Identification key for the genus Weingartia

“Why is a steinbachii a steinbachii?” This question was the hobbyhorse of Nol Brederoo. In 2009 I tried to answer this question with the use of a key (Pot 2009). The result was not satisfactory. I had accepted all sorts of suggestions from specialists and given names to unidentifiable groups. After several attempts, a name was found using the key, but there was still no definition for the taxon found.
After Dr. Karl Fickenscher published an identification key for the genus *Aylostera*, an email exchange followed, which gradually inspired me to look again for the answer to Nol's question.
To help me do this, I wrote a small program for a database in which all properties of the characteristics were divided into criteria. I took this data from another database with records of individual plants that I had compiled over several years. This data applied to plants of the Weingartia genus, even if the name was provisionally provided with “S” for Sulcorebutia. I quote Dr. Günter Hentzschel (2000):
“Identification key to identify the genus Sulcorebutia and related genera.

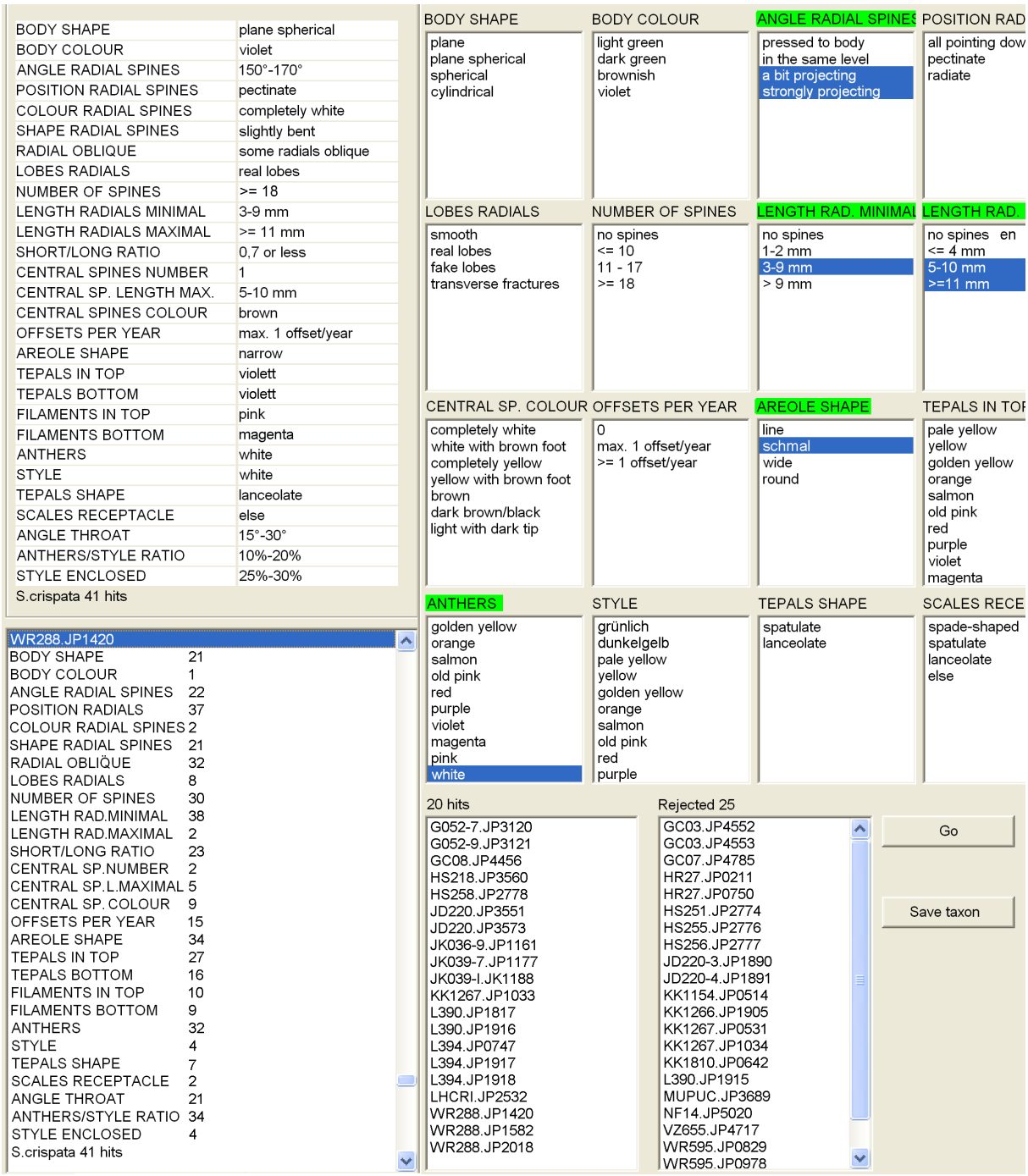
1. a) Short columnar or spherical plants with woolly buds and pointed triangular scaly leaves ⇨ *Echinopsis, Lobivia* etc. (this group is not further processed in this key).
   b) Short-columnar or spherical plants with externally bare buds and coarse, heart-shaped scaly leaves, at the bottom with auricles that completely cover the buds and apically displaced areoles ⇨ *Gymnocalycium, Weingartia, Sulcorebutia* ⇨ continue to 2.
2. a) Short-columnar or spherical plants with clear ribs, flowers near the apex ⇨ *Gymnocalycium, Weingartia* (southern group) ⇨ continue to 3.
2. b) Short-columnar or spherical plants, divided into spirally arranged, rhombic tubercles with apically shifted areoles ⇨ *Sulcorebutia, Weingartia* (northern group) ⇨ continue to 4.
3. a) Funiculi branched several times, fruits usually ripping lengthways ⇨ *Gymnocalycium.*
3. b) Funiculi individually or partially once branched, fruits ripping open ⇨ *Weingartia fidaiana, W. neumanniana, W. kargliana*).
4. a) Funiculi branched several times, fruits dropped soon after ripening ⇨ *Weingartia* (nördliche Gruppe = *Weingartia neocumingii* and related species).
4. b) Funiculi individually or partially once branched, fruits ripping open or drying leathery ⇨ *Sulcorebutia.*”

The criteria in section 4 are meaningless. In 2001 already, Hentzschel told me that the observation of Weingartia's multi-branched funiculi was based on an error. Funiculi of all Weingartia’s are individually or partially once branched. Therefore I assign all plants in my database to *Weingartia*.

I will now try to describe how the program works. (Fig. 1) The process starts by choosing a name, in this example crispata.[1]

Which plants should be called crispata? In principle, the plants of the type location and all others that look similar in the various criteria.

[1] The name “crispata” was chosen instead of “steinbachii” because the result rather prompts questions after each run.



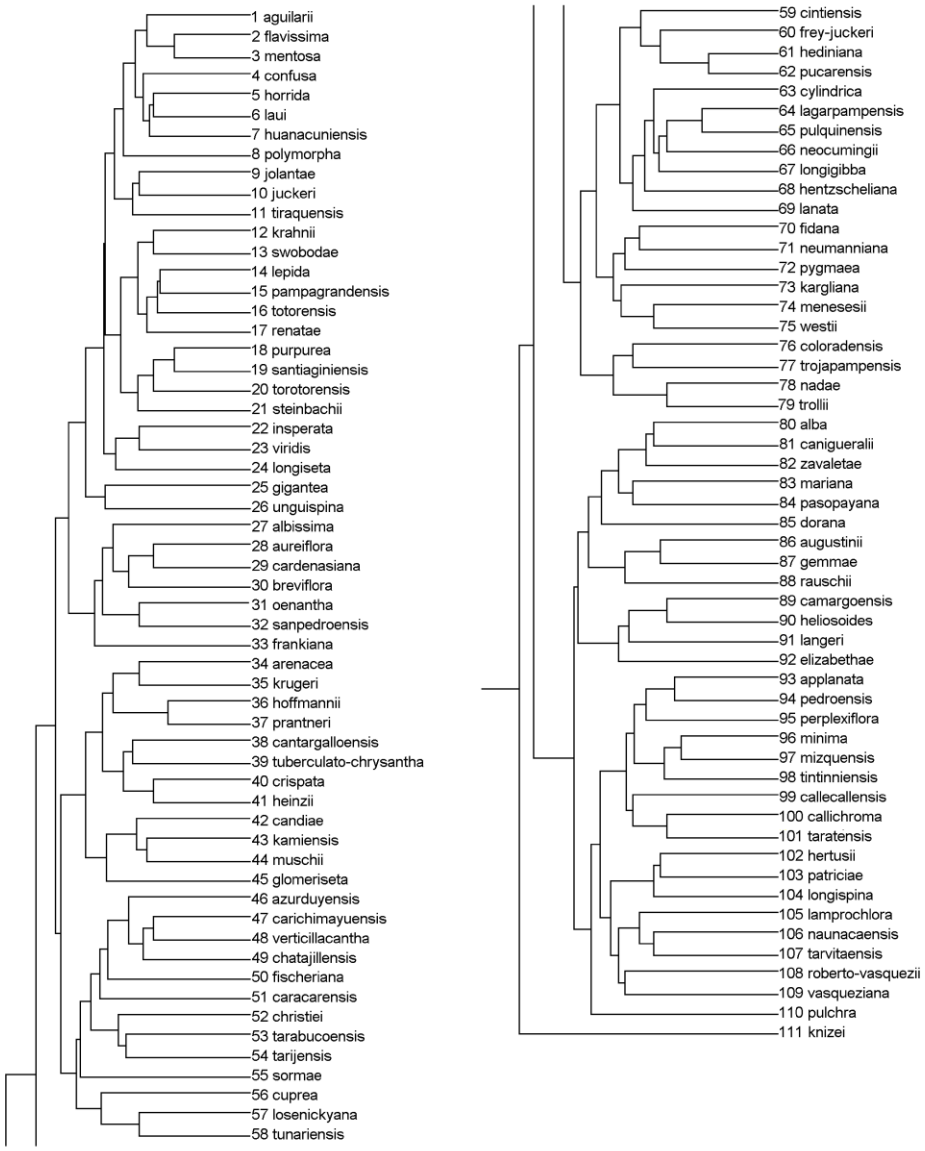
Example screen

The program searches from 2040 records in the database, all of which have been provisionally given the name crispata.
These are recorded with the designation field number + unique collection number in the column at the bottom left. A total of 28 characteristics are shown in this column for each record.
If I now select a field number (+ unique collection number) in this column, the column at the top left is filled with the properties of this plant. The column at the bottom left shows the number of times these properties also occur in other records with the name crispata.

The areole of the WR288.JP1420 is “narrow” (top left). This applies to 34 of the 41 names found (bottom left). It is therefore obvious to select this characteristic (see column *Areole shape* with green background, third row, right).
WR288.JP1420 has totally white radial spines. This characteristic is shared with just one other “crispata” and therefore makes no sense in this context. *Color radials* is therefore not selected.
After choosing a property, I click on “Go”. In the *Found* column, all names from the 2040 records appear that meet the conditions in the columns marked with green. The column *Rejected* contains the records that are provisionally called *crispata*, but differ in one or more properties.
Through trial and error, a favorable combination of the features is now sought. Ideally, all “crispata’s” - and no other plants - appear in the *Found* column, so the *Rejected* column is empty.
Plants with other provisional names that are still in the “Found” column may be outliers. Or they come from a population that was not previously considered *crispata*. Since I cannot find a better result, I consider the properties in the columns marked with green to be decisive for the plants that can bear the chosen name. This data is linked to the name in the key.
In this way 111 names have been added. For now, I prefer to call them taxa, which are all on the same level. These taxa are now defined and therefore you can answer the question why e.g. a *steinbachii* is a *steinbachii*.
You will not be surprised that some so-called steinbachii’s do not meet the criteria and are therefore better described as “Species of” + place name.
Those who are not happy about these definitions are invited to look for an alternative. I suspect that the characteristics I have selected offer little room for this. It is not easy to find the definition of these 111 taxa favourable for you, in the key.
That's why I have designed a signpost. The features in this guide do not necessarily have to be included in the definitions. In the example of *crispata* e.g. *Position radial spines* is not activated because this feature is in itself superfluous here. In the signpost, however, the feature plays a role for every taxon.
I quote from Lehrbuch der Pflanzenwissenschaften (2014):
“One can argue that morphologically recognizable species exist because:
- the individuals belonging to them belong to a reproductive community, but are reproductively isolated from other species (and thus meet the criteria of the biological species concept),
- they are exposed to similar selection conditions (and thus meet the criteria of the ecological species concept),
- they are the result of an independent evolution (and thus meet the criteria of the evolutionary species concept) and because
- they come from a common ancestor (and thus meet the criteria of the phylogenetic species concept). ”
This quote prompted me to design a cladogram (Fig. 2) based on the entire set of characteristics of the defined taxa, hoping to get an impression of the mutual relationships. I took over the numbering in this cladogram in the list of definitions.

However, the result does not seem convincing. One explanation may be that sometimes plants do meet the criteria of a taxon, provisionally have the same name, but differ in other characteristics. You will find e.g. menesesii (74) in a cluster with fidana and westii. If I do not accept the so-called menesesi's with field number FR775 as correct, we would find the Taxon menesesii in a cluster with arenacea and

candiae. Is that better? Who can say? I would appreciate sensible suggestions in such cases.



Cladogram based on the entire characteristics of the defined taxa

Not all of the names described can be found with the key. Sometimes I don't have enough material. I would be very happy for any offers of help to remedy this deficiency.
In this case, I would like from such taxon, flower sections from a minimum of 6 different clones, made with a scanner, resolution 600 DPI, as well as some other data relating to body and spine. For anyone interested in obtaining this key I would be happy to supply the PDF version.

I thank Dr. Karl Fickenscher for the many tips and Jim Gras for proof reading the English text.

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Figures:
Fig. 1: Example screen
Fig. 2: Cladogram based on the entire characteristics of the defined taxa

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