How Reliable are Morphological Criteria for Species Identification? A case study using ants of the Lasius genus

Kristine Jecha¹, Guillaume Lavanchy¹, Timothy Szewczyk¹, Anne Freitag², Tanja Schwander¹ ¹Department of Ecology and Evolution, University of Lausanne, Switzerland ²Cantonal Museum of Zoology, Lausanne, Switzerland

Background

species is often defined by Α interbreeding and reproductive isolation¹. However, many species are still only identified by morphology. Can we be sure that species delineated only by morphology are also reproductively isolated?

Morphological identification can also cause issues if there are large numbers of individuals or hybrids^{1,2}. Its accuracy must



Over 1,000 morphologically identified ants from the Lasius genus across the Vaud, Switzerland.

12 *Lasius* species: L.alienus, L.brunneus, L.emarginatus, L.flavus, L.fuliginosus, L.mixtus, L.myops, L.niger, L.paralienus, L.platythorax, L.psammophilus, L.umbratus



be confirmed before it can become a standard practice.

Methods				
Sample Collections	Read Decontamination	SNP Calling	Identify Genetic Species	Identify Hybrids
Samples collected from citizen science program, <i>Opération</i> <i>Fourmis,</i> and structured scientific sampling. DNA extracted and sequenced with RAD-seq.	Competitive mapping of reads against contaminant genome. Contaminant reads filtered out.	SNPs identified. Heterozygosity and allelic depth analyzed to confirm decontamination.	SNP-based MDS clustering and ADMIXTURE, and with COI gene phylogeny grouping compared with morphological identification.	Hybrid individuals identified through ADMIXTURE. Admixture proportion calculated per species pair.
Results				
Unambiguous Genetic Species Delineation Clustering of species based on genetic information (n=903, species with <5 individuals excluded) K=9, chosen based on cross-validation error				
Individuals of likely hybrid origin highlighted with an asterisk (n=49)				









Introgression from:

Conclusions

Lasius species delineations are consistent with their genetic delineations

Identification through DNA analysis can be more efficient and accurate than traditional morphological methods

Certain pairs of *Lasius* species show signatures of introgression

The presence of F2+ hybrids indicates that hybrid *Lasius* ants are fertile Divergence age between species pairs could factor into the ability to hybridize

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Contact: kristine.jecha@unil.ch

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