



Working with traits

v 1.3

Ecotaxonomy allows to establish a database including a flexible system of characters and traits (categorical, numerical or textual). The ecological traits are assumed to be 'functional' and comprise information on the ecology of a taxon (trophic niche, behaviour, life cycle). Identification characters are morphological features allowing the identification of species / taxa in Ecokeys. After logging in, on the 'Dashboard' you can work with the 'Taxonomic traits' and 'Identification characters' tables.

1. Add/delete/modify a trait.

- Taxonomic traits and identification characters are structurally the same, but have different functions. To work with them, open either 'Taxonomic traits' or 'Identification characters' table on the 'Dashboard'. Here you can see the list of all traits. To add a new trait, click on 'Create in form' button above the table. In the opened form fill in: the name of the trait (short, 1-2 words); the taxon to which the trait will be valid (e.g., trait for taxon 'Life' will be valid to all taxa, trait for taxon 'Arthropoda' will be valid to taxon Arthropoda and all taxa within Arthropoda); the data type – text (free text), short text (up to 255 characters), categorical (trait with selection of categories), logical (yes/no), text (long text), count (integer numbers), numeric (non-integer numbers). All identification characters that will be used in the Ecokeys need to be of type 'select' (in addition, text description may be provided; see Appendix for detailed manual). Click 'Save' button on the top panel to create the trait. It will take you to the trait modification form (see below).
- To modify traits, find the trait in the 'Taxonomic traits' or 'Identification characters' table, click on the trait name with the right button and select 'Open'. It will direct you to the trait modification form. On the left side, you can browse through the tree of taxa. Only taxa, to which some traits were attached, are shown here. By clicking on a taxon you can see the attached list of traits below the tree. You can switch between the traits in this list. On the right side you can modify information for a selected trait. Add definition, attach pictures to explain the trait and add categories for categorical traits (type = select) and their descriptions by pressing the 'Add value' button at the bottom. You can add as many categories as you like, but generally 3-6 categories are preferable. To delete a category press on the recycling bin badge on the right side (contact administrator if you do not have enough rights). Put check mark on 'is_main_filter' if you want the



character to appear among the first most relevant identification characters in the identification key for the group.

- To add a picture or a set of pictures to a trait click 'Load pictures' and find pictures on your local machine. Select one or more pictures and click 'Open'. In the next form you can add descriptions and other parameters; when you are finished, click 'Save'. To modify pictures, click on 'Modify pictures' in the pictures tab. To delete a picture, press on the recycling bin badge. See 'Manual_taxa' for more details. As a general rule, each trait that is used in Ecokeys, should be accompanied with a picture (personal drawing or picture from external resource with a reference), with all possible trait values. See the detailed description below.
- Literature source can be linked to a trait as a reference. Click on 'Add literature data' in the 'Literature data' tab in the trait form. In the opened window you need to choose from the added publications or copy 'BibTex' data for a new publication from e.g., scholar.google.com (*find the publication in scholar.google.com, click on 'cite' badge, click 'BibTex', copy the entire text in the opened window*). All other fields will be filled automatically. Alternatively, you can manually fill the fields. You may further attach a file (e.g., a pdf of publication) to the publication. The files will be available for the registered users. If you added a literature source once, it always can be found in the search field in the top left of the literature interface.
- After modifications are done, click 'Save' button on the top panel. The trait will appear in the taxon forms of all relevant taxa.
- To delete a trait, find it in the 'Traits' table, select the target row by check mark in the very left column and click 'Delete' above the table. You need to confirm this action. Only administrators are allowed to do this.



Appendix: How to create identification characters

Identification characters are morphological features of an organism that allow distinguishing that organism from others in the given group. The characters are used to establish a filtering system (tabular identification key – ‘Ecokey’) to identify species or supraspecific taxa. The main advantages of the filtering system as compared to dichotomous keys is that (1) not all characters have to be defined while using the key, (2) several categories for each character are allowed, (3) multiple choices in case of uncertainty is allowed. The list of identification characters are compiled for each broad taxonomic group separately (e.g., Oribatida, Carabidae, Formicidae). Each character is then filled for each species. In case of some species-rich subgroups (families/genera) within the group, additional lists of characters can be established specifically for that subgroups. The list of characters can be expanded with time, but it is much more efficient to establish a rather complete system from the beginning. In addition to the identification characters each species always have “Taxonomic diagnosis” in free-text form that allows exact identification. In Ecotaxonomy we use short lists of relatively easy-defined characters, which allow a student to identify an organism after a short training. While compiling the character list, please, consider the following hints:

- Use list of 10-30 characters in total depending on the species richness of the group. In case of species-rich subgroups (family/genus), establish an additional list of several characters only for this group.
- Use as much as possible universal characters that are relevant for most of subgroups within a taxon and for most of the geographical regions.
- The character list does not have to be comprehensive. Combination of characters is not necessary allow identification of species or even genus. The main aim of characters is to subdivide the whole list of species to small groups (1-20 species).
- Most of the characters need to be relatively easy. If necessary, include not more than few very specific small characters or destructive identification.
- You should use numeric categorical type of data for the identification characters.
- Each character can have multiple categories, a.k.a. values, a.k.a. states (e.g., antennae of 3 or 4 or 5 or 6 or 12 segments).
- Characters need not necessarily correspond to those commonly used in dichotomous keys. For example a character like “coloration”, rarely used in dichotomous keys, since it is convergent among different taxa and therefore useless above the species level. Nevertheless, it can be very useful in the table system: choosing red colour will filter out



the majority of species and the remaining species from the different taxa can be distinguished easily.

- All categories of a character should be illustrated with at least one picture. Each character and category should have a detailed description (see examples below). The best is to combine one plate with all possible categories and their names. Pictures can be extracted from identification keys with CC-BY license and accompanied with a reference.
- Remember that each species always have a “Taxonomic diagnosis” in a free-text form, that allows exact identification. In this diagnosis one can include all characters that are not defined explicitly. Nevertheless, some key characters that are included as traits can be additionally included here.
- Size (minimum and maximum length of the body) is universally included in all groups as identification character and does not need to be defined additionally. However, if other measures are relevant (e.g., length of limbs, body width or other structures) they can be included as new identification characters.
- General description of colour is universally included in all groups as an ecological trait. It has 4 categories: pale, dark (dark brown, grey or blue), bright uniform (yellow, green, red etc.), bright pattern (any clear bright patten on the body). If specific colour patterns will help in the group identification, they can be included as new identification character(s).



Example 1: Selected identification characters of Oribatida (in total ~20 traits used for ~200 species in Sumatra, Indonesia)

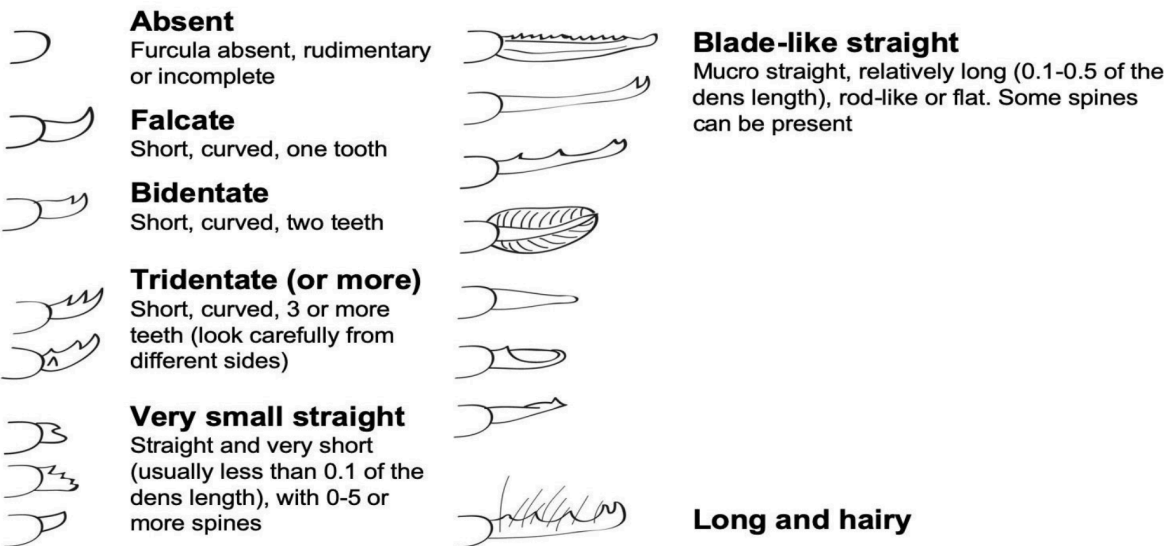
Character/category	Description	Picture
1. Lamellar cusps (type = select)	Appearance and shape of the freely projecting distal end of the Lamella	<p>lamellar cuspis small spiniform Kleine, spitze Cuspis</p> <p>cups absent Cusp nicht vorhanden</p>
Forming tectum	Lamella with free tip forming a tectum	<p>lamellar cuspis forming a tectum dachartige Cuspis</p>
No cuspis	Lamella without free projection	
Not known	No information available	
Small	Lamella with small, free projection	
2. Adanal setae (type = integer)	Number of setae on the adanal plate	<p>Enarthronota: Lohmannia-type, Mesolophorid-type ptyctimous bodyform.</p> <p>Parhyposomata: Parhyposomatid-type, Gehypochthonid-type.</p>
3. Aggenital setae (type = integer)	Number of setae on the aggenital plate	<p>Mixonomata: Eulohmannia-type speulodigastic, Epilohmannia-type schitzogastic, Euphthiracarid-type ptyctimous bodyform, Phthiracarid-type ptyctimous bodyform.</p>
4. Anal setae (type = integer)	Number of setae on the anal plate	<p>Desmonomatides - Notrina: Nothrus-type, Nanhermannia-type.</p>
5. Genital setae (type = integer)	Number of setae on the genital plate	<p>Desmonomatides - Brachypylina: Brachypylina-type.</p> <p>Legend: anal plate (yellow), adanal plate (orange), genital plate (red), aggenital plates (blue), fused adanal & aggenital plates (cyan), preanal plate (purple).</p> <p><small>© pictures G. Weigmann, SEM pictures and coloured schemes by K. Norton, assembly by D. Sandmann</small></p>



Example 2: Selected identification characters of Collembola (in total ~12 traits used for ~60 species in Sumatra, Indonesia)

Mucro

at the tip of the furcula. In doubt, select multiples choices.



Antennae

Morphology of antennal segments (length and subdivision)

