

## CERTAINTY AND UNCERTAINTY IN PLANT IDENTIFICATION

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**Summary** Many plant specimens are not identified correctly or many of the names used for them are not applied correctly. There is a need for plant identifications to be checked by specialists and specimens to be stored for future reference. This is particularly important for survey data and the only adequate long term storage appears to be in herbaria. Identifications are made in the light of current taxonomic knowledge and this is constantly being revised. Without access to the original specimens, results of previous surveys and research may not be of much use. Voucher specimens should therefore be a requirement for all plant research and this also applies to all weed research. Problems associated with use of databased collections and long term storage of specimens, particularly the expense of maintaining collections, are discussed.

### INTRODUCTION

Even for those species that we now regard as being nomenclaturally stable or biologically well known, we have no idea what the future may bring in regards to new information and subsequent improvement in our biological understanding. These principles apply to weed species possibly more than any other. Weeds are often first recorded as a problem in the field, passed on in the form of an inadequate specimen to an identification authority, with little or no idea of their origin. They are frequently either identified with species that have proven troublesome elsewhere or identified from inappropriate publications from wrong geographical areas.

For species that have had a simple change of name there is not much problem. The synonymy can be quite straightforward and easily transferable. Where there has been a misidentification, at whatever level, or our knowledge has changed such that we now recognise two or more species in what was formerly one species (a good example is the 10 species and a number of hybrids of blackberry that were formerly all called *Rubus fruticosus*) then it can be very difficult, if not impossible to track down what was the species actually being referred to.

Collecting and lodging relevant voucher specimens in recognised herbaria is the only process that allows the biological integrity of any particular survey or study to be checked or updated. We present examples below of some of the commonly confused weed species and some

examples where confusion has clouded the literature, we discuss the processes involved in storing and maintaining the specimens and some of the techniques or information sources that can be misused. Species names used here are as in Harden (1990–1993) except where that species is not covered, and then the authority is given.

### CONFUSION

There are many species that have been confused in the past and at present. Some examples of weed species commonly confused are given in Table 1.

In some cases confusion occurs between families, for example between *Cuscuta* spp. (Convolvulaceae) and *Cassytha* spp. (Lauraceae or Cassythaceae). It is also interesting to note that due to difficulty in identifying species of *Cuscuta*, all species in this genus have been declared noxious in many States of Australia (Parsons and Cuthbertson 1992). Native *Cuscuta* spp. are not considered to be a problem whereas *C. campestris* is considered to be a major problem (Parsons and Cuthbertson 1992). There are still a number of examples where species limits still need to be defined, for example at least two distinct entities are covered by the name *Tribulus terrestris* in Australia (Morrison and Scott 1993).

Misidentifications have resulted in delays to control programs for various weeds. This occurred in South Australia where *Solanum elaeagnifolium* was collected by J. M. Black in 1918 but it was believed to be *Solanum esuriale* at the time. In 1947 Black sent specimens to Kew and they were identified as *S. elaeagnifolium* (R. Carter personal communication). Co-ordinated control did not start until 1958 when the South Australian Department of Agriculture started to refer to the species as introduced (R. Carter personal communication).

Rapid spread of weeds may also occur through misidentifications. A recent example is the rapid distribution of alligator weed, *Alternanthera philoxeroides*, by the Sri Lankan community in Australia. The species was distributed in the mistaken belief that it was the vegetable, mukunawanna, *Alternanthera sessilis* (J. Dellow and R. Carter personal communication).

**Herbaria** The only way to minimize the problems of misidentifications or subsequent classification changes is to collect voucher specimens and to lodge them in a

**Table 1.** Weed species commonly confused and often incorrectly identified.

| Family                      | Genus                              | Species          | Family                        | Genus                              | Species                 |
|-----------------------------|------------------------------------|------------------|-------------------------------|------------------------------------|-------------------------|
| Asteraceae                  | <i>Aster</i>                       | <i>subulatus</i> | Poaceae (cont/...)            | <i>Eragrostis</i>                  | spp.                    |
|                             | <i>Conyza</i>                      | spp.             |                               | <i>Panicum</i>                     | spp.                    |
|                             | <i>Erigeron</i>                    | spp.             |                               | <i>Phalaris</i>                    | spp.                    |
|                             | <i>Bidens</i>                      | spp.             | Oleaceae                      | <i>Vulpia</i>                      | spp.                    |
|                             | <i>Carduus tenuiflorus</i>         |                  |                               | <i>Ligustrum</i>                   | <i>sinense</i>          |
|                             | <i>Carduus pycnocephalus</i>       |                  | <i>Ligustrum</i>              | <i>vulgare</i>                     |                         |
|                             | <i>Cassinia laevis</i>             |                  | Oxalidaceae                   | <i>Oxalis</i>                      | <i>chnöodes</i>         |
|                             | <i>Cassinia quinquefaria</i>       |                  |                               | <i>Oxalis</i>                      | <i>corniculatus</i>     |
|                             | <i>Centaurea melitensis</i>        |                  |                               | <i>Oxalis</i>                      | <i>exilis</i>           |
|                             | <i>Centaurea solstitialis</i>      |                  |                               | <i>Oxalis</i>                      | <i>perennans</i>        |
|                             | <i>Euchiton</i>                    | spp.             |                               | <i>Oxalis</i>                      | <i>radicans</i>         |
|                             | (prev. part of <i>Gnaphalium</i> ) |                  |                               | <i>Oxalis</i>                      | <i>rubens</i>           |
|                             | <i>Gamochoeta</i>                  | spp.             | Polygonaceae                  | <i>Oxalis</i>                      | sp. A                   |
|                             | (prev. part of <i>Gnaphalium</i> ) |                  |                               | <i>Persicaria</i>                  | spp.                    |
|                             | <i>Gnaphalium</i>                  | spp.             |                               | <i>Polygonum</i>                   | <i>arenastrum</i>       |
|                             | <i>Hypochaeris glabra</i>          |                  |                               | <i>Polygonum</i>                   | <i>aviculare</i>        |
|                             | <i>Hypochaeris radicata</i>        |                  |                               | <i>Rumex</i>                       | spp.                    |
|                             | <i>Onopordum acanthium</i>         |                  |                               | Rosaceae                           | <i>Rubus</i>            |
|                             | <i>Onopordum illyricum</i>         |                  | <i>Rubus</i>                  |                                    | <i>chloocladus</i>      |
|                             | <i>Senecio lautus</i>              | subspecies       | <i>Rubus</i>                  |                                    | <i>discolor</i>         |
|                             | <i>Senecio madagascariensis</i>    |                  |                               |                                    | [= <i>R. procerus</i> ] |
|                             | <i>Xanthium cavanillesii</i>       |                  | <i>Rubus</i>                  |                                    | <i>leightonii</i>       |
|                             | <i>Xanthium italicum</i>           |                  | <i>Rubus</i>                  |                                    | <i>polyanthemus</i>     |
| <i>Xanthium occidentale</i> |                                    | <i>Rubus</i>     | <i>pyramidalis</i>            |                                    |                         |
| <i>Xanthium orientale</i>   |                                    | <i>Rubus</i>     | <i>radula</i>                 |                                    |                         |
| Caryophyllaceae             | <i>Arenaria leptoclados</i>        |                  | <i>Rubus</i>                  |                                    | <i>rosaceus</i>         |
|                             | <i>Stellaria media</i>             |                  | <i>Rubus</i>                  |                                    | <i>selmeri</i>          |
|                             | <i>Stellaria pallida</i>           |                  | <i>Rubus</i>                  |                                    | <i>ulmifolius</i>       |
|                             | <i>Cerastium</i>                   | spp.             | <i>Rubus</i>                  | <i>ulmifolius</i> hybrids          |                         |
| Convolvulaceae              | <i>Cuscuta</i>                     | spp.             | <i>Rubus</i>                  | <i>vestitus</i>                    |                         |
| Cyperaceae                  | <i>Cyperus</i>                     | <i>bifax</i>     | Salicaceae                    | <i>Salix</i>                       | spp.                    |
|                             | <i>Cyperus rotundatus</i>          |                  | Scrophulariaceae              | <i>Orobancha</i>                   | spp.                    |
|                             | <i>Cyperus victoriensis</i>        |                  |                               | <i>Striga</i>                      | spp.                    |
| Euphorbiaceae               | <i>Chamaesyce</i>                  | spp.             | Solanaceae                    | <i>Physalis</i>                    | spp.                    |
| Fabaceae (Faboideae)        | <i>Cytisus scoparius</i>           |                  | <i>Solanum elaeagnifolium</i> |                                    |                         |
|                             | <i>Genista monspessulana</i>       |                  | <i>Solanum esuriale</i>       |                                    |                         |
|                             | <i>Genista stenopetala</i>         |                  | Thymelaeaceae                 | <i>Pimelea</i>                     | spp.                    |
|                             | <i>Vicia</i>                       | spp.             | Typhaceae                     | <i>Typha</i>                       | spp.                    |
| (Mimosoideae)               | <i>Prosopis</i>                    | spp.             | Verbenaceae                   | <i>Phyla</i>                       | spp.                    |
| Fumariaceae                 | <i>Fumaria</i>                     | spp.             |                               | <i>Stachytarpheta</i>              | spp.                    |
| Iridaceae                   | <i>Homeria</i>                     | spp.             | <i>Verbena bonariensis</i>    |                                    |                         |
|                             | <i>Watsonia</i>                    | spp.             | <i>Verbena incompta</i>       |                                    |                         |
| Juncaceae                   | <i>Juncus</i>                      | spp.             | <i>Verbena caracasana</i>     | Kunth                              |                         |
| Malaceae                    | <i>Cotoneaster</i>                 | spp.             | <i>Verbena litoralis</i>      |                                    |                         |
|                             | <i>Crataegus</i>                   | spp.             | <i>Verbena officinalis</i>    |                                    |                         |
|                             | <i>Pyracantha</i>                  | spp.             | <i>Verbena quadrangularis</i> | Vell.                              |                         |
| Papaveraceae                | <i>Argemone mexicana</i>           |                  |                               | (= <i>brasiliensis</i> misapplied) |                         |
|                             | <i>Argemone ochroleuca</i>         |                  | Zygophyllaceae                | <i>Tribulus micrococcus</i>        |                         |
|                             | <i>Argemone subfusiformis</i>      |                  |                               | <i>Tribulus minutus</i>            |                         |
| Poaceae                     | <i>Avena</i>                       | spp.             |                               | <i>Tribulus terrestris</i>         | (introduced)            |
|                             | <i>Digitaria ciliaris</i>          |                  |                               | <i>Tribulus terrestris</i>         | (native)                |
|                             | <i>Digitaria sanguinalis</i>       |                  |                               |                                    |                         |
|                             | <i>Echinochloa</i>                 | spp.             |                               |                                    |                         |

herbarium where there is some chance of the collections being maintained in the long term.

It is difficult for generalist Identification Officers, who are not specialists in any particular group, to correctly identify large numbers of specimens accurately. Such Officers deal with large numbers of enquiries for little or no charge, and are often very skilled. Mind reading, however, is not one of their skills and if you have some critical voucher specimens that should be retained then this information needs to be communicated. Most herbaria will not retain poor quality collections for any reason. If you have a research project where the lodging of voucher specimens is relevant, then you should arrange for the collaboration of an appropriate specialist beforehand. These days this often means including funds for identification.

There is also a cost associated with storage of plant specimens and this needs to be recognised. This cost should particularly be built into projects where many specimens will be collected and stored for future reference. The need for constant curation of collections is also necessary as anyone who has looked at specimens in herbaria will realize. It is difficult for Identification Officers who are not specialists in particular groups to be able to give the correct identification when a number of distinct species are included under the same name in collections. This is a common occurrence in herbaria and results in a number of misidentifications, but it is also how progress is made in understanding the group. The need to constantly update names and identifications in the light of current taxonomic knowledge and to increase funding to maintain collections cannot be overemphasized.

**Collection of specimens** There is a need for high quality plant specimens to be lodged in herbaria. In most cases this will mean flowering and fruiting sections of plants and in some cases other parts such as roots and bulbs. In some cases it is also desirable for collection of vegetative stages. This is particularly important for identification of forms of *Chondrilla juncea* (R. Groves personal communication). In this case natural enemies such as the rust fungus, *Puccinia chondrillina* Bubak & Syd., and the chondrilla gall mite, *Aceria chondrillae* (Canestrini) show specificity to particular forms of *C. juncea* (Groves and Cullen 1981).

**Databases are no substitute for looking at the specimens** Databasing of collections is increasing around Australia and this is desirable but it is no substitute for checking the specimens. Plants have often been misidentified, details from the collection typed in incorrectly and the location vague (could be applied to many areas). If using databases at least check outlying

locations as these are most likely to be incorrect. It also pays to check whether there have been any problems with the database. This may mean that changes have been made in the collection but do not appear on the database.

**Use of voucher specimens** Voucher specimens can be used to check previous identifications in the light of current taxonomic knowledge. For example the photograph of *Verbena bonariensis* in Auld and Medd (1987) was redetermined as *Verbena incompta* Michael (Michael 1995) because voucher specimens were lodged at the NSW Herbarium.

Many species are not sent to herbaria for identification because people think that they know the species they are dealing with. This was the case with *Chromolaena odorata* (L.) King & Robinson, from the Tully area, which locals called giant billy goat weed in the mistaken belief that the species was a large form of *Ageratum conyzoides*.

Many plant surveys, including weed surveys, have been published in the past where voucher specimens have not been lodged in a herbarium. We often have difficulty in believing some of the names on lists but there is no way to check the accuracy. Without specimens many of these records have to be disregarded. Good voucher specimens take time to collect but are essential. No survey should be published without vouchers being lodged in a designated herbarium.

Some plant books have excellent voucher specimens for the species photographed. For example Cunningham *et al.* (1981) and Auld and Medd (1987). A number of lists of plant species for various areas also have large numbers of voucher specimens lodged at various herbaria, for example McBarron (1955), Williams (1979) and Hosking (1990).

**Misuse of voucher specimens** It is essential that the policy of a herbarium with regard to specimens is understood. In some cases the number of specimens collected over time has been used to indicate whether a weed problem is increasing or decreasing. This is of little use if a herbarium considers that they have plenty of specimens for a particular area of the State and no longer retain additional collections. Most specimens sent in for identification are not retained by herbaria. Presence or absence of a species from an area based on herbarium specimens is also fraught with danger. So-called well known species are often rarely sent in for identification resulting in absence of specimens from various locations.

**Importance of correct identifications** In a number of cases the correct plant identification, and an understanding of its taxonomy and biogeography are important.

These are particularly important for biological control programs. For example:

1. Various strains of the blackberry rust, *Phragmidium violaceum*, are likely to be more effective than others on different introduced *Rubus* spp. in Australia (Bruzzese and Hasan 1986, Bruzzese 1995).
2. The seed-feeding weevil, *Erytanna consputa* Pascoe, used to control *Hakea sericea* in South Africa was collected from Wilson's Promitory Peninsula in the mistaken belief that this was the same plant as the one causing the problem in South Africa (Kluge and Nesar 1991). Recent taxonomic study has shown that the plant from Wilson's Promitory is *Hakea decurrens* R.Br. (Barker 1996). Populations of this weevil collected from *H. sericea* from south-eastern New South Wales, from the correct plant taxon, have successfully established on this plant in South Africa.
3. Early attempts to control *Salvinia molesta* were not successful because the weevil, *Cyrtobagous singularis* Hustache was collected from *Salvinia auriculata* Aubl. in the mistaken belief that the plant species were the same (Room 1986). *Salvinia* weevil, *Cyrtobagous salviniae* Calder & Sands, collected from *Salvinia molesta* now successfully controls this water fern in many areas around the world.

Correct identifications may also be important for chemical control of weeds. For example various *Fumaria* spp. appear to have different susceptibilities to herbicides (McQuinn 1990). Another example is where irrigation managers at Emerald in the 1970s noted that *Vallisneria gigantea* was not being controlled by the accepted concentration of acrolein (C. Julian personal communication). An investigation concluded that the 'form' of *Vallisneria* present in the Emerald channels had a thicker than usual leaf and required a higher dose rate. This 'form' has been known as *Vallisneria spiralis* var. *denseserrulata* Makino.

#### CONCLUSION

Collect voucher specimens and others will know with certainty the species being referred to. Do not collect vouchers and you may as well not publish your results.

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