It's all in the name: some tips for naming fungi in the field

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The desire to name organisms is human nature. Be it in everyday vernacular or scientific nomenclature, naming plays an important role in understanding the natural world.

There are three components to *naming* when it comes to species. Firstly, the species must be delimited; that is, the variation within it is circumscribed, and the species separated from close relatives, using whatever characters are available. Secondly, a Linnaean binomial (genus+species) is applied to the species, as delimited. These two components are the bread and butter of taxonomists. The third component of naming is *identifying*, which means assigning a name to a specimen or observation. This is something we all do, not just taxonomists. We *identify* when we look up to the sky and say 'wedgie' or when we observe a cluster of mushrooms and say 'ghost fungus'. Some identifications can be as rapid as a glance at the silhouette of a bird, or could take hours of careful inspection of fine details of the surfaces of a mushroom, or even the characters of its spores under a compound microscope.

Few scientists are employed as taxonomists in Australia today. The *taxonomic impediment*, or dearth of taxonomists, especially mycological taxonomists, reflects the lack of recognition of the importance of naming species. However, if you're unlucky enough to ingest a poisonous mushroom, you'll be grateful that a taxonomic mycologist can identify the culprit and help determine the best course of action, depending on the toxin ingested. A taxonomist might well save your life! Indeed, accurate naming of species underpins all aspects of biological science, as each species has unique characteristics.

This article explores the third phase of naming - identification, in particular the importance of correct identification and how to deal with uncertainty in identification. Accurate identification of species has important implications for distribution and hence ecology and conservation.

Recording fungi

Lists of animal, plant and fungus species have been recorded by naturalists since the first issue of *The Victorian Naturalist* in 1884. In recent decades, the general public has contributed to the understanding of the whereabouts of species through the collection of distribution records. Today, the ubiquity of the Internet, social media and nature platforms enables contributors to place records in the public domain, allowing for mass data collection, and also ready visualisation of records such as through the Atlas of Living Australia (https://www.ala.org.au/).

The Fungimap project (https://fungimap.org.au/), founded in 1996, was the first fungus-mapping scheme in the Southern Hemisphere. Almost a thousand participants have contributed

Oudemansiella gigaspora group – a distinctive Fungimap target that is mapped as a group of species that are not readily distinguishable in the field. Photography © Alison Pouliot

more than a hundred thousand fungus distribution records, making it one of Australia's largest citizen science projects. Several Wombat Forestcare members actively contribute records to Fungimap and these account for most of the knowledge about the distribution of fungi in our local forests. However, identifying fungi presents additional challenges relative to animals and plants. This is because fungi are characterised by relatively high species richness and a large number of rare or little-known species. Moreover, fungal taxonomy is unstable and many decades behind that for animals and plants. This instability manifests in several ways, including changes in both generic and species concepts, as well as discovery of novel species. Recent advances in molecular mycology are revealing a staggering diversity of fungus species.

Identifying a fungus to species level by macro-characteristics alone is not easy. Those who have stumbled across LBMs (little brown mushrooms) or members of the genus *Cortinarius* (with over 2000 species worldwide) know how difficult they are to identify. This is why Fungimap focuses on carefully selected 'target species' – those with conspicuous features recognisable in the field, with few or no look-a-like species. The choice of target species increases the likelihood of accurate identifications. It also increases the satisfaction for the identifier in being able to give a name to a specimen. At the same time, it is important to resist putting a name on something unless you are very sure of the accuracy of your identification, because inaccurate identifications have implications.

The importance of accurate records for conservation

The accuracy of fungus records is important for mapping the distribution of fungi. This feeds into our understanding ecology and allows for effective conservation and management. There are implications of applying the wrong name to a species, especially for rare species. It is better to 'under-record', that is, to leave a species at genus level, than assign it an incorrect species name. This approach ensures higher data quality.

So-called 'false positives' or 'type 1 errors' are errors in data reporting that falsely indicate the presence of a species due to a mis-identification. An example would be the incorrect recording of the wet-forest specialist *Vibrissea dura* from the mallee, due to confusion with a stalked puffball. 'False negatives' or 'type 2 errors' are the failure to identify a species that is present, perhaps because it is very similar to another common species that is already known from an area. Both types of errors have consequences for conservation research. False positives outside of the known distribution can be picked up by expert reviewers (from inspection of maps) and can be corrected as long as there is supporting information such as a photo or specimen (see below). False negatives of rare or inconspicuous species can be especially difficult to detect. Errors in reporting fungi can bias analyses; for example, when creating species distribution models or estimating the rates of local extinctions or colonisation. As most conservation hinges on the presence of rare species, it is critical that data about rarity are correct.

Dealing with uncertainty in naming

There are some simple protocols for naming species where identifications are uncertain. If you can identify your observation to genus level but not to species level, it is best to describe it as 'Genus sp.', ('sp.' being shorthand for 'species). For example, *Russula* sp. If your observation does not match well to the particular species known from an area, add a question mark between the genus and species names. For example, *Russula* ? *marangania*. If there is a possibility that your observation might be a rare species, do include this information, but include it in the notes rather than make the identification definitely. Some online citizen science portals (such as the ALA direct recording facility) use whatever name you supply without any checking at the time of record submission. This can lead to misleading records appearing on maps.

If the species recorded is known to be a species complex, use the word 'group' following the genus and species name. For example: *Oudemansiella gigaspora* group. Being easy to identify, the *Oudemansiella gigaspora* group is a useful target 'species group', distinguished by the brownish pileus (cap) that is sticky when fresh, the rather widely spaced, white lamellae (gills) and the rooting stipe base. Until recently, Australian members of this group were lumped under the name of the European species *Oudemansiella radicata* (sometimes placed in the genus *Xerula*). A taxonomic revision of *Oudemansiella* and related genera revealed that *O. radicata* is not present in Australia, but there are a number of closely related species that look rather similar in the field. *Oudemansiella gigaspora* was originally named *Hygrophorus gigasporus* by Cooke and Massee in 1887. Because this is the

oldest name among the members of the group, we use *O. gigaspora*, as the basis for the 'group'.

If you see a particular species regularly that has something distinctive about it but you cannot identify it, make up a 'tag name' or 'field name'. This is a better option than assigning the Latin abbreviations 'aff.' (meaning 'similar to') or 'cf.' (meaning 'compare with') to a described species, particularly when that described species does not occur in Australia. Do not use tag names that look like species epithets (i.e. not in Latin). A short phrase is best, especially one that conjures up unique features that separate the species from others. For example, *Mycena* 'tiny blue lights', as used by the FNCV Fungi Group for a tiny bluish *Mycena* that is bioluminescent. Ideally, lodge a voucher collection (i.e. submit a dried fungus specimen) under that tag name in a reference collection such as a herbarium. This allows mycologists to name the species once revisions have been carried out. You'll need appropriate permits to make a collection, especially from nature reserves. You may be able to get advice on permits from your local Friends, Landcare or Fungus Interest group.

Supporting your record

When submitting records of fungi, it is always useful to include a photograph, especially if it is the first time you have recorded a particular species. Photos that are submitted with records should show distinctive characters of the species. For example, for mushrooms, it is important to show the underside of the pileus so that the lamellae are visible, and provide a clear view of the base of the stipe. Also note features not evident from a photo, such as the texture of surfaces or odour.

In the case of a record being submitted for a rare species, or one that is found outside its usual distribution range, Fungimap will usually seek more information from the recorder if a photo it not provided or not adequate for identification. Given the ephemeral nature of many fungus sporing bodies (the visible reproductive part of the fungus such as mushrooms and puffballs), they might well have disappeared before Fungimap can respond. In this instance Fungimap encourages the recorder to look out for the species the following season and capture further photos.

Taxonomy is tricky business. Identifying fungi to species level takes time and practice. Start with the ones that are most conspicuous and easily recognisable. The more often you see the same species, the more familiar you will become with the extent of variation within that species. Equip yourself with a field guide (such as the guide to Fungimap target species, *Fungi Down Under*) and a hand lens to see some of the smaller details. You are quite likely to see at least a few of the Fungimap target species each time you visit the forest during the fungus season. Each fungus distribution record, even of common and widespread species, helps scientists understand species distribution and contributes to the conservation of biodiversity. ■