Assessment of Unique Material in European Collections of Umbellifer Crops

Final Report for project ref LOA 10/047

Introduction

Through collaborative efforts between participants, the aim of this project is to deliver a method for identifying the Most Appropriate Accessions from the combined European umbellifer collections for future inclusion into AEGIS, and to use this method to create a draft list of MAAs for collection curators. The specific objectives of the project are:

- To analyse the existing data associated with the European Umbel collections as held in both the European Umbel Database (EUDB) and the EURISCO catalogue with regard to completeness of passport information. The level of passport data will influence how accessions are assessed for uniqueness.

- To assess the entire European Umbel collections for duplications and synonyms

- To set up a list of criteria for MAA definition based on documents already produced within the AEGIS programme

- To use the results to draw up a list of MAAs for inclusion into AEGIS

Progress since Interim Report

1. Initial Analysis of EURISCO *Daucus* Dataset

1.1 Methods

As discussed at the first Project Workshop (held at Wellesbourne in October 2010), the EURISCO *Daucus* dataset, augmented with data from non-EURISCO accessions from France and the UK, was processed and divided up between the six workshop participants:

- Wild and landrace material was removed as these data would be considered using a different method
- Material was sorted by accession name and 'cultivar groups' identified – this was done to group all cultivars with similar names, even if they didn't fall next to each other in an alphabetically sorted list.
- The whole list of *Daucus* advanced cultivars with data in the 'ACCENAME' field was then resorted based on cultivar group. It was then split into six roughly equal sections for the six workshop participants to analyse separately.
- An additional column (MAA status) was inserted into each worksheet, and each accession was assessed as either 'MAA', 'pending', or 'not an MAA'. The workflow developed at the first workshop (see Figure 1) was used, along with the assessor's own personal knowledge and experience where data were lacking.
- 'Pending' accessions were breeding material or where an MAA choice was unclear and required input from a collection curator (e.g. 2 accessions with the same name, collected from the same country – the MAA might in this case be the one with the best seed stock level and viability).

Table 1. Composition of the dataset analysed in this project

Accessions in EURISCO *D. carota* dataset	**4671**
Accessions without data in 'ACCENAME'	1116
*Accessions with data in 'ACCENAME'	3555
*Accessions not in EURISCO from Warwick GRU	242
*Accessions not in EURISCO from France	83
Accessions considered in this exercise (all marked with *)	**3880**
- **accessions discounted as wild/landrace** - **accessions discounted as F1 hybrids** - **accessions classified as breeding material for separate consideration by curators**	**679** **94** **159**
Total *D. carota* accessions analysed for MAA status	**2948**

Of the 3880 accessions considered, 679 were wild or landrace samples, so were removed from the dataset for separate consideration. A further 94 accessions were identified as F1 hybrids, and so inadmissible as MAAs as regeneration is not possible for this material. Another 159 accessions were identified as 'breeding material' and placed on a list for consideration by collection curators. In total 2948 accessions were considered for MAA status

2. Outputs of Second Project Workshop

The second project workshop was held jointly with the first meeting of the Umbellifer Crops Working Group in Quedlinburg, Germany from 30th March to 1st April 2011. It was felt that this would be an excellent opportunity to disseminate the results of the project to the wider WG and to obtain their input on the next steps to take.

A summary of the work and results so far was presented, and the issues project partners encountered in applying the workflow to their own section of the Daucus dataset. The initial analysis of the dataset by the six project partners after the first workshop resulted in 43% of accessions being selected as potential MAAs from the pool of 2948 accessions considered.

A group discussion followed suggesting ways to resolve particular issues and problems. Most issues arose due to incomplete passport data being available for the accessions in question. The following considerations and decisions were agreed:

1. the MAA selection process will never be totally objective due to missing data

2. 'Country of Origin' remains an important criterion – particularly when it relates to the country of registration for the European Common Catalogue

3. If several (less than 10) accessions have the same name, select 2-3 where there is a potential for genetic difference (eg different country of origin or very different collection dates). This is because carrot variety names are the same as, or are derived from root types (e.g. Chantenay, Berlicum, Nantes) and this means that accessions with the same name may be genetically different, particularly if they originate from different geographical regions. Without access to morphological or molecular data it is difficult to know the amount of variation present between accessions with the same name, so a starting point for the European Collection would be to select a minimum (2-3) accessions from different geographical origins. Preference would be given to accessions held in the country of origin, and then others selected based on a range of geographical origins to represent diversity.

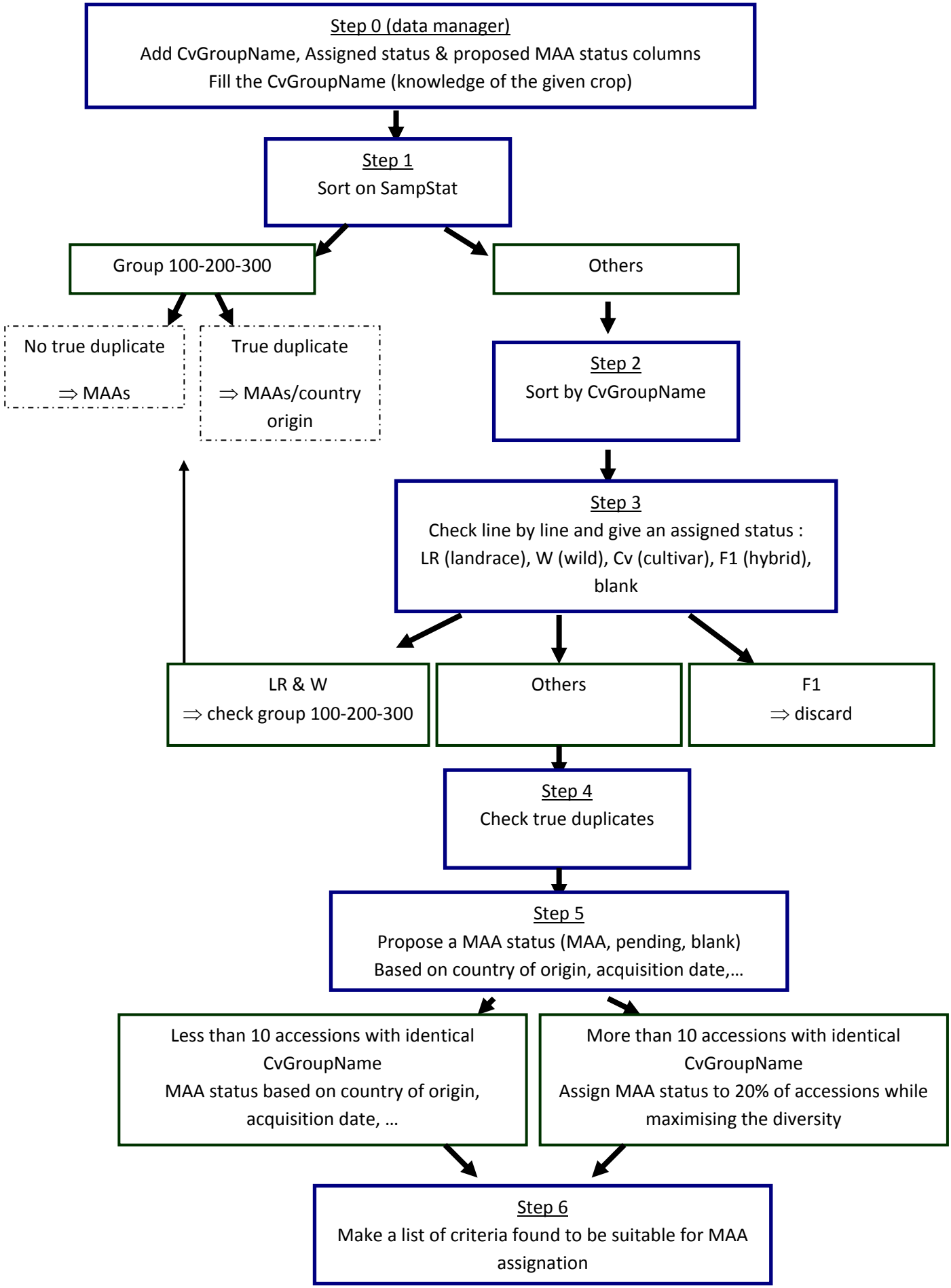
   Selecting 2-3 accessions would provide a preliminary list of accessions for the European Collection, based on available data at the current time. There is likely to be a relatively high

level of redundancy within these groups so in order to maximise genetic diversity in the European collection while minimising the number of genetically similar accessions, an initial selection of 2-3 accessions was judged to be reasonable. As more data become available we propose that accessions can be added or removed. Such data might include morphological and molecular studies of diversity.

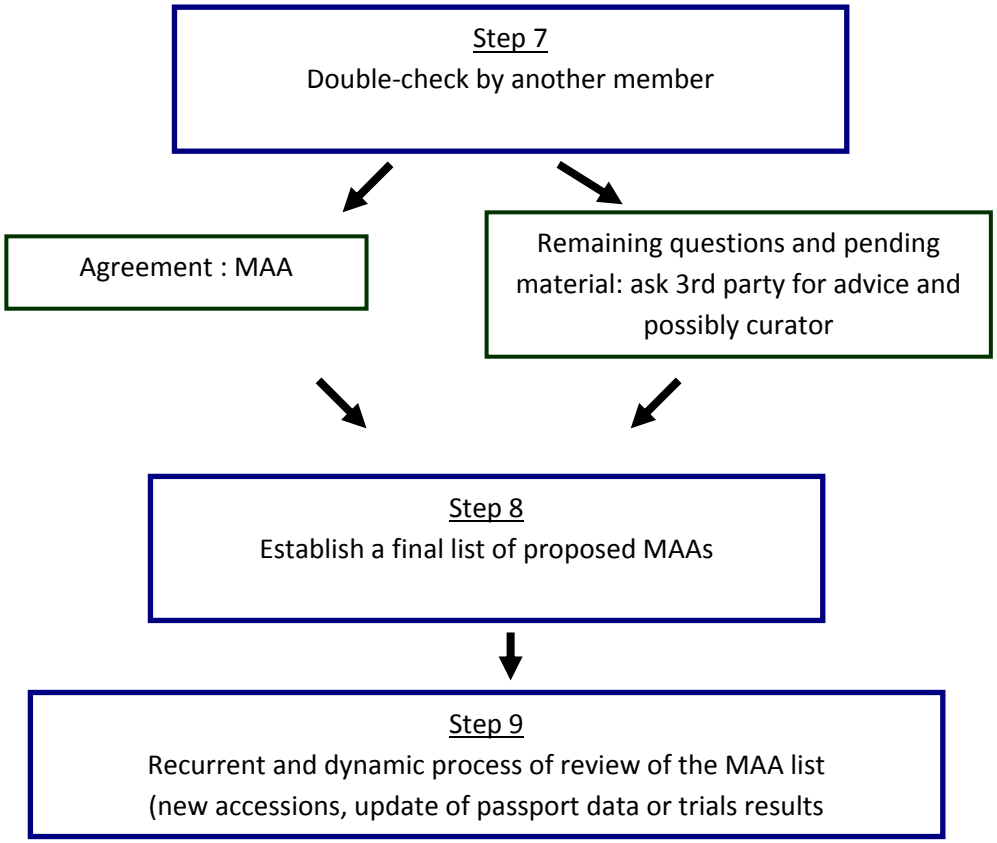
4. Following the procedure above, if more than 10 accessions have the same name, aim to select 20% as MAAs to maximise potential genetic diversity in the European Collection without unduly increasing the risk of duplication and redundancy.

5. Material which is not European in origin should be kept but consideration should be given to selecting only a single representative accession from groups of accessions with the same or similar names So if there are 12 accessions of a variety of known Chinese origin (with the same name), only one will be selected as an MAA, rather than 20% of accessions.

Figure 1. Workflow for MAA selection proposed at First workshop



New steps to complete the first workflow



- On the issue of synonyms, the European Common Catalogue can be a useful reference but it would be unwise to assume that groups of synonyms are genetically homogenous as they are often named after broad 'umbrella' varieties e.g. 'Berlicum'.

The selection of MAAs was checked by another project participant reviewing each of the six sub lists of cultivated *Daucus* material and making their MAA selections. Where these differed from the original selection, either the two participants came to an agreement on MAAs or a third person repeated the exercise and accessions were deemed to be MAAs if selected by two of the three people involved. This step appears to be necessary due to the subjective nature of some decisions required due to incomplete passport data.

2.1 Results

After the validation of selections by one or more project partners, a total of 1281 potential European Accessions for advanced cultivars of carrot were identified. This represents 43% of eligible advanced cultivars in the European collection (i.e. not F1 hybrids or accessions without names). The distribution of accessions among institutions is shown in Figure 2.

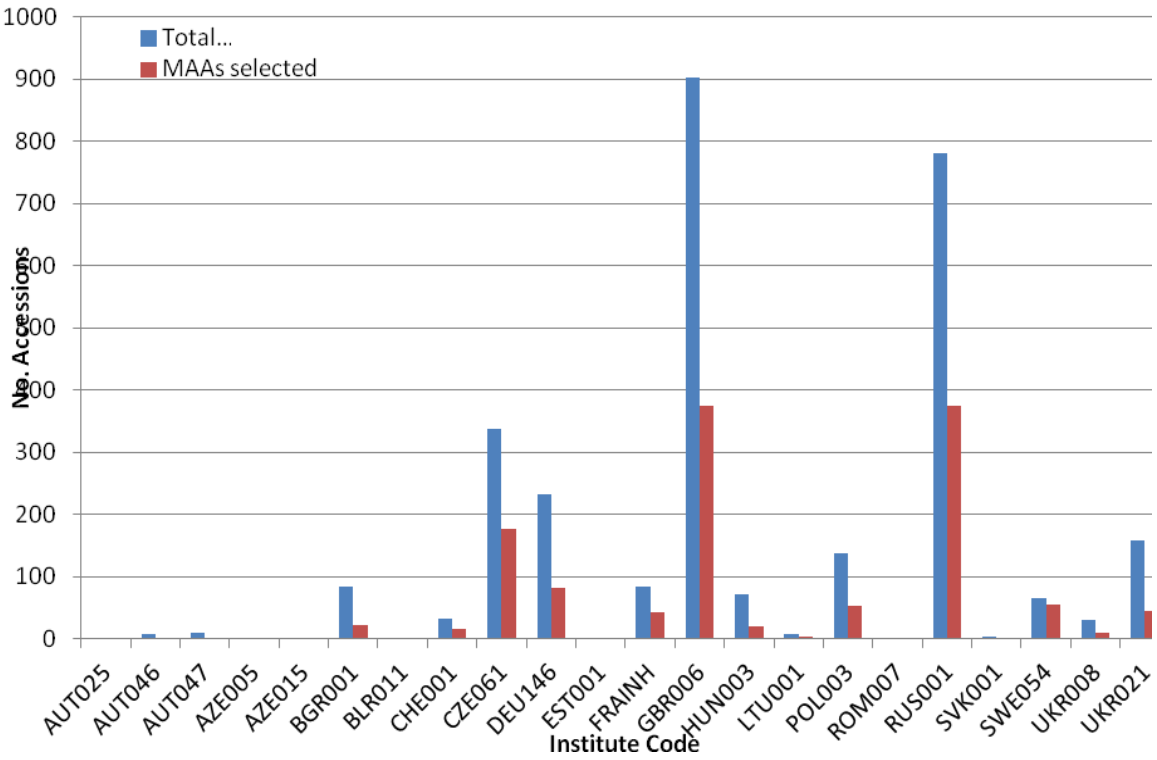
A second list contained 252 accessions identified as breeding material in their associated passport data. All accessions with a sample status of 'breeding material' from the original EURISCO dataset were placed in this group, regardless of whether they had an accession name or not. This group contains some F1 hybrids – these will be deleted from the list. When asking collection curators for their input it is important to emaphsise that such hybrids cannot be selected as MAAs so if there are others they aware of, they should not be put forward as an MAA. Commercial companies are not likely to donate germplasm of their parent lines to public genebanks as they are highly sensitive commercial property (verified by various conversations with breeding company representatives), and even if the variety in question is no longer maintained, the parent lines may still be in use in

their breeding programme. Additionally, as companies merge or disappear, it is possible that the parent lines themselves no longer exist.

The third list, also for comment by collection curators contains accessions where not enough information is available to choose an MAA. For example such a situation might arise if two or more accessions have the same name and the same country of origin – in this case seed stock levels or other factors might influence the final selection. The primary selection criterion was 'country of origin' so preference is always given to material conserved in the country in which it was collected. Curators would give their input over their own material but the WG (or subgroup) would make a choice if similar accessions were maintained in different genebanks after asking curators for any further relevant information (number of regenerations, characterisation data, viability, stock levels – in that order). Once input has been given by collection curators, any further accessions deemed as European Accession can be added to the 1281 already selected.

The final list of MAAs is available in spreadsheet format. The relevant part of the final list will be presented to each national co-ordinator via the collection curators. A national decision must be made at the relevant level to ratify the MAA list, and to agree to the quality and availability requirements of AEGIS for this material.

Figure 2. Impact of MAA selection process on different genebanks – blue bars represent the total numbers of Daucus accessions (n=2948, non F1 hybrid advanced cultivars with names) in each collection which were considered for MAA status, red bars show the number of accessions selected as MAAs.



3. Future Work

The number of accessions selected from groups with the same or similar names (2-3 or 20%, see pages 2 and 3 of this report) could be validated by comparing genetic diversity within or among accessions using molecular markers. Due to the outbreeding and heterozygous nature of carrot accessions an extensive sampling strategy would be required, and the type of marker selected carefully in order to obtain meaningful data. This is not a trivial task and requires a sufficient level of funding to ensure it succeeds

Work is currently ongoing to select MAAs from the wild/landrace *Daucus* dataset. This material should be simpler to work with as both the project partners and the Umbellifer WG agreed that, disregarding true duplicates between genebanks, most of this material is expected to be unique. A process needs to be determined for 'advanced cultivars' without accession names but in principle the same procedure could apply. It is possible that errors have meant that accession names or other useful data are not present in EURISCO – a further course of action could be to compare EUDB data with EURISCO, and to confirm with curators that all available data have been submitted.

Using the methods and principles worked out for carrot during this project, the Umbellifer Crops Working Group agreed to carry on with the identification of potential MAAs among other crop types

Name	*Crop*
Herve De Clerq	Celery/Parsley
Teresa Kotlinska	Dill
Ana Gulbani	Dill
Ulrike Lohwasser	Parsnip
Pavel Kopecky	Parsley/Parsnip/Celery
Svein Solberg	Caraway
Charlotte Allender	Fennel/Parsnip

Charlotte Allender will divide up the lists, but this will be coordinated with an update of the European Umbel Database (EUDB).

4. Conclusion

The ECPGR supported AEGIS project has permitted effective progress to be made on the implementation of AEGIS for Umbellifer genetic resources through:

- exchanges between members about the goal and philosophy of MAA identification, and the development of common views
- the involvement of participants and a shared input
- the definition of criteria (and their limits) and a suitable procedure for MAA identification on carrot, to be applied to other Apiceae
- the proposition of a MAA list in carrot