

A Database for Three Dioscoridean Illustrated Herbals

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Abstract. An image database was developed for three illustrated recensions of the non-illustrated manuscript of Dioscorides entitled Περὶ ὕλης ἰατρικῆς (*De Materia Medica* in Latin; *On Medical Matters* in English) written in approximately Year 65: *Juliana Anicia Codex (JAC)* or *Codex Vindobonensis* produced in Year 512, *Codex Neopolitanus (NAP)* produced in the late sixth or early seventh century, and *Morgan 652 (M652)* produced between 927 and 985. The database that brings up images and accompanying records is searchable by herbal, common name in English and Greek (Roman alphabet), binomial (current and in source document), and botanical family. In addition, a Venn diagram of images in the three herbals permits a search for images that are common or unique among the three herbals. The database makes it possible to locate images in herbals written in Greek that are difficult to access and will be useful to horticulturists and herbal scholars. The database can be accessed at <<http://www.hort.purdue.edu/newcrop/herbalimages>>.

The non-illustrated Greek herbal of Pedanius Dioscorides written in Year 65 is one of the most important and influential books on pharmacology, herbal medicine, and horticulture and influenced medicine for almost two millennia. The manuscript was reconstructed by Wellman (1906–14) in three volumes and recently translated into English (Beck, 2005). Three illustrated recensions in Greek still exist and are invaluable resources for studies of ancient and early medieval plant images. The earliest is the *JAC*, completed in Constantinople in 512 and dedicated to the Imperial Princess Juliana Anicia (462–527), daughter of Anicius Olybrius, Emperor of the western Roman Empire. The bound volume is located in the Österreichische in Vienna and is available in facsimile in two volumes (Der Wiener Dioskurides, 1998, 1999; Janick and Hummer, 2012). Identification of the two-volume *JAC* images (folios 12v–387r) by the facsimile editor Otto Mazal was available in an index called *Das Herbarium* divided in two volumes that included binomials and families in Latin and common names and some descriptions in German.

The illustrated *NAP* dates to ≈600 and since 1923 resides in the Biblioteca Nazionale, Naples (Collins, 2000). A facsimile is available (Dioscurides *De Materia Medica*, Codex Neopolitanus Graceus I of the National Library of Naples, 2000). The *NAP* images have the Greek name as an integral part of most images, and there is an index of Greek names on p. 223 to 243 in the volume accompanying the facsimile. *NAP* appears to be an extended

version of *JAC* with many images either copied from or based on *JAC* and can be considered a sister manuscript based on a lost archetype, although it cannot be excluded that some images of *NAP* were copied from *JAC* (Janick and Stolarczyk, 2012).

M652 completed in Constantinople between 927 and 985 is related both to *JAC* and *NAP* (Janick et al., 2013). It is now in the collection of the Morgan Museum and Library where it is available online (<<http://www.themorgan.org/home.asp>>). An index has been made available by the library and

contains the Greek name in Roman letters, common name, and binomial.

These three illustrated herbals are clearly related to each other either by copying or from an earlier lost manuscript. An image analysis of the three herbals was made by Janick et al. (2013) and in the process, a database was constructed to determine the relationship between images. The database is currently online (<<http://www.hort.purdue.edu/newcrop/herbalimages>>). The objective of this article is to describe the construction of the database and bring it to the attention of horticulturists and herbal scholars who should find the information useful.

Materials and Methods

Acquisition and digitization of images. A database of the images contained in *JAC* (404 images), *NAP* (410 images), and *M652* (453 images) was constructed to make the visual and textual comparison of images a more manageable task. Facsimiles of *JAC* and *NAP* were scanned to create digitized images, whereas *M652* was accessed from a digital online version available from the Morgan Museum and Library. The binomials, common English and Greek names of *M652*, were obtained from the Excel (Microsoft Inc., Redmond, WA) spreadsheet provided by The Morgan Library and Museum. Binomials and Greek names from *JAC* associated with the *JAC* images were based on the index made by Otto Mazal, the facsimile editor. The *NAP* images contained Greek names in red uncial and were also available in an index in the Greek alphabet provided in the accompanying volume of the facsimiles, which were put into Roman letters.

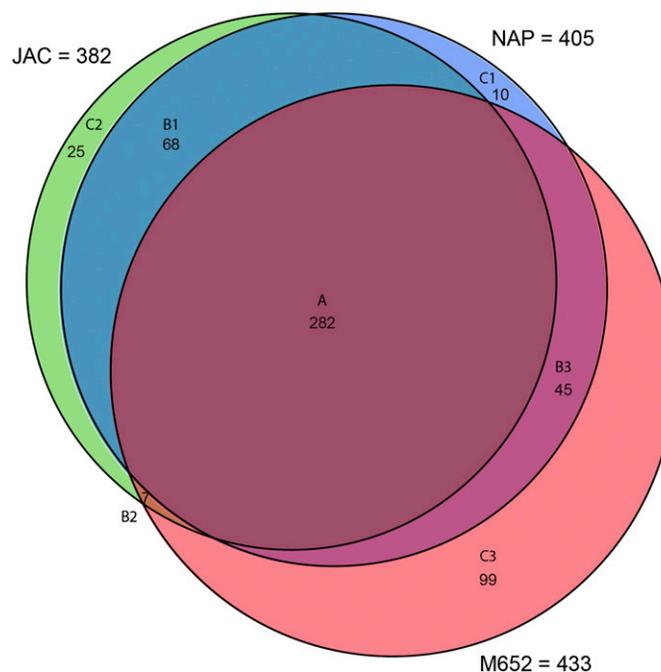


Fig. 1. Venn diagram of images in *Juliana Anicia Codex (JAC)*, *Codex Neopolitanus (NAP)*, and *Morgan 652 (M652)*. Source: Janick et al. (2013).

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Database development. A relational database was built using FileMaker Pro 11.0 FileMaker Inc. A separate file was created for each herbal. Each image is a separate record containing the following fields: location in the source document by folio number and position on the page; Greek name (Roman alphabet); English common names; binomial in the source document, current binomial, and authority; botanical family; comment; and set number. The set number was the key field used to associate the matching images.

To make the database available online, the FileMaker database was exported to two-comma separated files. The first exported file contained the individual image records, which were used to create an image record table. The second exported file contained derived images called synteny groups (Janick et al., 2013), which were used to create a synteny set table. The exported data files were then imported into a MySQL Version: 5.5.13 (current database manufacturer Oracle Corporation).

Development of web interface. PHP scripting enables access to the database through a web interface. An index was made for each name field and the set field and all the information were made available in dropdown boxes for searching purposes. There were complications resulting from variant spelling, superimposition of more than one image in a few cases, and obvious errors in assigning proper names. These were corrected as they became obvious. All images and information are displayed together. Images can be enlarged by clicking on them. In addition, it is possible to search any field such as current binomial, source binomial, family, common name, Greek name, folio, or comments without recourse to the dropdown menu. Results however are not restricted to whole words only. Thus, putting in oat will also come up with goat.

We have also reproduced the Venn diagram (Fig. 1) from Janick et al. (2013). Clicking on the labels in the diagram on the Herbal Images web site will retrieve common images from each comparison, e.g., A will bring up images common to *JAC*, *NAP*, and *M652*. It should be noted that this Venn diagram is based on 382 images for *JAC*, 405 images for *NAP*, and 433 images for *M652*. In the case of *M652*, the reduced number is because we included only images from folios 3 to 199 (Book, 1, Fruits and Herbs of Dioscorides); in the case of *JAC*, only images from folio 12v to 387 (based on Dioscorides) were included and images made in the 12th to 13th century were omitted; and in the case of *NAP*, only images were included, although records were available from some torn pages.

Using the Database

An example of how the database operates can be explained as follows. Let us assume the viewer is interested in carrot. A number of terms might be used including carrot, wild carrot, cultivated carrot, *Daucus*, *Daucus carota*, or *Daucus gingidium*. Using *Daucus*

as a search term in “Search by Word or Phrase” will bring up seven images as shown in Figure 2. These will include *Daucus carota*, *Daucus gingidium*, *Mallabaila sekakul*, and *Daucus silvestris*, but the information will make clear that *Daucus carota* is the current binomial for all. However, it will become

obvious that both *Daucus carota* include wild carrot (*Daucus carota* L. subsp. *silvestris*) and cultivated carrot (*Daucus carota* L. subsp. *carota*). These terms can also be accessed using the dropdown index. It should be noted that if we search for the term carrot, we also come up with *Thapsia garganica* (known

The screenshot shows a web search interface for "Daucus". At the top, there are buttons for "Home" and "Return to Search", and a header indicating "Search Results for 'Daucus' - Total Images Found: 7".

Set 57 displays three image thumbnails: "Juliana Anicia Codex", "Morgan 652", and "Codex Neapolitanus". Each thumbnail has a "Click to Enlarge Image" link below it. Below the thumbnails are three metadata tables:

Current Binomial	Daucus carota L.	Current Binomial	Daucus carota L.	Current Binomial	Daucus carota L.
Source Binomial	Daucus gingidium	Source Binomial	<i>Mallabaila sekakul</i>	Source Binomial	
Family	Aplacaceae, Umbelliferae	Family	Aplacaceae, Umbelliferae	Family	
Common Name	Carrot, Wild Carrot	Common Name	Gingidium, Wild Carrot	Common Name	Wild Carrot
Greek Name	gingidion	Greek Name	gingidion	Greek Name	giggidion (gingidion)
Folio	088r	Folio	32v	Folio	59
Page Position		Page Position		Page Position	R
Synteny Rating	0	Synteny Rating	2	Synteny Rating	
Comment	subsp. carota	Comment	subsp. carota	Comment	subsp. carota

Set 577 displays two image thumbnails: "Juliana Anicia Codex" and "Codex Neapolitanus". Each thumbnail has a "Click to Enlarge Image" link below it. Below the thumbnails are two metadata tables:

Current Binomial	Daucus carota L.	Current Binomial	Daucus carota L.
Source Binomial	Daucus carota	Source Binomial	
Family	Aplacaceae, Umbelliferae	Family	
Common Name	Carrot, domestic carrot	Common Name	Domestic carrot
Greek Name	stafulinos kepalos	Greek Name	stafulinos kepalos (kepeos)
Folio	312r	Folio	151
Page Position		Page Position	L
Synteny Rating		Synteny Rating	
Comment	subsp. sativus	Comment	subsp. sativus

Set 578 displays two image thumbnails: "Juliana Anicia Codex" and "Codex Neapolitanus". Each thumbnail has a "Click to Enlarge Image" link below it. Below the thumbnails are two metadata tables:

Current Binomial	Daucus carota L.	Current Binomial	Daucus carota L.
Source Binomial	Daucus silvestris	Source Binomial	
Family	Aplacaceae, Umbelliferae	Family	
Common Name	Wild carrot	Common Name	Wild carrot
Greek Name	stafulinos agrios	Greek Name	stafulinos agrios
Folio	313r	Folio	151
Page Position		Page Position	R
Synteny Rating		Synteny Rating	
Comment	subsp. silvestris	Comment	subsp. silvestris

Fig. 2. Results returned when entering *Daucus* in “Search by Word or Phrase.”

variously as false fennel and deadly carrot) because the word carrot occurs in the common name field.

Conclusions

The database has a number of valuable uses. First it makes available images from herbals that are difficult to access. Second, it allows images to be searched by common name, binomials, or Greek names in the Roman alphabet. Third it shows which images are unique to one herbal, common to two of the three herbals, or common to all three of the herbals. The database is considered a work in progress, and we plan to incorporate corrections and additions as they are supplied as

well as providing updated binomials. Plant taxonomists are invited to submit nomenclature corrections using a feedback form.

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