required, to view the possible identifications, or it may be left open continuously. As features in the character windows are selected or de-selected, the Species window is updated to reflect the species remaining.

At any stage, selecting a species in the Species window provides access to further information on that species. To select a species, move the cursor to the species name and left-click on the name. The species is highlighted, and the **Show** menu in the Species window becomes active. The drop-down menu under Show provides access to a series of items, each of which opens up a window with additional information on the selected species.

The **Additional Features** window provides information on the species selected. Information is available on nomenclature, synonymy, diagnostic features from the leaves, stem, flowers, fruits and seedlings of

the species, and notes on the distribution, ecology and natural history. It is possible to control the information displayed in the Additional Features window. Under the **Window** menu of the Additional Features window, each individual component of the information may be selected or de-selected. These selections remain until the program is closed. Also available under the Window menu is the ability to show the RFK (rain forest key) code number. This is the code number assigned to each species during development of the key. It is mainly of interest to users of the earlier versions of the key, in that it allows them to track nomenclatural and taxonomic changes to the species included in those earlier versions. The font in the Additional Features window may be changed; see under the **Options** menu below.

The **Leaf Image** window displays the x-ray image of a leaf or leaflet for the selected species. Within the Leaf Image window, a menu allows display of the image at one of two different sizes. **Image size screen** displays the image so that the whole leaf or leaflet fits vertically on the screen, and is useful in obtaining a general impression of leaf or leaflet size and shape. **Image size 100%** displays the image at full scanned resolution, where the image is generally larger than the screen, and is useful in examining details of leaf venation. In all cases there is a scale bar on the image to provide an indication of the actual size of the leaf or leaflet. The **Image information** item in the menu of the Leaf Image window displays information on the voucher specimen and copyright holder for the currently displayed leaf or leaflet image, and the size of the scale bar.

The **Distribution Map** window shows the known distribution within northern Australia of the currently selected species, based on herbarium specimens held at the Australian National Herbarium in Canberra (CANB) and Atherton (QRS), the Northern Territory Herbarium, Darwin (DNA) and the Queensland Herbarium, Brisbane (BRI).

Photographs are available for many, but not all, species in the rain forest key. The **Photographs** item in the Show menu is highlighted if there are one or more photographs available for the selected taxon. Selecting this item will display the first of the photographs. If further photographs are available, as indicated in the title of the Photograph window or in the

Window menu, they may be accessed in one of two ways. The **Window** menu in the Photograph window provides access to all the available photographs of the selected species. The various items in the menu are enabled if photographs are available. Additionally, left-clicking in the Photograph window itself will rotate through all available photographs. The **Photograph information** item in the menu of the Photograph window displays information on the voucher specimen and copyright holder for the currently displayed photograph, as well as some notes on the photograph.

Line drawings are available for only a few species. The **Line drawing** item in the Show window is highlighted if there is a line drawing available for the selected taxon. Within the **Line Drawing** window, a menu allows display of the drawing at one of two different sizes. **Drawing size screen** displays the image so that the whole drawing fits vertically on the screen, and is useful in obtaining a general impression of the drawing. **Drawing size 100%** displays the drawing at full scanned resolution, where the drawing is generally larger than the screen, and is useful in examining details on the line drawing. The **Drawing information** item in the menu of the Line Drawing window displays information on the voucher specimen and copyright holder for the currently displayed drawing, as well as some notes on the drawing.

The **Information** window available under the Show menu provides some general information on the family and genus to which the selected species belongs, together with specific references relating to that family.

Seedling images are available for many, but not all, species in the rain forest key. The **Seedling images** item in the Show menu is highlighted if there are one or more seedling images available for the selected taxon. There are three different types of seedling image for each taxon, and the appropriate menu item is enabled if an image is available. The **Cotyledon stage** image is a scan of a pressed seedling at the cotyledon stage. The **Tenth leaf stage** is a scan of a pressed seedling at the tenth leaf stage. The **Seedling** image is a photograph of a seedling. A scale bar is usually present beside each image. Within the Seedling Image window, a menu allows display of the image at one of two different sizes. **Image size screen** displays the image so that the whole seedling

fits vertically on the screen, whereas **Image size 100%** displays the image at full scanned resolution, where the image is generally larger than the screen. If more than one image is available, they may be accessed in one of three ways. The Seedling Images menu under the Show menu of the Species window gives access to all available images. In a similar way, so does the Window menu of the Seedling Image window. Finally, left-clicking in the Seedling Image window itself will rotate through all available images. The **Image information** item in the menu of the Seedling Image window displays information on the voucher specimen and copyright holder for the currently displayed image, as well as some notes on the image.

The **Features Coded** window displays a complete list of the features coded for the selected species within the key. This may be opened and compared with the **Features Used** window when it is desired to compare a known species with the specimen being identified. Note that the features coded within this key contain some of the variations within the species, as well as possible misinterpretations of various features that a user might make. It is possible to control the information displayed in the Features Coded window. Under the **Window** menu of the Features Coded window, each individual set of characters may be selected or de-selected. These selections remain until the program is closed. The **Print features coded** item under the **Window** menu will print the full list of features coded to an attached printer, while the **Close features coded window** item will close the Features Coded window.

The **Print species** item under the **Windows** menu in the Species window will print the names of the remaining taxa on an attached printer. The **Close species window** item will close the Species window.

Names

Under the **Names** window there are four different lists of names available.

Alphabetical by common name

The **Alphabetical by common name** item opens up a window with a list of common names, in alphabetical order, together with their botanical (scientific) name. It is possible to move through the list in a

number of ways. The vertical scroll bar to the right of the window allows movement up and down one line at a time, one page at a time, or to any position by dragging the thumb. It is also possible to move through the list of names via the **Names** menu in the Names window. A drop-down menu allows movement through the list alphabetically. By left-clicking on any Common Name it is highlighted, and the **Show** menu is enabled. This provides access to all the information available on that taxon in a similar way to the Show menu of the Species window. Thus, where the information is available, the menu items for Additional features, Leaf image, Distribution map, Photographs, Line drawing, Information, Seedling images and Features coded are enabled.

Alphabetical by scientific name

The **Alphabetical by scientific name** item opens up a window with a list of common names, in alphabetical order, together with their common names. The facilities for moving through this list, and the information available, are the same as those described above for the Alphabetical by Common Name window. In each of these lists, Standard Trade Names are given in capital letters, while common names have lower-case letters.

Genus name with family

The **Genus name with family** item opens up the Genus List window with a list of genera, in alphabetical order, together with their family placement. It is possible to move through the list in a number of ways. The vertical scroll bar to the right of the window allows movement up and down one line at a time, one page at a time, or to any position by dragging the thumb. It is also possible to move through the list of names via the **Genus** menu. A drop-down menu allows movement through the list alphabetically. By left-clicking on any genus name it is highlighted, and the Show menu is enabled. This provides access to the information menu, which provides some general information on the genus, and the family to which it belongs.

Synonyms

The **Synonyms** item opens up the Synonyms window, which lists all the scientific names encountered in the key whether they be currently accepted names, basionyms, nomenclatural or taxonomic synonyms. It is

possible to move through the list in a number of ways. The vertical scroll bar to the right of the window allows movement up and down one line at a time, one page at a time, or to any position by dragging the thumb. It is also possible to move through the list of names via the **Species name** menu. A drop-down menu allows movement through the list alphabetically. By left-clicking on a name it is highlighted, and the Show menu is enabled. Under the **Show** menu there are two menu items. The **List of synonyms** item provides the currently accepted name for that taxon (whether it is the same as or different from the highlighted name), plus a list of synonyms (where relevant) that have been applied to plants in Australia. The **Publication details** item provides information on the original publication and type specimen of the highlighted name, whatever its current nomenclatural or taxonomic status.

Options

The **Window positions** item provides the capability of saving or recalling preferred window position settings. The **save current positions** option will store information on the current size and positions of all windows in the key, for future use. This can be used to save a favoured setup of the key, and will become the default setup when re-starting the key. The **restore saved positions** option will recall and use the last set of saved windows positions; this may be useful if the user has temporarily changed some settings but now wishes to return to the last saved positions. The **restore default positions** will recall and use the default positions as determined by the key, and seen when the key is used for the first time.

The **Font** item provides the capability of changing the text font in all the windows. The windows are divided into three different categories, and it is possible to set the font separately in each category. The **character windows** include those showing the list of characters (habit, bark, leaf, flower, fruit, seedling and geography) plus the Features Used and the Features Coded windows. The **names windows** include the Species, Common Names, Scientific Names, Genus and Synonyms windows. The **information windows** include the Additional Features and the Information windows. The fonts available in each case are those present on the computer that fit the required criteria. The fonts

available for selection in the character and names windows are non-proportional fonts, while those available in the information windows are both proportional and non-proportional fonts. The **select font** option allows the user to select from the available fonts in each of the categories of windows. The **save selected fonts** will save the currently selected font in each of the windows categories, for future use; this will become the default font when re-starting the key.

Help

There are several ways in which help may be accessed.

- Select the **Help** item from the **Help** menu in the main window for general help on use of the key, characters and the glossary. See the note below for more details.
- Help on any window may be obtained under the **Help** menu in that window, or by pressing the F1 key when the window has a highlighted title bar. Help on the various character sets is also available under the **Help** menu in the character windows.
- Context-sensitive help is available on the various features by left-clicking on the feature number, to the left of the red vertical line, in the various character windows. The help cursor (question mark) appears when the cursor is in this position.

Note: The Help window in the rain forest key uses the general help system that is part of Windows. There will therefore be some differences depending on the version of Windows running. The Help window is re-sizeable, and on initial opening has two windows, left and right. Various properties may be set in both the left and right windows by right-clicking within the window (left window only in some versions of Windows).

The Help window should be minimised when not required, rather than closed, as then the Windows help system does not have to be re-loaded. When using the Help window for context-sensitive help on the characters (by left-clicking on the feature number within the character window), it is best to close the left window (right-click in the left window, and choose close; re-size the remaining window). Then simply call up help on each character in turn. Users can re-open the left window by choosing Navigate in the menu of the right-hand window.

The **Recall initial help screen** menu item provides access to the help screen that was shown when the program was used for the first time. This initial help screen provides a brief description of the use of the key. This screen may be closed temporarily, for the duration of the current session (by clicking on the 'Close' button) or permanently (by clicking on the 'Do not show this help screen in future' button before clicking on the 'Close' button). Either way, the initial help screen may be recalled at any time by means of the Recall initial help screen menu, and the settings may then be changed.

The **About** menu item provides further information on the authors, and on the many individuals and organisations who have assisted in the production of this key.

CHARACTERS

The characters and their various states (features) are listed here, in order to provide a general overview of the features available for identification in the key. This list may also be used as a reminder, during normal operation of the key. Detailed information is available on each feature in the on-screen help within the key, where the features are defined and, where appropriate, illustrated.

Habit characters

- H 1 Tree
- H 2 Shrub
- H 3 Vine

Bark characters (trees)

These characters are only available when Tree has been selected under Habit.

Bark texture

- B 1 Bark smooth
- B 2 Bark fissured
- B 3 Bark tessellated
- B 4 Bark papery
- B 5 Bark flaky
- B 6 Bark nondescript

Bark exudate

- B 7 Bark exudate clear
- B 8 Bark exudate milky
- B 9 Bark exudate yellow
- B10 Bark exudate red
- B11 Bark exudate absent

Lenticel shape

- B12 Lenticels elongated laterally
- B13 Lenticels elongated vertically
- B14 Lenticels round or irregular in shape

Lenticel colour or perception

- B15 Lenticels black or dark
- B16 Lenticels rusty
- B17 Lenticels pale
- B18 Lenticels inconspicuous

Outer blaze colour

- B19 Outer blaze yellow, white or cream
- B20 Outer blaze red
- B21 Outer blaze pink
- B22 Outer blaze brown
- B23 Outer blaze mixed colours

Outer blaze markings

- B24 Outer blaze speckled markedly
- B25 Outer blaze with longitudinal stripes

Outer blaze texture

- B26 Outer blaze fibrous
- B27 Outer blaze granular

Inner blaze colour

- B28 Inner blaze yellow, white or cream
- B29 Inner blaze red
- B30 Inner blaze pink
- B31 Inner blaze brown
- B32 Inner blaze mixed colours

Inner blaze markings

- B33 Inner blaze speckled markedly
- B34 Inner blaze with longitudinal stripes

Inner blaze texture

- B35 Inner blaze fibrous
- B36 Inner blaze granular

Blaze layering

B37 Blaze layered

Blaze odour

B38 Blaze odour conspicuous

Blaze thickness

B39 Bark less than 2.5 cm thick

B40 Bark more than 2.5 cm thick

Subrhytidome layer

B41 Subrhytidome layer brown or black

B42 Subrhytidome layer yellow, white or cream

B43 Subrhytidome layer pink-red

B44 Subrhytidome layer green

Trunk fluting

B45 Trunk markedly fluted

Coppice shoots

B46 Coppice at the base of the stem

Buttresses

B47 Buttresses absent

B48 Buttresses present

Bark characters (vines)

These characters are only available when Vine has been selected under Habit. They should only be used for the larger vines that have a distinct bark; they are not applicable to slender, basically herbaceous vines.

Climbing method

VB 1 Twiner

VB 2 Tendril

VB 3 Hook

VB 4 Root

VB 5 Branch

VB 6 Leaner

Stem (in cross-section)

VB 7 Normal

VB 8 Fluted

Bark texture

VB 9 Bark smooth

VB10 Bark fissured

VB11 Bark tessellated

VB12 Bark papery

VB13 Bark flaky

VB14 Bark corky

VB15 Bark thorny

VB16 Bark nondescript

Lenticel shape

VB17 Lenticels elongated laterally

VB18 Lenticels elongated vertically

VB19 Lenticels round or irregular in shape

Lenticel colour or perception

VB20 Lenticels black or dark

VB21 Lenticels rusty

VB22 Lenticels pale

VB23 Lenticels inconspicuous

Phloem presence or absence

VB24 Phloem, i.e. living bark, present

VB25 Phloem absent

Subrhytidome layer

VB26 Subrhytidome layer brown or black

VB27 Subrhytidome layer cream

VB28 Subrhytidome layer pink-red

VB29 Subrhytidome layer green

Bark exudate

VB30 Bark exudate clear

VB31 Bark exudate milky

- VB32 Bark exudate yellow
- VB33 Bark exudate red
- VB34 Bark exudate absent

Blaze colour

- VB35 Blaze yellow, white or cream
- VB36 Blaze red
- VB37 Blaze pink
- VB38 Blaze brown
- VB39 Blaze speckled markedly
- VB40 Blaze with longitudinal stripes

Blaze texture

- VB41 Blaze fibrous
- VB42 Blaze granular

Blaze layering

- VB43 Blaze layered

Blaze odour

- VB44 Blaze odour conspicuous

Wood characters

- VB45 Vascular rays obvious
- VB46 Vessels in radial lines
- VB47 Vessels in tangential lines
- VB48 Sections of bark in the wood

Leaf characters

Leaf presence/absence

- L 1 Leaves present
- L 2 Leaves never present or not photosynthetically active

Leaf type

- L 3 Leaves simple
- L 4 Leaves compound

Leaf arrangement (of simple or compound leaves)

- L 5 Leaves alternately or spirally arranged
- L 6 Leaves opposite
- L 7 Leaves whorled
- L 8 Leaves basal or radical

Stipules

- L 9 Stipules or stipular scars present
- L10 Stipules or stipular scars absent

Oil dots (in leaves, or leaflets in compound leaves)

- L11 Oil dots visible to the naked eye
- L12 Oil dots visible with a lens
- L13 Oil dots absent

Leaf or leaflet length/breadth ratio (leaflet in compound leaves)

- L14 Leaf length/breadth ratio less than 1.5
- L15 Leaf length/breadth ratio 1.5–4
- L16 Leaf length/breadth ratio more than 4

Leaf or leaflet margin (leaflet in compound leaves)

- L17 Leaf margin smooth
- L18 Leaf margin toothed
- L19 Leaf margin lobed

Leaf or leaflet intramarginal vein (leaflet in compound leaves)

- L20 Intramarginal vein present
- L21 Intramarginal vein absent

Leaf or leaflet venation (leaflet in compound leaves)

- L22 Leaf three-veined
- L23 No lateral veins either side of the midrib
- L24 Up to 7 lateral veins on each side of the midrib
- L25 8–20 lateral veins on each side of the midrib
- L26 More than 20 veins on each side of the midrib
- L27 Leaves with longitudinally parallel venation
- L28 Other types of venation

Leaf or leaflet midrib (leaflet in compound leaves)

L29 Midrib distinctly raised on the upper surface

L30 Midrib distinctly depressed on the upper surface

L31 Midrib more or less flush with the upper surface

Leaf or leaflet lateral vein angle (leaflet in compound leaves)

L32 Lateral vein angle less than 30 degrees

L33 Lateral vein angle 30–60 degrees

L34 Lateral vein angle more than 60 degrees

Domatia (in leaf, or leaflet in compound leaves)

L35 Undersurface with domatia

Leaf or leaflet undersurface texture (leaflet in compound leaves)

L36 Undersurface smooth

L37 Undersurface hairy or sandpapery

Leaf or leaflet undersurface colour (leaflet in compound leaves)

L38 Undersurface same colour as the upper surface

L39 Undersurface paler green than the upper surface

L40 Undersurface rusty-brown to white but not from hairs

Petiole or leaflet stalk length (leaflet stalk in compound leaves)

L41 Petiole absent (leaves or leaflets sessile)

L42 Petiole short (less than 1/5 of the leaf blade)

L43 Petiole long (more than 1/5 of the blade)

Petiole or leaflet stalk margin (leaflet stalk in compound leaves)

L44 Petiole distinctly winged

L45 Petiole not winged

Pulvinus

L46 Pulvinus present

L47 Pulvinus absent

Leaf division in compound leaves

- L48 Compound leaves with three leaflets
- L49 Compound leaves digitate
- L50 Compound leaves pinnate (with as few as two leaflets)
- L51 Compound leaves bipinnate or tripinnate

Terminal leaflet in compound leaves (pinnate, bipinnate or tripinnate)

- L52 Terminal leaflet present
- L53 Terminal leaflet absent

Leaflet arrangement in compound leaves (pinnate, bipinnate or tripinnate)

- L54 Leaflets opposite
- L55 Leaflets alternate

Leaflet number in compound leaves (pinnate, bipinnate, tripinnate or digitate)

- L56 Up to 7 leaflets in the compound leaf
- L57 8–20 leaflets in the compound leaf
- L58 More than 20 leaflets in the compound leaf

Leaf rhachis in compound leaves (pinnate, bipinnate or tripinnate)

- L59 Rhachis distinctly winged
- L60 Rhachis not winged

Leaf or leaflet shape (leaflet in compound leaves)

- L61 Leaves or leaflets linear
- L62 Leaves or leaflets oblong
- L63 Leaves or leaflets lanceolate
- L64 Leaves or leaflets elliptic
- L65 Leaves or leaflets falcate
- L66 Leaves or leaflets rhomboid
- L67 Leaves or leaflets ovate
- L68 Leaves or leaflets orbicular
- L69 Leaves or leaflets obovate
- L70 Leaves or leaflets triangular, cordate or palmate
- L71 Leaves or leaflets cuneate

Leaf or leaflet apex (leaflet in compound leaves)

- L72 Apex subulate
- L73 Apex aristate
- L74 Apex acuminate
- L75 Apex mucronate
- L76 Apex apiculate
- L77 Apex acute
- L78 Apex obtuse
- L79 Apex retuse
- L80 Apex emarginate
- L81 Apex truncate

Leaf or leaflet base (leaflet in compound leaves)

- L82 Base cuneate
- L83 Base attenuate
- L84 Base obtuse
- L85 Base cordate
- L86 Base auriculate
- L87 Base sagittate
- L88 Base hastate
- L89 Base truncate
- L90 Base oblique
- L91 Base peltate
- L92 Base perfoliate
- L93 Base sheathing

Leaf or leaflet margin (leaflet in compound leaves)

- L94 Margin entire
- L95 Margin serrate
- L96 Margin dentate
- L97 Margin crenate
- L98 Margin sinuate
- L99 Margin undulate
- L100 Margin lobed
- L101 Margin pinnatifid
- L102 Margin pinnatisect
- L103 Margin palmatifid
- L104 Margin palmatisect

Leaf attachment (of simple or compound leaves)

L105 Leaf base or petiole sheathing stem or leafy axis

L106 Leaf base or petiole not sheathing stem or leafy axis

Appendages or modifications which may or may not be involved in climbing

L107 Stems and/or branches twining

L108 Tendrils present

L109 Hooks or spines present

L110 Branches obviously modified

L111 Adventitious roots or haustoria present

Flower characters

Inflorescence position

FL 1 Inflorescence terminal

FL 2 Inflorescence axillary or basal

FL 3 Inflorescence cauliflorous

FL 4 Inflorescence ramiflorous

Inflorescence type

FL 5 Inflorescence a solitary flower

FL 6 Inflorescence a raceme

FL 7 Inflorescence a spike

FL 8 Inflorescence a corymb

FL 9 Inflorescence an umbel

FL10 Inflorescence a fascicle

FL11 Inflorescence a cyme

FL12 Inflorescence a panicle

FL13 Inflorescence a head

FL14 Inflorescence a cone

Flower sexuality

FL15 Flowers unisexual

FL16 Flowers bisexual

Plant sexuality (when flowers unisexual)

FL17 Plant monoecious

FL18 Plant dioecious

Flower size (when fully developed)

FL19 Flowers small (less than 10 mm diam)

FL20 Flowers large (more than 10 mm diam)

Flower perianth form

FL21 Flowers with distinct sepals and petals

FL22 Flowers with 2 (or more) similar perianth whorls

FL23 Flowers with 1 perianth whorl

FL24 Flowers with no perianth

Number of floral parts

FL25 Flowers 2-merous

FL26 Flowers 3-merous

FL27 Flowers 4-merous

FL28 Flowers 4-merous

FL29 Flowers 6-merous

FL30 Flowers more than 6-merous, or not distinguishable

Flower symmetry

FL31 Flowers actinomorphic (regular)

FL32 Flowers slightly zygomorphic (bilateral)

FL33 Flowers markedly zygomorphic (bilateral)

Flower form

FL34 Flowers hypogynous

FL35 Flowers perigynous

FL36 Flowers epigynous

Where calyx and corolla are not clearly differentiated, go to corolla features

Calyx fusion

FL37 Calyx of fused sepals

FL38 Calyx of free sepals

Extent of calyx fusion

- FL39 Sepals fused for more than half their length
- FL40 Sepals fused for less than half their length

Calyx parts

- FL41 Calyx none
- FL42 Calyx of 1 sepal or lobe
- FL43 Calyx of 2 sepals or lobes
- FL44 Calyx of 3 sepals or lobes
- FL45 Calyx of 4 sepals or lobes
- FL46 Calyx of 5 sepals or lobes
- FL47 Calyx of 5 or more sepals or lobes
- FL48 Calyx calyprate, sepals fused to form an operculum

Calyx colour at anthesis

- FL49 Calyx white, cream, translucent or transparent
- FL50 Calyx brown
- FL51 Calyx green
- FL52 Calyx yellow
- FL53 Calyx orange
- FL54 Calyx pink
- FL55 Calyx red
- FL56 Calyx blue
- FL57 Calyx purple or black

Corolla fusion

- FL58 Corolla of free petals
- FL59 Corolla of fused petals

Extent of corolla fusion

- FL60 Petals fused for more than half their length
- FL61 Petals fused for less than half their length

Corolla parts

- FL62 Corolla none
- FL63 Corolla of 1 petal
- FL64 Corolla of 2 petals
- FL65 Corolla of 3 petals
- FL66 Corolla of 4 petals
- FL67 Corolla of 5 petals
- FL68 Corolla of 6 or more petals
- FL69 Corolla calyptrate, petals fused to form an operculum

Corolla colour at anthesis

- FL70 Corolla white, cream, translucent or transparent
- FL71 Corolla brown
- FL72 Corolla green
- FL73 Corolla yellow
- FL74 Corolla orange
- FL75 Corolla pink
- FL76 Corolla red
- FL77 Corolla blue
- FL78 Corolla purple or black

Petal aestivation

- FL79 Petals not touching in bud
- FL80 Petals valvate in bud
- FL81 Petals imbricate (including contorted) in bud

Stamen number

- FL82 Stamens none
- FL83 Stamens 1
- FL84 Stamens 2
- FL85 Stamens 3
- FL86 Stamens 4
- FL87 Stamens 5
- FL88 Stamens 6–10
- FL89 Stamens 11–25
- FL90 Stamens more than 25

Stamen number in relation to the petals or corolla lobes (sepals or tepals if corolla absent)

- FL91 Stamens fewer than petals
- FL92 Stamens same number as petals
- FL93 Stamens twice the number of petals
- FL94 Stamens more than twice the number of petals
- FL95 Stamen number not related to petal number

Stamen position in relation to the petals or corolla lobes

- FL96 Stamens alternating with the petals
- FL97 Stamens opposite the petals
- FL98 Stamens not related to petal position

Stamen position in relation to the sepals (or tepals) (where corolla absent)

- FL99 Stamens alternating with the sepals (or tepals)
- FL100 Stamens opposite the sepals (or tepals)
- FL101 Stamens not related to sepal (or tepal) position

Stamen fusion

- FL102 Stamens free from one another
- FL103 Stamens fused to one another

Stamen fusion to other floral parts

- FL104 Stamens epipetalous
- FL105 Stamens episepalous (or epitepalous)

Staminodes

- FL106 Staminodes present
- FL107 Staminodes absent

Anther shape

- FL108 Anthers wider than long (including reniform)
- FL109 Anthers globose or equidimensional or nearly so
- FL110 Anthers longer than wide

Anther dehiscence

- FL111 Anthers opening by apical pores
- FL112 Anthers opening by lateral pores
- FL113 Anthers opening by apical slits
- FL114 Anthers opening by longitudinal slits
- FL115 Anthers opening by transverse slits
- FL116 Anthers opening by valves

Anther attachment position

- FL117 Anthers basifixed
- FL118 Anthers dorsifixed or ventrifixed

Anther attachment type

- FL119 Anthers versatile
- FL120 Anthers not versatile

Anther locule number

- FL121 Anther locules 1
- FL122 Anther locules 2
- FL123 Anther locules 3
- FL124 Anther locules 4
- FL125 Anther locules more than 4

Anther opening

- FL126 Anthers introrse
- FL127 Anthers extrorse
- FL128 Anthers opening laterally

Filament length

- FL129 Filament very short/absent (< 0.25 length of anther)
- FL130 Filament short (0.25–2.0 times length of anther)
- FL131 Filament long (more than 2.0 times length of anther)

Male flower rudimentary ovary

- FL132 Male flowers with a rudimentary ovary present
- FL133 Male flowers with no rudimentary ovary

Gynoecium fusion (to be used with caution)

- FL134 Gynoecium of a single carpel (unicarpellate)
- FL135 Gynoecium apocarpous (of 2 or more free carpels)
- FL136 Gynoecium syncarpous (of 2 or more fused carpels)

Gynoecium position

- FL137 Gynoecium (ovary) inferior
- FL138 Gynoecium (ovary) half-inferior
- FL139 Gynoecium (ovary) superior

Carpel number (when apocarpous)

- FL140 Gynoecium of 2 free carpels
- FL141 Gynoecium of 3 free carpels
- FL142 Gynoecium of 4 free carpels
- FL143 Gynoecium of 5 free carpels
- FL144 Gynoecium of 6 or more free carpels

Locule number (when syncarpous or unicarpellate)

- FL145 Fused gynoecium with 1 locule
- FL146 Fused gynoecium with 2 locules
- FL147 Fused gynoecium with 3 locules
- FL148 Fused gynoecium with 4 locules
- FL149 Fused gynoecium with 5 locules
- FL150 Fused gynoecium with 6 or more locules

Placentation

- FL151 Placentation marginal
- FL152 Placentation axile
- FL153 Placentation parietal
- FL154 Placentation free central (including free basal)
- FL155 Placentation apical
- FL156 Placentation basal

Style form and number (number per flower, not per carpel)

- FL157 Style absent (stigma sessile)
- FL158 Style single, unbranched
- FL159 Style single, branched (2 or more fused)
- FL160 Style more than 1 (2 or more free)

Stigma number (number per flower, not per style)

- FL161 Stigmas 1
- FL162 Stigmas 2
- FL163 Stigmas 3
- FL164 Stigmas 4
- FL165 Stigmas 5
- FL166 Stigmas 6 or more

Fruit characters

Fruit

- FR 1 Fruit fleshy
- FR 2 Fruit dry, leathery or woody

Fruit derivation (to be used with caution)

- FR 3 Fruit simple
- FR 4 Fruit aggregate
- FR 5 Fruit multiple

Fruit type

- FR 6 Fruit a follicle
- FR 7 Fruit a capsule
- FR 8 Fruit a samara
- FR 9 Fruit a nut
- FR10 Fruit a plumed achene
- FR11 Fruit a cone

Fruit dehiscence

- FR12 Fruit dehiscent
- FR13 Fruit indehiscent

Fruit colour

- FR14 Fruit white or cream
- FR15 Fruit brown
- FR16 Fruit green
- FR17 Fruit yellow
- FR18 Fruit orange
- FR19 Fruit pink
- FR20 Fruit red
- FR21 Fruit blue
- FR22 Fruit purple
- FR23 Fruit black

Seeds per fruit

- FR24 Seeds 1 per fruit
- FR25 Seeds 2 per fruit
- FR26 Seeds more than 2 per fruit

Seed size (not including aril, if present)

- FR27 Seed small (10 mm long or less, including appendages)
- FR28 Seed large (10 mm long or more, including appendages)

Testa colour

- FR29 Testa white or cream
- FR30 Testa brown
- FR31 Testa green
- FR32 Testa yellow
- FR33 Testa orange
- FR34 Testa pink
- FR35 Testa red
- FR36 Testa blue
- FR37 Testa purple
- FR38 Testa black

Aril presence or absence

- FR39 Seed with a distinct aril
- FR40 Seed without a distinct aril

Aril colour

- FR41 Aril white, cream, translucent or transparent
- FR42 Aril brown
- FR43 Aril green
- FR44 Aril yellow
- FR45 Aril orange
- FR46 Aril pink
- FR47 Aril red
- FR48 Aril blue
- FR49 Aril purple
- FR50 Aril black

Seed wing

- FR51 Seed with a distinct membranous wing or wings
- FR52 Seed with distinct hairs or plumes
- FR53 Seed not distinctly winged or plumed

Endosperm presence or absence

- FR54 Endosperm present
- FR55 Endosperm absent

Endosperm texture

- FR56 Endosperm ruminant
- FR57 Endosperm not ruminant

Cotyledon form (within the seed)

- FR58 Cotyledons folded or rolled
- FR59 Cotyledons straight or slightly curved

Cotyledon texture (within the seed)

- FR60 Cotyledons ruminant
- FR61 Cotyledons not ruminant

Radicle form (within the seed)

- FR62 Radicle straight
- FR63 Radicle curved
- FR64 Radicle coiled, recurved or U-shaped

Seedling characters

It is advisable to use Seedling characters alone or in combination with geographic distribution only. There is no certainty that the seedling growing nearby or under an adult plant is the same species as that plant; the seed may not have come from that species.

Germination type

- S 1 Germination epigeal
- S 2 Germination semi-hypogeal
- S 3 Germination hypogeal
- S 4 Germination 'durian'

Cotyledons (in seeds with epigeal germination only)

Cotyledon size

- S 5 Cotyledons less than 5 mm
- S 6 Cotyledons 5–20 mm
- S 7 Cotyledons 20–60 mm
- S 8 Cotyledons more than 60 mm

Cotyledon shape

- S 9 Cotyledons wider than long
- S10 Cotyledons longer than wide

Cotyledon petiole

- S11 Cotyledons petiolate
- S12 Cotyledons sessile

Cotyledon apex

- S13 Cotyledon apex acute
- S14 Cotyledon apex obtuse
- S15 Cotyledon apex retuse or emarginate

Cotyledon base

- S16 Cotyledon base cuneate to attenuate
- S17 Cotyledon base rounded
- S18 Cotyledon base cordate to sagittate

Cotyledon venation

- S19 Cotyledons with midrib alone or no veins visible
- S20 Cotyledons penniveined
- S21 Cotyledons 3-veined
- S22 Cotyledons with other types of venation

Cotyledon oil dots

- S23 Cotyledons with oil dots visible with a x10 lens
- S24 Cotyledons with no oil dots visible with a x10 lens

Cotyledon lower surface

- S25 Cotyledon lower surface hairy
- S26 Cotyledon lower surface glabrous

Cotyledon margin

- S27 Cotyledon margin smooth
- S28 Cotyledon margin toothed or lobed

Cataphylls

- S29 Cataphylls present
- S30 Cataphylls absent

Leaf type (first pair of fully developed, normal leaves)

- S31 First pair of true leaves simple
- S32 First pair of true leaves compound, not with 3 leaflets
- S33 First pair of true leaves compound, with 3 leaflets

Leaf arrangement (first pair of fully developed, normal leaves)

- S34 First pair of true leaves alternate
- S35 First pair of true leaves opposite or part of a whorl

Tenth leaf stage (stage at which tenth leaf is produced)

Oil dots

- S36 Tenth leaf with oil dots visible with a x10 lens
- S37 Tenth leaf with no oil dots visible with a x10 lens

Stipules

- S38 Tenth leaf with stipules present
- S39 Tenth leaf with stipules absent

Leaf arrangement

- S40 Tenth leaf alternate
- S41 Tenth leaf opposite
- S42 Tenth leaf forming part of a whorl

Leaf type

- S43 Tenth leaf simple
- S44 Tenth leaf compound with three leaflets
- S45 Tenth leaf compound not consisting of three leaflets

Leaf division

- S46 Tenth leaf bipinnate

Terminal leaflet (pinnate compound leaves)

- S47 Tenth leaf with a terminal leaflet present
- S48 Tenth leaf with a terminal leaflet absent

Leaflet arrangement (pinnate compound leaves)

- S49 Tenth leaf with opposite leaflets
- S50 Tenth leaf with alternate leaflets

Digitate or palmate compound leaf (not pinnate leaves)

- S51 Tenth leaf with 4 or more leaflets from the centre

Leaflet number in the compound leaf (pinnate and palmate leaves)

- S52 Tenth leaf with up to 7 leaflets
- S53 Tenth leaf with 8–20 leaflets
- S54 Tenth leaf with more than 20 leaflets

Leaf margin (leaflet margin in compound leaves)

- S55 Tenth leaf with smooth margin
- S56 Tenth leaf with toothed margin
- S57 Tenth leaf with lobed margin

Intramarginal vein (in leaflet in compound leaves)

- S58 Tenth leaf with an intramarginal vein
- S59 Tenth leaf without an intramarginal vein

Leaf venation (leaflet in compound leaves)

- S60 Tenth leaf with midrib but no other veins visible
- S61 Tenth leaf penniveined
- S62 Tenth leaf 3-veined
- S63 Tenth leaf with other types of venation

Lateral vein angle (in leaflet in compound leaves)

- S64 Tenth leaf with vein angle less than 30 degrees
- S65 Tenth leaf with vein angle 30–60 degrees
- S66 Tenth leaf with vein angle more than 60 degrees

Leaf blade undersurface texture (leaflet in compound leaves)

- S67 Tenth leaf undersurface smooth
- S68 Tenth leaf undersurface hairy

Leaf blade undersurface colour (leaflet in compound leaves)

- S69 Tenth leaf undersurface green
- S70 Tenth leaf undersurface brown to white

Petiole (leaflet stalk in compound leaves)

- S71 Tenth leaf petiole short (less than 1/5 of leaf blade)
- S72 Tenth leaf petiole long (more than 1/5 of leaf blade)

Pulvini (leaflet in compound leaves)

- S73 Tenth leaf pulvinus present
- S74 Tenth leaf pulvinus absent

Petiole exudate

- S75 Tenth leaf petiole exudate clear
- S76 Tenth leaf petiole exudate milky
- S77 Tenth leaf petiole exudate yellow
- S78 Tenth leaf petiole exudate red
- S79 Tenth leaf petiole exudate absent

Terminal bud

S80 Tenth leaf stage – terminal bud smooth

S81 Tenth leaf stage – terminal bud hairy

Seedling stem cross-section

S82 Tenth leaf stage – stem terete, i.e. circular

S83 Tenth leaf stage – stem 4-angled, i.e. square

S84 Tenth leaf stage – stem winged

Seedling stem texture

S85 Tenth leaf stage – stem smooth

S86 Tenth leaf stage – stem hairy

Family characters

Acanthaceae	Celastraceae	Goodeniaceae
Actinidiaceae	Chenopodiaceae	Grossulariaceae
Agavaceae	Chrysobalanaceae	Gyrostemonaceae
Alangiaceae	Clusiaceae	Hamamelidaceae
Alseuosmiaceae	Combretaceae	Hanguanaceae
Amaranthaceae	Commelinaceae	Hernandiaceae
Anacardiaceae	Connaraceae	Himantandraceae
Annonaceae	Convolvulaceae	Hippocrateaceae
Apiaceae	Corynocarpaceae	Icacinaceae
Apocynaceae	Costaceae	Idiospermeaceae
Aquifoliaceae	Crassulaceae	Juncaceae
Araceae	Cucurbitaceae	Lamiaceae
Araliaceae	Cunoniaceae	Lauraceae
Araucariaceae	Cupressaceae	Lecythidaceae
Arecaceae	Cycadaceae	Leeaceae
Aristolochiaceae	Cyperaceae	Liliaceae
Asclepiadaceae	Datisceae	Linaceae
Asteraceae	Davidsoniaceae	Loganiaceae
Austrobaileyaceae	Dichapetalaceae	Lythraceae
Balanopaceae	Dilleniaceae	Malpighiaceae
Balsaminiaceae	Dioscoreaceae	Malvaceae
Basellaceae	Ebenaceae	Melastomataceae
Bignoniaceae	Elaeagnaceae	Meliaceae
Bixaceae	Elaeocarpaceae	Menispermaceae
Bombacaceae	Epacridaceae	Mimosaceae
Boraginaceae	Ericaceae	Monimiaceae
Burseraceae	Erythroxylaceae	Moraceae
Caesalpiniaceae	Eucryphiaceae	Moringaceae
Campanulaceae	Euphorbiaceae	Musaceae
Cannaceae	Eupomatiaceae	Myoporaceae
Capparaceae	Fabaceae	Myristicaceae
Caprifoliaceae	Flacourtiaceae	Myrsinaceae
Cardiopteridaceae	Flagellariaceae	Myrtaceae
Casuarinaceae	Gesneriaceae	Nepenthaceae

Nyctaginaceae	Proteaceae	Symplocaceae
Ochnaceae	Ranunculaceae	Taccaceae
Olacaceae	Rhamnaceae	Theaceae
Oleaceae	Rhizophoraceae	Thymelaeaceae
Onagraceae	Rosaceae	Tiliaceae
Opiliaceae	Rubiaceae	Ulmaceae
Orchidaceae	Rutaceae	Urticaceae
Pandanaceae	Santalaceae	Verbenaceae
Passifloraceae	Sapindaceae	Violaceae
Pedaliaceae	Sapotaceae	Viscaceae
Phylodraceae	Scrophulariaceae	Vitaceae
Phytolaccaceae	Simaroubaceae	Winteraceae
Piperaceae	Smilacaceae	Xanthophyllaceae
Pittosporaceae	Solanaceae	Xanthorrhoeaceae
Plumbaginaceae	Stangeriaceae	Zamiaceae
Poaceae	Stemonaceae	Zingiberaceae
Podocarpaceae	Sterculiaceae	
Polygonaceae	Surianaceae	

Geographic characters

- G1 Western Australia (WA)
- G2 Northern Territory (NT)
- G3 Cape York Peninsula (CYP)
- G4 North-east Queensland (NEQ)

REFERENCES

The references provided here are general references, applicable to many genera and species, or those that relate to common names, uses or natural history. The much larger number of more specialised references relating to the taxonomy and nomenclature of particular taxa are included under the Information menu of the Species window in the key itself.

- Anon.** (1968). *Nomenclature of Commercial Timbers Imported into Australia AS0118-1968*, Standards Association of Australia, Sydney, 79 pp.
- Anon.** (1970). *Nomenclature of Australian Timbers AS02-1970*, Standards Association of Australia, Sydney, 104 pp.
- Anon.** (1995). *Arboretum Guide*, CSIRO Tropical Forest Research Centre, Atherton, 50 pp.
- Bailey, F.M.** (1913). *Comprehensive Catalogue of Queensland Plants*, A.J. Cumming, Government Printer, Brisbane, 879 pp.
- Bentham, G.** (1863–78). *Flora Australiensis*, Vols I–VII, Lovell Reeve & Co., London.
- Blake, S.T.** (1954). Studies on miscellaneous northern Australian plants. *Australian Journal of Botany* 2: 99–136.
- Blake, S.T.** (1959). New or noteworthy plants, chiefly from Queensland. I. *Proceedings of the Royal Society of Queensland* 70–73: 33–46.
- Brock, J.** (1988). *Top End Native Plants*, John Brock, Darwin, 353 pp.
- Brummitt, R.K. & Powell, C.E.** (1992). *Authors of Plant Names*, Royal Botanic Gardens, Kew, 732 pp.
- Burger, D.** (1972). *Seedlings of Some Tropical Trees and Shrubs mainly of South East Asia*, Centre for Agricultural Publishing and Documentation, Washington, 399 pp.
- Cause, M.L., Rudder, E.J. & Kynaston, W.T.** (1989). *Queensland Timbers*, Technical Report Pamphlet No. 2, Department of Forestry, Brisbane, 126 pp.
- Chapman, A.D.** (1991). *Australian Plant Name Index*, Australian Flora & Fauna Series Nos 12–15, Australian Government Publishing Service, Canberra, 3055 pp.
- Cleland, J.B.** (1943). Plants including fungi, poisonous or otherwise injurious to man in Australia. Series IV. *Medical Journal of Australia* 2: 161–4.

- Collins, D.J., Culvenor, C.C.J., Lamberton, J.A., Loder, J.W. & Price, J.R.** (1990). *Plants for Medicine. A Chemical and Pharmacological Survey of Plants in the Australian Region*, CSIRO, Melbourne, 303 pp.
- Common, I.F.B. & Waterhouse, D.F.** (1981). *Butterflies of Australia*, Angus & Robertson, Sydney, 682 pp.
- Cooper, W. & Cooper, W.T.** (1994). *Fruits of the Rain Forest*, Geo Productions, Sydney, 327 pp.
- Cronquist, A.** (1981). *An Integrated System of Classification of Flowering Plants*, Columbia University Press, New York, 1262 pp.
- Dallimore, W. & Jackson, A.B.** (1966). *A Handbook of Coniferae & Ginkgoaceae*, Edward Arnold, London, 729 pp.
- Dunlop, C.R., Leach, G.J. & Cowie, I.D.** (1995). *Flora of the Darwin Region*, Vol. II, Conservation Commission of the Northern Territory, Palmerston, 261 pp.
- Ellison, D.** (1934). *Cultivated Plants of the World: Trees, Shrubs, Climbers*, Flora Publications International, Brisbane, 598 pp.
- Everist, S.** (1974). *Poisonous Plants of Australia*, Angus & Robertson, Sydney, 684 pp.
- Floyd, A.G.** (1989). *Rainforest Trees of Mainland South-eastern Australia*, Inkata Press, Melbourne, 420 pp.
- Francis, W.D.** (1970). *Australian Rain-Forest Trees*, Australian Government Publishing Service, Canberra, 468 pp.
- Hacker, J.B.** (1990). *A Guide to Herbaceous and Shrub Legumes of Queensland*, University of Queensland Press, St. Lucia, 351 pp.
- Hartley, W.** (1979). *A Checklist of Economic Plants in Australia*, CSIRO, Melbourne, 214 pp.
- Henderson, R.J.F.** (1997). *Queensland Plant Names and Distribution*, Queensland Herbarium Department of Environment, Indooroopilly, 286 pp.
- Henty, E.E. & Pritchard, G.H.** (1987). *Weeds of New Guinea and their Control*, Botany Bulletin No. 7, Department of Forests, Division of Botany, Lae, 180 pp.
- Hnatiuk, R.J.** (1990). *Census of Australian Vascular Plants*, Australian Flora & Fauna Series No. 11, Australian Government Publishing Service, Canberra, 650 pp.

- Jacks, B.R.** (1987). *Plants of Magnetic Island*, James Cook University of North Queensland, Townsville, 141 pp.
- Jackson, B.D.** (1965). *A Glossary of Botanic Terms*, Gerald Duckworth & Co., London, 481 pp.
- Jacobs, M.R.** (1955). *Growth Habits of the Eucalypts*, A.J. Arthur, Commonwealth Government Printer, Canberra, 262 pp.
- Jones, D.L.** (1986). *Ornamental Rainforest Plants in Australia*, Reed Books, Sydney, 364 pp.
- Kenneally, K., Edinger, D.C. & Willing, T.** (1996). *Plants and People of the Dampier Peninsula, Kimberley, Western Australia*, Department of Conservation & Land Management, Como, WA, 256 pp.
- Kenneally, K., Thomson, C., Done, C. & Wheeler, J.** (1995). *Common Plants of the Kimberley*, Department of Conservation & Land Management, Como, WA, 72 pp.
- Kleinschmidt, H.E. & Johnson, R.W.** (1977). *Weeds of Queensland*, Government Printer, Brisbane, 469 pp.
- Lawrence, G.H.M.** (1951). *Taxonomy of Vascular Plants*, Macmillan, New York, 823 pp.
- Lazarides, M. & Hince, B.** (1993). *CSIRO Handbook of Economic Plants of Australia*, CSIRO, Melbourne, 330 pp.
- Little, E.L. Jr & Wadsworth, F.H.** (1964). *Common Trees of Puerto Rico and the Virgin Islands*, US Department of Agriculture Forest Service, Washington, 548 pp.
- Little E.L. Jr, Woodbury, R.O. & Wadsworth, F.H.** (1974). *Trees of Puerto Rico and the Virgin Islands*, US Department of Agriculture Forest Service, Washington, 1024 pp.
- Maiden, J.H.** (1975). *The Useful Native Plants of Australia*, Compendium, Melbourne, 696 pp.
- Marrfurra, P., Akanburru, M., Wawul, M., Kumunerrin, T., Adya, H., Kamarrama, K., Kanintyanu, M., Waya, T., Kannyi, M., Wightman, G. & Williams, L.** (1995). *Ngan'gikurungurr and Ngan'gimurri Ethnobotany: Aboriginal Plant Use from the Daly River Area, Northern Australia*, Northern Territory Botanical Bulletin No. 22, Conservation Commission of the Northern Territory, Darwin, 112 pp.
- Menninger, E.A.** (1970). *Flowering Vines of the World*, Hearthside Press, New York, 410 pp.

- Morley, B.D. & Toelken, H.R. (eds) (1983). *Flowering Plants in Australia*, Rigby Publishers, Adelaide, 416 pp.
- Ng, E.S.P. (1975). The fruits, seeds & seedlings of Malayan trees, I–XI, *The Malaysian Forester* **38**: 33–99.
- Ng, E.S.P. (1978). Strategies of establishment in Malayan forest trees, In: *Tropical Trees as Living Systems*, eds P.B. Tomlinson & M.H. Zimmermann, Cambridge University Press, Cambridge, pp. 129–62.
- Nicholson, N. & Nicholson, H. (1991). *Australian Rain Forest Plants*, Vol. III, Terania Rainforest Publishing, The Channon, 72 pp.
- Nicholson, N. & Nicholson, H. (1994). *Australian Rain Forest Plants*, Vol. IV, Terania Rainforest Publishing, The Channon, 72 pp.
- Ochse, J.J. (1931). *Vegetables of the Dutch East Indies (Edible Tubers, Bulbs, Rhizomes and Spices Included): Survey of Indigenous and Foreign Plants Serving as Pot-plants and Side-dishes*, Archipel Drukkeris, Bogor, 1005 pp.
- Queensland Herbarium, Staff (1994). *Queensland Vascular Plants: Names and Distribution*, Queensland Department of Environment & Heritage, Brisbane, 361 pp.
- Radke, A., Radke, P. & Sankowsky, G. (1990). *Native Plants for North Queensland*, 5th edn, Yuruga Nursery, Walkamin, 59 pp.
- Radke, A., Radke, P. & Sankowsky, G. (1991). *North Queensland Native Plants*, Yuruga Nursery, Walkamin, 66 pp.
- Sankowsky, G. & Neilsen, L.A. (2002). *A Garden on the Wing*, CD-ROM, Zodiac Publications, Tolga.
- Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (1987). *Weeds of Rice in Indonesia*, Balai Pustaka, Jakarta, 716 pp.
- Stanley, T.D. & Ross, E.M. (1983–89). *Flora of South-eastern Queensland*, Vols 1–3, Queensland Department of Primary Industries, Brisbane.
- Swain, E.H.F. (1928). *The Timbers and Forest Products of Queensland*, Anthony James Cumming, Government Printer, Brisbane, 500 pp.
- Terrell, E.E., Hill, S.R., Wiersema, J.H. & Rice, W.E. (1986). *A Checklist of Names for 3,000 Vascular Plants of Economic Importance*, US Department of Agriculture, Washington, 244 pp.
- Uphof, J.C.Th. (1968). *Dictionary of Economic Plants*, J. Cramer, Lehre, 591 pp.
- Williams, J.B. (1979). *A Checklist of Rainforest Flora of New South Wales*, University of New England, Armidale, 39 pp.

- Williams, J.B., Harden, G.J. & McDonald, W.J.F.** (1984). *Trees and Shrubs in Rainforests of New South Wales and Southern Queensland*, University of New England, Armidale, 142 pp.
- Williams, K.A.W.** (1979). *Native Plants of Queensland*, Vol. 1, Cranbrook Press, Brisbane, 288 pp.
- Yunupingu, B., Yunupingu-Marika, L., Marika, D., Marika, B., Marika, B., Marika, R. & Wightman, G.** (1995). *Riratjingu Ethnobotany: Aboriginal Plant Use from Yirkkala, Arnhem Land, Australia*, Northern Territory Botanical Bulletin No. 21, Parks & Wildlife Commission of the Northern Territory, Darwin, 112 pp.