

# The use of DNA barcoding to improve the taxonomy of Afrotropical hoverflies (Diptera: Syrphidae)

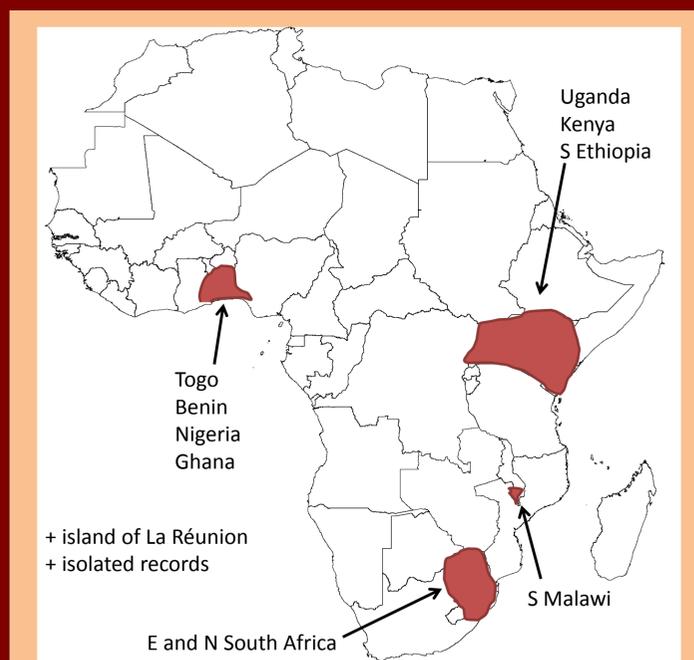
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**Background:** Currently, there are about 600 nominal morphospecies of Afrotropical hoverflies (Syrphidae) whose morphological identification is very difficult because of limited recent taxonomic revisions and the lack of comprehensive identification keys. A few years ago, we constructed a reference dataset of approximately 500 COI barcodes for almost 100 of the more common nominal species from West Africa. The results showed that DNA barcoding is a very helpful tool to identify these species and that it allowed to pinpoint those taxonomic groups that are in need of revision. We now have extended this reference barcode dataset (i) to get a broader coverage of this group and (ii) to cover a larger area of the Afrotropics. **Results:** The current reference database comprises almost 2,000 barcodes for almost half the known number of Afrotropical syrphid species. The identification accuracy of this dataset was evaluated with three methods (K2P distance-based, Neighbor-Joining (NJ) / Maximum Likelihood (ML) analysis, and using SpeciesIdentifier). The identification success estimated using the three methods was high (> 95%) and comparable to our previous study. **Significance:** DNA barcoding is a useful alternative identification tool for the Afrotropical Syrphidae. It also improves the taxonomy of Afrotropical hoverflies and these barcoding efforts have resulted in the start of taxonomic revisions of several of the Afrotropical syrphid genera. Moreover, several other research groups are adding barcodes to the dataset and this will speed-up taxonomic revisions even more.

Syrphidae (hoverflies) is a diverse group with >6000 species worldwide. Adults are often important pollinators, and predatory larvae of some species are used to control insect pests.

Current morphological identification tools are insufficient to identify all Afrotropical hoverflies and for many species only one of the sexes is known. Yet, reliable species identification is crucial to investigate the role of hoverflies in pollination networks, plant-insect interactions and pest control. Here, we present a DNA-barcoding reference database that will assist in species identification of Afrotropical hoverflies.



**Fig. 1:** Areas in the Afrotropical Region where hoverflies were collected.

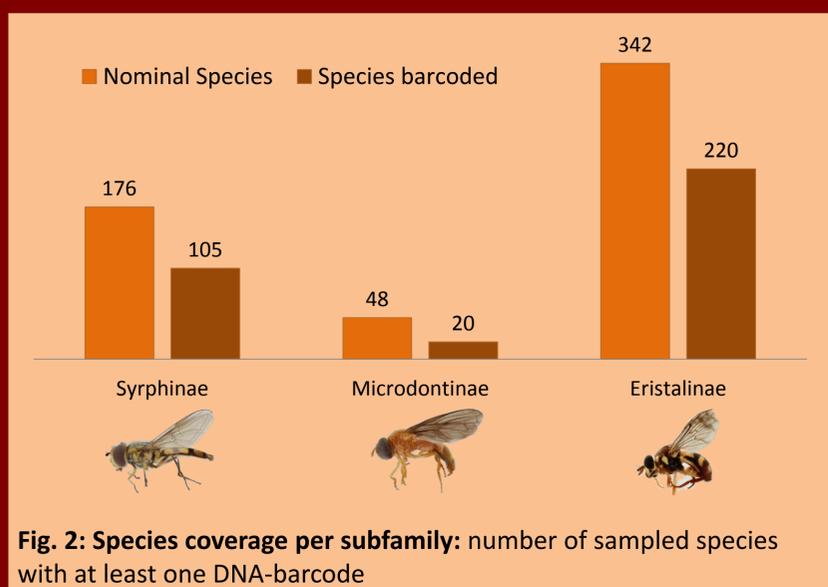
Since 2012 we have been sampling hoverflies throughout the African continent (Fig. 1). Specimens (>5000) are either pinned or stored in absolute ethanol and vouchered in the entomological collections of the Royal Museum for Central Africa (RMCA).

As far as possible, specimens were identified using external morphology. A selection of the specimens were barcoded.

Barcode gap detection was done using the R-package Spider.

Overall, the reference database currently comprises around 2700 DNA barcodes and the database is still improved by adding barcodes of other research teams (see acknowledgements).

The database covers 357 (60% of the) nominal species over 46 (80% of the) genera (with species coverage per genus 25-80%).



**Fig. 2: Species coverage per subfamily:** number of sampled species with at least one DNA-barcode

## Subfamily Syrphinae

- 932 barcodes from 105 species out of 176 nominal species.
- No barcode gap in some of the genera (e.g. *Betasyrphus*).

## Subfamily Microdontinae

- 54 barcodes from 20 species out of 48 nominal species.
- Distinct barcode gap in all genera.

## Subfamily Eristalinae

- 1705 barcodes from 220 sampled species out of 342 nominal species
- No barcode gap in several of the genera (e.g. *Syritta*)

This study shows that DNA barcoding is a helpful tool in many genera of Afrotropical Syrphidae. Yet, in some genera there is no clear barcode gap and these genera will require a taxonomic revision.

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