

The value of museum collections for development of DNA barcode libraries

December 30 2013



This is *Ozyptila praticola*, one of 31 frequently collected Dutch spider species included in the time series study. DNA barcodes of this small species (3 mm) were produced from specimens that had been in a museum collection for nearly 30. Credit: Naturalis Biodiversity Center, RMNH.ARA.14408.

The ability to sequence the DNA of plants and animals has revolutionized many areas of biology, but the unstable character of DNA

poses difficulties for sequencing specimens in museum collection over time. In an attempt to answer these issues, a recent study of 31 target spider species from the Naturalis Biodiversity Center in Leiden, discovers that both time and body size are significant factors in determining which specimens can produce DNA barcode sequences. The study was published in a special issue of the open access journal *ZooKeys*.

The specimens contained in the world's natural history museums are the basis for most of what scientists know about biodiversity. Much like libraries, natural history museums are responsible for the long term preservation of their collections while circulating loans to active scientists. Museum curation techniques were developed over hundreds of years and optimized for anatomical preservation, and are often not ideal for preserving tissues for DNA sequencing.

DNA barcoding is an approach to the study of biodiversity that involves sequencing a standard region from the genome of an unidentified specimen and comparing it to a library of identified reference sequences representing many species. The success of this approach is in part dependent on the completeness of the library of reference sequences. When building such a reference library, specimens must either be freshly collected or taken from an existing collection.

The question addressed in this study is can we predict which specimens in a museum collection are likely to yield a successful DNA barcode sequence? If so, we can optimize our resources, wisely select museum specimens to sequence, and plan fresh collections to supplement. This study focused on Dutch spiders.

31 target species that have been frequently collected in the Netherlands over several decades and deposited in the Naturalis Biodiversity Center in Leiden were selected. For each target species, a series of increasingly

older specimens was selected and brought to the lab for DNA sequencing. This was supplemented with freshly collected material representing nearly 150 Dutch spider species. The scientists recorded which specimens successfully produced DNA barcode sequences and which failed. They also experimented with DNA extraction techniques.

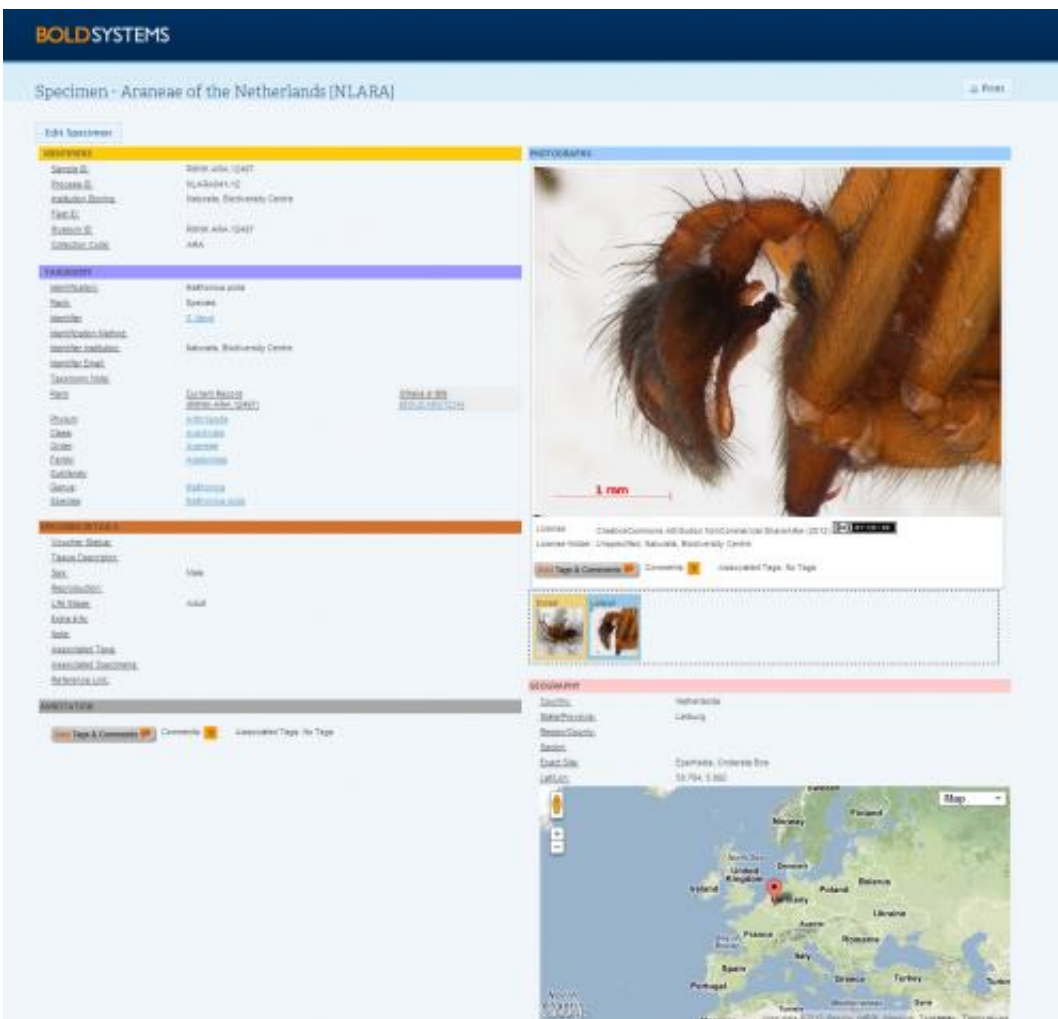


This is *Euryopsis flavomaculata*, one of nearly 150 Dutch spider species contributed by this study to the growing global library of DNA barcodes. Credit: Naturalis Biodiversity Center, RMNH.ARA.12481.

Typically, DNA extraction begins with the removal of muscle tissue; this is destructive extraction. An alternative approach is to soak the specimen in a solution that releases DNA from cells but does little or no damage to anatomy; this is nondestructive extraction. They found that failure rates

for DNA barcode sequencing rise with time since collection, but body size is also a significant factor.

For freshly collected specimens overall, body size is not a predictor of sequencing success or failure. But larger species have a longer DNA barcoding shelf life than smaller species. Nondestructive extraction techniques can significantly improve the chances of obtaining a DNA barcode sequence. Considering only the commonly applied destructive extraction method, small spiders are useful for only a few years while those with a body length of around 3 mm or more have a good chance of yielding a barcode sequence for about 20 years after collection.



The screenshot shows the BOLD SYSTEMS interface for a specimen record titled "Specimen - Araneae of the Netherlands (NLARA)". The interface is divided into several sections:

- EDIT SPECIMEN**: A header for the specimen record.
- IDENTIFIERS**: A table listing various identifiers and their values.

Barcode ID	9430441-12
Barcode Source	INRA, Biodiversity Centre
Field ID	
Barcode ID	9430441-12487
Barcode Code	AAA
- TAXONOMY**: A table listing taxonomic ranks and their corresponding values.

Kingdom	Metazoa
Phylum	Arachnida
Class	Arachnida
Order	Araneae
Suborder	Araneae
Superfamily	Araneae
Family	Araneae
Genus	Araneae
Species	Araneae
Authority	Araneae
Year	Araneae
Class	Arachnida
Order	Araneae
Suborder	Araneae
Superfamily	Araneae
Family	Araneae
Genus	Araneae
Species	Araneae
Authority	Araneae
Year	Araneae
- PHOTOGRAPHS**: A large image showing a close-up of a spider's leg and chela. A scale bar indicates 1 mm. Below the image are options for "Download", "Comments", and "Associated Tags".
- GEOLLOCATION**: A map showing the location of the specimen in the Netherlands. The location is marked with a red dot and labeled "Eindhoven". The map includes labels for various European countries and cities.

This is a screen shot from the BOLD database showing one of the records contributed for this study. Credit: Naturalis Biodiversity Center, RMNH.ARA.12497

But using nondestructive extraction, even small spiders with a body length of 4 mm or less have a good chance of yielding a DNA barcode sequence for about 15 years after collection while spiders above this size can yield barcode sequences for a considerably longer time. The success of nondestructive extraction demonstrated here coupled with the need to preserve museum [specimens](#) for a variety of research purposes bodes well for museum collections are source material for DNA barcode libraries.

More information: Miller JA, Beentjes KK, van Helsdingen P, IJland S (2013) Which specimens from a museum collection will yield DNA barcodes? A time series study of spiders in alcohol. In: Nagy ZT, Backeljau T, De Meyer M, Jordaens K (Eds) DNA barcoding: a practical tool for fundamental and applied biodiversity research. *ZooKeys* 365: 245–261. [DOI: 10.3897/zookeys.365.5787](https://doi.org/10.3897/zookeys.365.5787)

Provided by Pensoft Publishers

Citation: The value of museum collections for development of DNA barcode libraries (2013, December 30) retrieved 29 April 2024 from <https://phys.org/news/2013-12-museum-dna-barcode-libraries.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.